THE IMPACT OF CHANGES IN STATUTORY GRAIN FREIGHT RATES ON CANADA'S SHARE OF THE EXPORT WHEAT MARKET

by

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ABSTRACT

Most wheat exporting and importing countries have domestic policies which are designed to stabilize or support farm incomes. The market is pervaded by state trading and other non-tariff barriers which prevent the world price signals from being passed through to domestic markets. One such policy is the Crow subsidy. The level and composition of Canadian agricultural production has been heavily influenced by the statutory Crow's Nest Pass grain freight rates. The trade effects of a removal of the Crow subsidy have not been well researched. This thesis is an initial experiment in developing the trade modeling capacity to evaluate the impact of changes in statutory grain freight rates on Canada's share of the export wheat market.

The objectives of the thesis are to identify the extent to which the statutory grain freight rates have determined Canada's export wheat market shares and to estimate the impact of changing the freight rates on Canada's comparative advantage and consequent trade flows. These objectives are accomplished by estimating both static and dynamic market share models applied to selected markets during the period 1960-83.

The thesis begins with a brief review of previous studies that have attempted to analyze the historical evolution of the Crow and its impact on the Prairie agriculture. This is followed by a theoretical analysis of the question of diversification via

freight rate policies. Subsequently, the world wheat market and the price variability in that market are considered. The study then concentrates on the development and specification of the elasticity of substitution and market share models. The question of price responsiveness in import demand functions is analyzed and a simple procedure to quantify nonprice preferences for Canadian wheat is suggested. Finally, the empirical results of the study are reported and analyzed.

The main proposition emerging from the analysis is that the statutory grain freight rates have had very little or no impact on Canada's wheat market shares in almost all the countries surveyed. In addition, substitution of the different compensatory grain freight rates for the statutory ones will only have a marginal impact on Canada's wheat market shares.

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INTRODUCTION

1.1 BACKGROUND

Canada's agricultural trade is not only vital to the agricultural sector but also to the entire economy. Agricultural exports in the 1980's have averaged approximately $10 billion per annum. Agricultural imports were valued at approximately $5 billion per annum. Canada's agricultural exports, therefore, contribute about $5 billion annually to its balance of trade. Canada is one of the few developed countries that is a net exporter of agricultural products.

Canada's share in world agricultural exports is approximately 4.5 percent. It has a significant position in world wheat, barley and rapeseed markets, accounting in 1985 for approximately 20, 25 and 45 percent of total world exports of these products, respectively. Over one half of Canada's agricultural exports is still sold to other developed countries, with the remainder going to the centrally-planned and less-developed countries.

Grains and oilseeds and their products comprise approximately 75 percent of Canada's total agricultural exports, with wheat and wheat flour alone generating 50 percent of all revenues from food and agricultural exports. World wheat trade more than doubled between 1960 and 1985 (from 45 to over 105 million tonnes). The

real world price of wheat, however, declined nearly 50 percent over that period. Although annual wheat market shares have fluctuated, during this time Canada has generally accounted for about 20 percent of world exports. Wheat also plays a critical role in achieving a food balance in many countries with domestic shortages of staple crops. Over the past 25 years, wheat imports of less-developed and centrally-planned countries have grown rapidly; while those of developed countries have declined.

Most exporting and importing countries have domestic policies which are designed to stabilize or support farm incomes. The market is pervaded by state-trading and other non-tariff barriers which prevent the world price signals from being passed through to domestic markets. One such policy is the Crow subsidy. The level and composition of Canadian agricultural production have been heavily influenced by the Crow's Nest Pass grain freight rates. In the past, these rates have provided a transportation subsidy to Canadian grain producers and have encouraged the movement of the raw product to an export position. However, these low freight rates have also resulted in under-investment in grain transportation facilities and this has constrained export potential. A solution to Canada's "transportation problem" would undoubtedly change both the level and composition of agricultural exports. This would come about from a shift in western Canada's comparative advantage in grains and oilseeds vis-a-vis the rest of the world. These trade effects from a removal of the Crow subsidy have not been well researched. This study is an initial experiment in developing the trade modeling capacity to evaluate

the impact of changes in statutory grain freight rates on Canada's share of the export wheat market.

1.2 OBJECTIVE AND METHODOLOGY

The main objectives of this study are twofold:

1. To identify the extent to which the statutory grain freight rates have determined Canada's export wheat market shares.
2. To estimate the impact of changing the freight rates on Canada's comparative advantage and consequent trade flows.

These objectives will be accomplished by estimating both static and dynamic market share models during the period 1960-83. The static analysis will be performed via an elasticity of substitution model and the dynamic analysis will be provided within the framework of a partial adjustment market share model. These models will allow us to isolate the impact of transportation costs on Canada's wheat market shares in selected countries and to make market share projections.

1.3 ORGANIZATION OF THE STUDY

The organization of this study is as follows. In Chapter II a brief review of previous studies that have attempted to analyze the historical evolution of "the Crow" and its impact on Prairie agriculture is presented. Chapter III develops a theoretical framework for the analysis of the question of diversification via freight rate policies. Chapter IV combines a review of the world

wheat market with an analysis of the price variability in that market. Chapter V concentrates on the development and specification of the elasticity of substitution and constant market share models. Chapter VI contains the empirical results of the study. The summary and conclusions are provided in Chapter VII.

Chapter II

CANADA'S TRANSPORTATION PROBLEM: AN HISTORICAL PERSPECTIVE

2.1 INTRODUCTION

This study analyzes the impact of changes in statutory grain freight rates on Canada's share of the export wheat market. The demand for exports of a particular commodity from a given country is determined both by market forces and by institutional factors. It is the institutional factors that provide the framework under which the effective demand materializes. One particularly controversial institutional factor that has influenced Canadian grain exports was the Crow's Nest Pass Agreement.

The objective of this chapter is to survey the relevant studies which have attempted to analyze the historical evolution of the Crow and its impact on Prairie agriculture. The economics of the Crow and the political economy of the freight rate reform are discussed in sections 2.2 and 2.3 respectively, while the conclusions are presented in section 2.4.

2.2 THE ECONOMICS OF "THE CROW"

In 1897, as part of an agreement between the Dominion of Canada and the Canadian Pacific Railway, the latter agreed to lower its freight rates on grain and flour moving east-bound to Fort William/Port Arthur (Thunder Bay), and thereafter maintain the lower level, in return for a subsidy of $3.4 million to build a rail line through the Crow's Nest Pass. At the same time, the railway agreed to government regulation of freight rates, thus completely ending the unrestricted monopoly power originally won through the building of the "National Dream" (Harvey, 1980). The purpose of the Crow's Nest Pass Agreement was to facilitate the development of promising mining areas in southern B.C. and to integrate the areas into the Canadian economy (Gilson, 1982).

Terms of the Agreement were suspended under the West Measures Act in 1918 and rates were allowed to rise above the "Crow" level. In 1925, however, the maximum rate limit on eastbound grain and flour was made statutory (Gilson, 1982). The statutory freight rates were referred to as the freight rates for the movement of grain and grain products from various points in western Canada to ports of export. Those grains eligible to be moved by rail at the statutory rate were called statutory grains (Hall, et al., 1985). According to the Gilson report, prior to the Western Grain Transportation Act, over 50 commodities were moving at the statutory rate, ranging from wheat to such minor items as sunflower seed oil cake meal (Gilson, 1982).

The obvious implication of keeping grain freight rates at their 1897 level was that they no longer bore any resemblance to

actual expenses incurred in moving the product. As early as 1959/61, at the time of the MacPherson Commission, evidence was presented that the rates failed to cover even variable costs, much less make any contribution to railway overhead. Since that time, of course, costs had risen dramatically with general inflation, so that whatever distortion prevailed then was magnified many times over. By 1976, it had become clear that the railways were losing money on shipping statutory grains. In that year, the Snavely Report found that the railroads had lost $105.5 million on shipping grain in 1974, without any contribution to constant costs (Snavely, 1976 to 1979). The Gilson report concluded that the railway loss in 1980 was $215 million even after the inclusion of the $170 million in revenues received from the Federal Government as branch line subsidies and rehabilitation payments. After the addition of an appropriate contribution to constant costs, the loss amounted to $299 million (Gilson, 1982). Other estimates from the Snavely Report as reported in Harvey (1980) show revenue from statutory grains at 38 percent of variable costs in 1974. (i.e., excluding any contribution to overhead), 32.4 percent in 1977, and 18 percent in 1987. The total railway revenue requirement for grain transportation at varying rates of inflation is illustrated in Figure 2.1.

Figure 2.2 shows the time path of both the Crow rate and the full cost or compensatory rate in moving grains from 1950 and projected to 1991. Because of the fixed nature of the statutory rate, inflation in grain transportation costs since the 1950's has produced a widening gap between the actual costs of moving

grains and what producers have paid via the statutory rates. By 1981, shippers of statutory grains paid only about 20 percent of the costs of moving grains and it is projected that they would be paying less than 10 percent by 1990 if the Crow were left unchanged (Kirk, 1983).

This vast discrepancy between rates paid and costs incurred has both efficiency and equity implications. The former arise because of three separate types of distortions; (a) between statutory grains versus all other traffic from the viewpoint of the railroads, (b) between rail versus trucks as a means of moving grain from the farm to collection points, and finally (c) between statutory grains and other types of agricultural and processing activities within the West. Equity issues are involved since hauling grains below cost is a subsidy that must be covered somewhere in the economy.

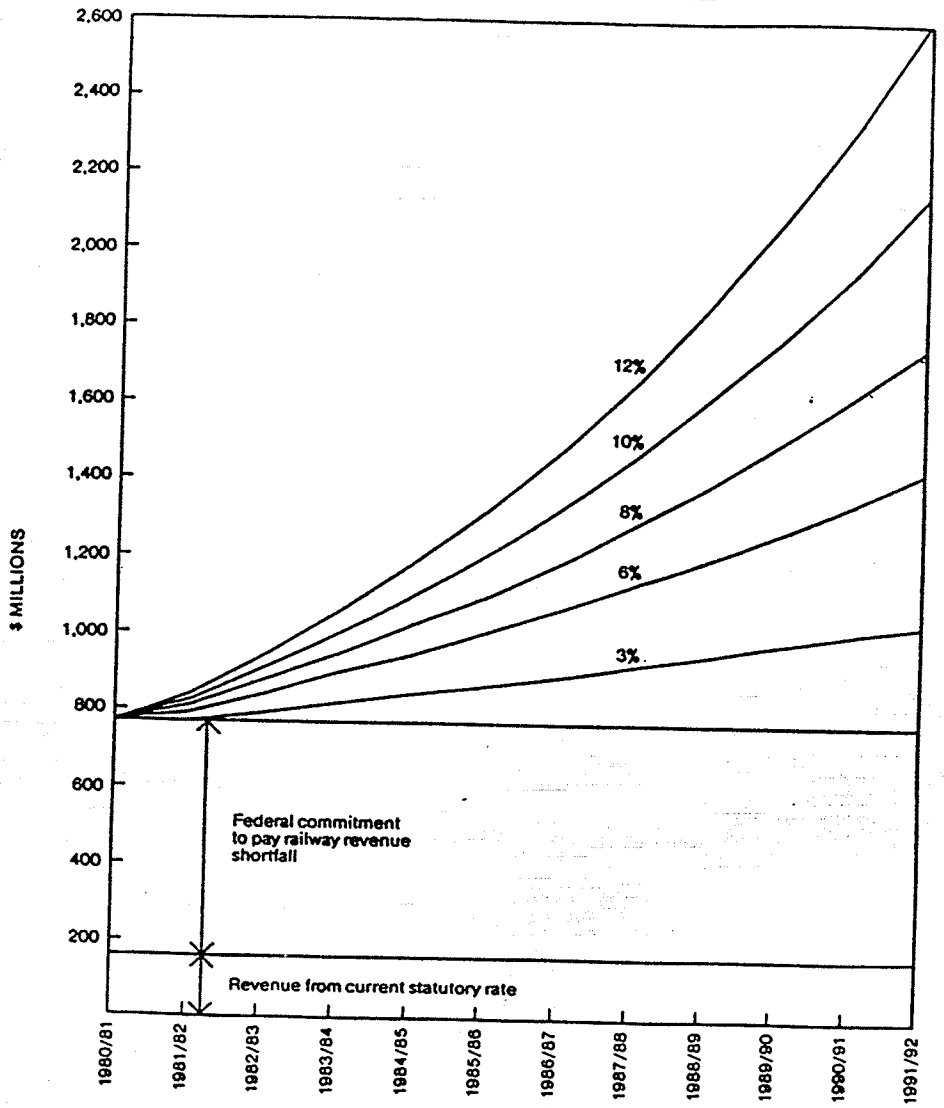

Figure 2.1

Total Railway Revenue Requirements With Inflation Rate at Varying Levels

Source: Gilson, J.C., Western Grain Transporation: Report on Consultations and Recommendations, Transport Canada, June 1982.

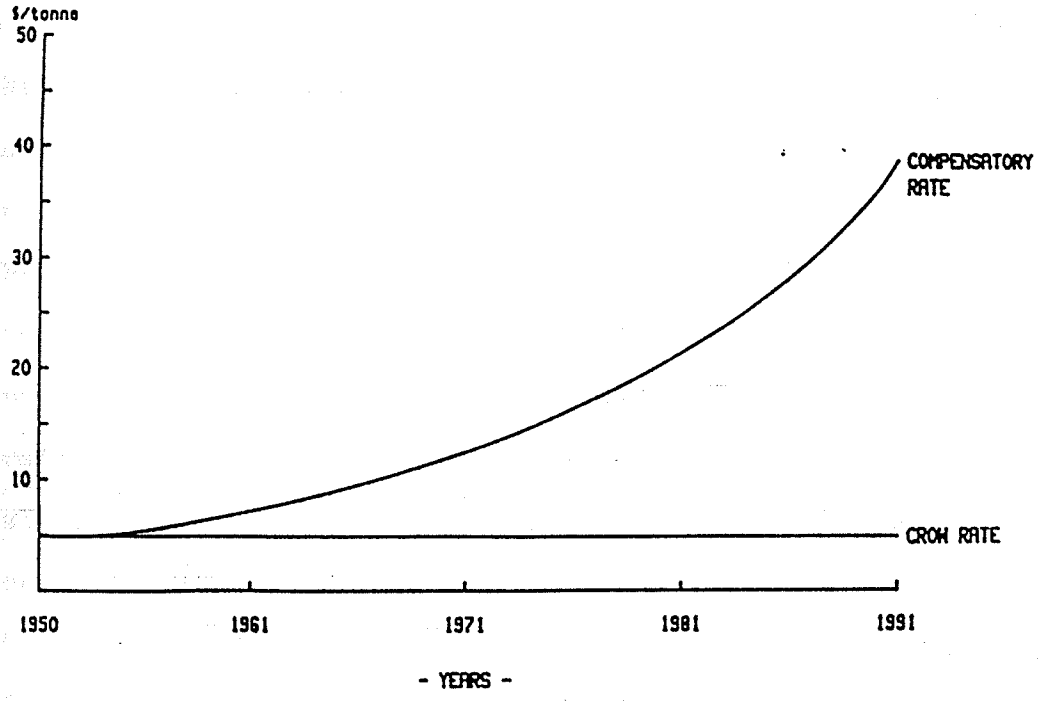

Figure 2.2

Crow and Compensatory Rates

Source: Kirk, E., Agricultural Impacts of Crow Change: Final Report, Agriculture Canada, February, 1983.

2.2.1 Efficiency Considerations

The railways have been subjected to an increasing loss of money for each tonne of statutory grains moved. They could not abandon this traffic, but they had no incentive to invest in new facilities and equipment linked to the grain trade, or even to maintain the existing facilities. The result was that the entire grain handling and distribution system was in a state of disrepair by the early 1970's (Gilson, 1982). The boxcar fleet had shrunk dramatically, branch lines were deteriorating, and train speeds had to be reduced. The losses were mounting year by year and the situation was becoming unacceptable to the railroads; to the Federal Government; to the grain producers; and to the national economy. Indeed, it is alleged that restrictive delivery quotas imposed by the Canadian Wheat Board stemming from inadequate transportation capacity resulted in lost and deferred grain sales (Kirk, 1983). On-farm storage costs increased as well, reaching as high as $100 million in 1978/79 for wheat alone (Kirk, 1983). According to the Gilson report lost sales in 1977/78 amounted to $400-600 million and in 1978/79 to $600 million. Demurrage costs were $20 million in 1978 (Gilson, 1982). Gilson (1982), too, emphasizes that deferment of sales resulted in increased storage costs and grain producer's incomes were reduced as a result of the inability of the system to handle greater volumes. There has also been evidence of distress local grain sales due to large grain surpluses on the Prairies. These have occurred both because of worldwide excess grain supplies and because of the inability of the handling and transport system to

move available quantities of grain to export positions, e.g., grain carry-overs of the late 1960's were due to marketing problems relating to the International Wheat Agreement and a Canadian Wheat Board decision to export wheat instead of barley (Lang, 1984).

As a result, there was an efficiency cost associated with relying on such a system. In the short run, there was uneconomic depreciation of capital facilities, outdated technology, unnecessary administrative expenses, the opportunity costs of lost grain sales, additional storage costs, foregone production on the Prairies with constrained marketing opportunities, and distress sales on the Prairies. In the longer run, there was the very real possibility that if a significant restructuring was not accomplished soon, Canada's capacity to deliver grain to export markets on a systematic basis would be severely damaged. This is extremely important due to the fact that Canada's Prairie region is very dependent on grain production and exports.

The inefficiencies went beyond the railway system itself. For instance, all grain movement requires some combination of trucks and rail transport. With the latter subsidized, there was an incentive to use it intensively and to economize on the former. More grain was moved by rail as opposed to trucks than was socially optimal and too many collection points are maintained as a result. These collection points are, in effect, small Prairie towns. This particular feature has been a key element in the opposition to change (Norrie, 1983).

The third type of efficiency consideration, which is central in the freight rate discussions, stems from the fact that freight rates below cost also imply grain prices at the farm gate that are higher than they otherwise would be. This follows from the recognition that Canadian farmers are effectively price-takers for most of their output. If they are to sell internationally, all costs of getting the grain to market must be borne internally and very little, if any, can be shifted forward to consuming nations. Local grain prices are thus equal to world prices less transport and handling charges. If the cost of shipping grain by rail to the export point is subsidized, a smaller deduction need be made at the point of farm delivery, meaning that farmers normally receive a higher price for their products than they would if they paid the full shipping charges. However, this may not be the case every year, as, for example, there were distress grain sales in 1977/78 and 1978/79 (Carter, et al., 1984).

Artificially high farm-gate prices raise two types of efficiency considerations. First, inflated returns maintain some farmland in production that would otherwise be uneconomic. This is corroborated in all of the existing studies on the subject (Harvey, 1980, 1981; Fields and Kraft, 1981; Norrie, 1983). Estimates of the extent of uneconomic farmland left in production vary somewhat due to different methodologies, data bases, reference years, and estimates of the size of the "Crow gap" (Harvey, 1980), but the numbers are typically rather small, reflecting the limited alternative use for most Prairie land.

The second distortion (Harvey, 1980; Gilson, 1982; Kirk, 1983; Davey and Kirk, 1984) between primary and processing activities is the efficiency consideration that has received the most attention. The argument is that industries such as feedlots and meat packing would seem to be naturally located in the West. It takes several pounds of grain to produce one pound of beef, pork, or poultry. Thus, even if meat products are more expensive to ship per unit, it should still be cheaper to feed the animals close to where the grain is produced. If the rates for shipping the input are artifically low, however, while those on the finished products are unregulated, this advantage may be offset. The result is a sub-optimal location for Canada's feedlots, hog farms, and meat packing industries and fewer industrial jobs in the West than economic calculations suggest. The argument was extended to the oilseed crushing industry as well.

Most analysts have found that there is, indeed, a distortion of this type, and that it is probably quite significant. Harvey's (1980) estimates suggested a 3 to 6 percent expansion in the short run for hog and beef production following removal of the Crow subsidy. In the long run, expansions of 12 to 14 percent were suggested. Harvey (1980) found a significant positive effect on such secondary industries as rapeseed crushing, meat processing, meat transport, and feed processing as well, although he cautioned that the numbers were "approximate". Assuming an increase in the grain rate from 21 cents/cwt. to 77 cents/cwt., Arcus (1977) found that gross revenue from livestock production would increase by $100.1 million or 7.7 percent. He also esti-

mated that, given the above increase, the farm gate price of rapeseed would decrease and therefore reduce production by 4.4 percent and gross producer revenue by $17.8 million. A more recent study of the rapeseed industry (Furtan, et al., 1979) examined the effect of changing grain rates as well as the Japanese import tariff on Canadian production and processing. Following an increase in the grain rates to $8.32/tonne, they found that rapeseed prices in Canada would decrease by $3.50/tonne (1.1 percent), Canadian rapeseed crush would increase by 13,260 tonnes (5 percent) oil exports from Canada would increase by 5,460 tonnes, and Canadian meal consumption would increase by 5,740 tonnes.

Gilson (1982) summarized the economic studies underlying his report as indicating, "...a positive potential of indeterminate size for the western livestock industry" and a possibility of further expansion of canola crushing. Thus, it is probably safe to assume that statutory grain rates were responsible for some distortion in the location of feedlots, meat-packing plants, and canola-crushing plants.

2.2.2 Equity Considerations

Equity concerns arise because providing an economic service at a price that is less than the opportunity costs of the resources involved means that some groups are being subsidized, presumably, at someone else's expense. Equity is normally thought of as involving welfare comparisons among individuals and certainly there is an important element of this in the Crow debate. The nature of the transfers involved, however, has meant that the equity

question has come to be cast as a sectoral and even a regional issue as well. It is this latter development, in fact, that has generated the intensive political debate that appears to have reduced any chance for meaningful reform (Norrie, 1983).

Clearly, freight rates below cost mean that the return per acre to producing statutory grains is higher than it would be in an undistorted situation. In other words, western farmers producing grain for export receive a subsidy. The exact magnitude of this transfer, however, depends on the size of the Crow gap and the price sensitivity of the export demand for Canadian grains. An important offsetting factor is the "cost" of a deteriorating transportation system and foregone production and sales. On the benefit side, Arcus (1977) put the additional revenue from wheat sales at nearly $200 million, or 12.8 percent of gross sales. The subsidies on other export grains and by-products and the losses caused by an inefficient transportation network must also be taken into account to get the total direct impact of the policy.

This transfer is not restricted to export grains alone, however. Because nearly two-thirds of Prairie grain production is traditionally sold off the Prairies, the local market tends to be a residual or price-taking market. Hence, prices of statutory grains sold locally normally reflect the farm-gate prices of grain sold for export. This means that the prices of all statutory grains, and not just those which are moved off the Prairies, are higher due to the Crow. The estimate of the size of the Crow benefit is thus better calculated as the subsidy received on all

grain production in the West, rather than just on that grain destined for export. On this basis, Harvey (1980) estimated that 1978 transfer to grain producers was from $338 million to $439 million, depending on whether grain traffic without the Crow would pay a rate that would cover variable costs or to make some contribution to overhead. Arcus (1977) put the figure for one year earlier at $341 million or 9.9 percent of the total revenues. Another study by the IBI Group cited in Wilson and Tyrchniewicz (1980) estimated that in 1977 the Crow benefit was between $241 million and $459 million, depending on whether the rates were increased to the compensatory level, or to a level similar to other traffic. Norrie and Percy (1983) put the loss in income to agricultural landowners from removing the Crow subsidy at 9.2 percent under a "best guess" short-run scenario, and at 5.8 percent once all adjustments had been made. By any calculation, then, the income gains are clearly significant under the Crow.

The form this transfer takes can be seen most clearly in a long-run, general equilibrium context. Artificially low freight rates increase the expected return per bushel of grain, which tends to keep more land, labor, and capital in agriculture than would be the case otherwise. If all these factors were fixed in supply to the region, their returns would be buoyed up above what they would be otherwise. Over a sufficiently long period of time, however, the stocks of capital and labor adjust to eliminate this differential. Thus, the only sustainable income gains from the Crow rates are presumably capitalized into land prices.

It is, therefore, the current landowners who are the prime beneficiaries of the Crow subsidy, and who would consequently lose the most from its abolition. On the other hand, if the freight rate distortion keeps the number of farms artificially high, and if it indirectly keeps a number of branch lines in operation that would be otherwise abandoned, it thereby creates a greater demand for the products and services of merchants of Prairie towns. The end of the Crow means the end of this excess demand, and, since these assets have no alternative use, this means a capital loss for these individuals.

If these two groups are the main beneficiaries from the Crow rate structure, who are the losers? Society as a whole bears the efficiency losses detailed above. Railway profits are lower than they would be otherwise, since the railways receive no direct compensation for losses incurred under this policy (we are not yet considering the provisions of Bill C-155, by which the Federal Government pays some $658.6 million per year in perpetuity to the two national railways). Canadian Pacific Railway shareholders receive lower dividends as a result, and these would in turn be reflected in a lower price for the stock. Lower Canadian National Railway profits presumably mean larger claims on, or smaller contributions to, public sector general revenues in some long-run sense, so there is an element of redistribution from Canadian taxpayers generally to western grain growers.

It is often alleged that industrial users of western grains such as livestock, feedlots, and canola crushers are disadvantaged by the rate distortion (Harvey, 1980; Wilson and Tyrchniew-

icz, 1980; Gilson, 1982; Kirk, 1983; Tyrchniewicz, 1984). Feed-grain prices within the West are higher than natural conditions would dictate by some portion, or perhaps by all, of the Crow benefit. This means that locally-based producers have higher input costs and end up with lower profits, since they face unregulated freight rates on their own products and operate in a highly competitive market where they cannot pass these forward. Over time, as the wedge between rates increases, this reduces processing margins of these industries and hence their otherwise natural incentives to expand.

Finally, the Crow has promoted the production of statutory grain on the Prairies at the expense of other crops. As a consequence of the Crow, farm-gate prices of statutory grains have generally been higher in relation to the prices of non-statutory crops, which must bear the full costs of transportation. As a result, Prairie farmers have less incentive to diversify their crop mix. Moreover, the existing disincentive to crop diversification will increase over time in the absence of Crow reform (Gilson, 1982).

2.3 THE POLITICAL ECONOMY OF THE FREIGHT RATE REFORM

As an exercise in the political economy of regional policymaking, the Crow debate is even more interesting. To illustrate this, we will evaluate what is contained in the Gilson report with respect to the economic factors summarized above. The ultimate legislation (Bill C-155) will be discussed on these same terms. Finally, the merits of Hall's recently published report will be presented.

2.3.1 The Gilson Report and the Western Grain Transportation Act

In February 1982, the Federal Government announced its intention to rectify once and for all the serious situation that was developing in grain transportation. Dr. J. Clayton Gilson was commissioned to find an acceptable means of implementing a new grain freight rate structure. His report was issued in June 1982 and formed the basis for the Federal Government transportation proposals of February 1983.

The heart of the Gilson report was in Chapter V where a "comprehensive solution" was outlined. The procedures followed in arriving at the recommendations can be outlined briefly. First, a base year (the 1981/82 crop year) and a reference volume of statutory grain shipments (30.4 million tonnes) were selected. Then the total costs of moving this amount of grain and the revenue that this would generate under the existing Crow rates were calculated, with the difference between the two being termed the "Gross Railway Revenue Shortfall." This figure ($641.1 million) would become an obligation in perpetuity of the Federal Government to the West. Contrary to what is sometimes asserted, there was no attempt to overturn an 85-year old concession to western farmers; quite the contrary, in fact. The Gilson report assumes without question that this group is entitled to receive, forever, a basic subsidy equal to the 1981/82 value of the transfer.

Under Gilson's recommendation, the Federal Government's financial obligation in support of grain movement would, however, extend beyond this basic payment in three ways. First, Ottawa

would share in any cost increase after the base year--a further subsidy to cover railway cost increases beyond the base year level would be added to the $644.1 million mentioned above. This meant that for the first time since 1897 western farmers would have to cover part of the rising costs of shipping grain out of the region. In this sense, the federal announcement of February 1982 and the Gilson report would have put an end to the Crow, at least if that term is taken to mean that western farmers would be forever protected against rising nominal freight rates on grain. The second feature was a transitional measure called an "Agricultural Adjustment Shortfall." This was a payment over and above the reference amount of $641.1 million, justified on the grounds that it was virtually impossible to devise a scheme of direct compensation for those identifiably affected by the rate changes. Disbursements under the Gilson proposals were to be made on an acreage basis, meaning that those who grew non-statutory grain could not be easily excluded from sharing in the $641.1 million compensation. The adjustment payment was intended to offset this "dilution" effect, although only on a temporary basis. It was to begin with the 1983/84 crop year and be phased out by 1989/90. The third and final element was that the capital program, wherein Ottawa purchases hopper cars and contributes to railway upgrading, was to continue.

Thus far, only the amount of the Federal Government subsidy has been dealt with. A further question, and it has turned out to be a most controversial one, is how these payments would be made. Two polar cases can be distinguished. Under one, the en-

tire amount would be paid directly to the railroads, with freight rates left at their current level. In the other polar case, it would be paid entirely to the producers. A discussion on the pros and cons of the two alternatives follows in the next section. Gilson, however, recommended a compromise between these two extremes. He suggested that the entire subsidy be given to the railroads in 1982/83. It would then gradually be partitioned between them and shippers until 1989/90, when the split would be 19 percent for the railroads and 81 percent for the farmers. Gilson effectively accepted the second of the two polar views noted above, but maintained the advisability of some payments to the railroads, presumably for "leverage" purposes. He appeared to have been persuaded by the arguments detailing the costs of the intersectoral distortions due to outdated freight rates, and his proposal would have certainly gone a long way towards correcting them.

However, the Western Grain Transportation Act (Bill C-155) which was tabled and amended in May 1983 and was passed by the Federal Government in November 1983, changed the original intentions of the government and the Gilson report recommendations. Specifically, the government changed the method of payment recommendation. Beginning with the 1983/84 crop year, the entire Crow benefit was to be paid each year to the railways. This was in contrast to the 50-50 split proposed by the Minister just three months earlier, the 19 percent railway share Gilson recommended, and the 100 percent grant to the shippers that economic efficiency calls for. Under Bill C-155, there was to be no major, one-

time corrective adjustment of statutory grain freight rates or an associated economic distribution. This feature of the Act, taken by itself, will perpetuate existing anomalies in crop mixes, acreage decisions and industrial locations. Whatever chance there might have been to make a major impact on any of these appears to have been sacrificed for short-run political gain.[1]

The other critical issue was the way in which the legislation assigned the burden of future increases in transporation costs. Effective in the 1983/84 crop year, shippers were to be responsible for the first three percentage points of any increase in annual railway costs until the 1985/86 crop year when their share would rise to the first six points, with the government in each instance making up the remainder. In addition, any shipment beyond the 31.1 million tonne ceiling would pay the full charges as set out in a Canadian Transport Commission approved rate schedule. The actual rate would be a blend of subsidized and full cost rates in this event. A provision in the Act put a cap on any rate increases, however, by stipulating that average statutory freight rates paid by shippers in each calendar year could never exceed a defined percentage of the weighted selling price as measured by the in-store asking price at principal part of export, of a "basket" of six grains (Bill C-155).

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[1] K. Macmillan (1983): "Most observers agree, and the Government has admitted, that it was political pressure exerted by the Prairie Wheat Pools and the Quebec agricultural groups which forced this 'about face' in policy," p. 2.

Based on these provisions, among others, nominal freight charges on grain rose for the first time in nearly 100 years at the beginning of the crop year 1983/84. As we noted above, however, what once looked like a decisive and imaginative solution to a long-standing problem appears to have deteriorated into a hesitant and confused retreat in the face of vested interest groups.

2.3.2 The Hall Report

Because of the complexity of issues considered in the Western Grain Transportation Act and the wide range of divergent views in the consultations and debate, Parliament accepted the Gilson recommendation that the new Act be subject to a comprehensive review in 1985/86, when all medium term outcomes could be more accurately measured and evaluated. Although Parliament legislated that payments of the benefit should be made directly to the railways, in the face of conflicting views and arguments, it required that a Committee of Inquiry be appointed to make recommendations as to the method of paying the benefit "that would be most conducive to the development of agriculture in Canada, and to the improvement of the grain transportation system to serve the interests of western agriculture and the nation as a whole" (Hall, et al., 1985).

The Committee of Inquiry headed by Judge Hall was appointed in April 1984 and released its report in March 1985. The report recommended that the Crow benefit be paid directly to the producers as opposed to the railroads. This recommendation may, effec-

tively, be the key to the long-standing problem. However, the Grain Transportation Agency (1986) has found some shortcomings in either a "pay the railways" or "pay the producer" option.

It may be argued that paying the entire amount of the benefit directly to the railroads, although farmers now pay over 20 percent of the cost, has left freight rates at their fixed level. Each year the railway companies would receive whatever revenue the statutory rates generated, plus a $658.6 million base subsidy[2] payment plus the incremental costs. This has made grain traffic compensatory again, providing the incentive to maintain and upgrade railway facilities that has been so desperately needed. This plan had considerable appeal to some western grain growers. They would still receive a subsidy, but one that has all the appearances of being given to the railways. They also argued that this would give Ottawa maximum "leverage" over the railway companies with respect to enforcing compliance on infrastructure proposals, an understandable position for a region that has always viewed railroads as adversaries. Much simpler administration was cited as a further virture of this option (Hall, et al., 1985).

According to this option, shippers paid the old Crow rate plus some predetermined share of future cost increases. Thus while their total transporation outlays rose, the amount they paid per tonne would remain forever below full cost by the extent of the base subsidy. That grain prices at the farm gate would be perma-

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[2] This base subsidy also called the "Crow Benefit" is not all payable in a drought year when shipping volumes are low.

nently higher by this amount illustrates the problems with this proposal. It would leave intact the intersectoral distortions that caused much concern in the first place; only the railway's under-investment would be corrected.

The Hall recommendation, whereby the subsidy would be paid entirely to the producers, would correct distortions identified earlier. Rates would be adjusted upwards until they reached the compensatory level, with grain prices on the Prairies falling correspondingly. For the reference year 1981/82, farmers would receive a payment from Ottawa which would compensate them exactly for the lower net returns, and this would continue in perpetuity. After that, returns would depend on the movements in grain prices relative to their share of incremental transport costs, the situation faced by other shippers. A lower intra-regional grain price would correct the distortions among crops and sectors and between transporation modes for grain (rail versus trucking industries) and generate additional efficiency gains. The railroads would receive compensatory rates, and presumably would find it profitable to maintain and expand rail facilities. Economically speaking, therefore, Judge Hall's solution to the payment problem would be an optimal one and can lead to economic rationality in the region and ultimately in the country.

2.4 CONCLUSIONS

The original purpose of the Crow rate was to foster agricultural growth in the West, and for many years it served this purpose well. By the early 1960's, however, mounting losses incurred by the railways due to the fixed nature of the rate, had produced severe strain in the grain handling and transportation system.

A brief review of the literature dealing with the impact of the Crow problem on western agriculture suggests the following: (a) the Crow impact on the Prairies has meant a dominance of, and dependence on, production of statutory grains for export at the expense of other crops with a concomitant loss of economic output from lower levels of grain processing and livestock production; and (b) an inadequate transportation system has led to restrictive delivery quotas, higher storage costs, and less than potential grain production, thereby reducing total income from grain as well as income from associated activities.

The major beneficiaries of the Crow rate have been agricultural land owners and those with assets in farm service sectors and centers. The main costs have been the economic inefficiencies that are or will be a consequence of the distortion. Society as a whole has borne these costs in the first instance, with the ultimate incidence depending on how the extra output foregone would have been allocated.

The political sensitivity on the matter, however, stems from the fact that capital and labor adjust to interregional earnings differentials. The West has fewer and less profitable feeding

operations, meat packing plants, and canola-crushing firms than it would have under an undistorted freight rate structure. The "cost" of the policy is in terms of a smaller and less industrialized western economy rather than real factor rewards, since in this sector these are largely set by the outside world.

Western Canada needs diversification of its industrial base to reduce its dependence on a narrow range of grains and minerals that are subject to cyclical variations in demand. The issue, however, is whether or not freight rate changes would bring about dramatic changes in the region's industrial structure. This and other related questions will be the topic of the next chapter.

Chapter III

CANADA'S TRANSPORTATION PROBLEM: A THEORETICAL PERSPECTIVE

3.1 INTRODUCTION

Many individuals and farm groups argue that railway pricing somehow interferes with the economic development of the West. The popular belief is that the discriminatory aspect of the railway rate structure fosters continued dependence on traditional western industries and interferes with possible industrial diversification (Brown, 1925; Adams-Webber, 1983). There is some causality here, but it is complex. It is not only the railway rate structure that determines the industrial structure of a region but also the cost and market structure of the industries that determines their ability to pay for transportation and, hence, the structure of railway pricing. This long-standing concern about railway rate structures and economic development merits further discussion and it is examined in this chapter.

The organization of this chapter is as follows: section 3.2 introduces the social goals of the Crow and freight rate discrimination and provides the theoretical framework for the analysis; the question of diversification via freight rate policies is taken up in section 3.3; and the conclusions are presented in section 3.4.

3.2 SOCIAL GOALS OF THE CROW AND FREIGHT RATE DISCRIMINATION

Both Gilson (1982) and Tyrchniewicz (1984), argue that the Crow rate structure appeared to have worked effectively from its inception until the late 1950's. However, not much has been said about the reasoning behind this observation. We now attempt to justify why this has been the case.

The Crow rate structure (which was one form of commodity price discrimination) permitted low-value grains to travel at relatively low rates, while higher rates were charged for other crops, livestock, processed agricultural products and manufactured commodities. This structure satisfied important social goals. Lower rates on grains produced in the West enabled western producers to compete with alternative sources of supply closer to the large eastern markets and thus assisted their development. Similarly, lower rates supported farm incomes at a level that encouraged people to undertake the risks and hardships of settling the western and southwestern lands. If the supply of agricultural production factors had been fixed in the short run, rate increases would have been pushed back to producers, reducing their income; this, in turn, would have had the long-run effect of slowing down the development of these areas. Although this rate structure tended to turn the terms of trade against the western farmers by encouraging low prices for grain exports and high prices for their manufactured imports, its net effect was to encourage the development of the West.

The Crow rate structure that met these social goals was also in the long-run, profit-maximizing interest of the railroads.

Because of their rapid expansion of capacity, the railroads developed a cost structure characterized by high fixed costs relative to variable costs. This meant that where competitive pressures prevailed, rail rates tended to be pushed down to variable costs. Where few competitive pressures existed, rail rates tended to rise considerably above average total costs.

Bulk commodities were subject to considerable competitive pressure because of water competition, alternative sources of supply, and the high proportion of freight costs in the final goods price, which ensured that a rate increase would be reflected in the price. These commodities had a highly elastic demand for rail service; any rate change would have led to a more than proportional change in traffic. On the other hand, no other means of transport was as well suited as railways for carrying high-value manufactured goods, and the small proportion of freight costs in their final prices ensured that rate increases have a relatively insignificant effect on demand (Heaver and Nelson, 1977). Hence, these commodities had an inelastic demand for rail services; any rate change would have led to a less than proportional change in traffic.

In view of their cost structure and the nature of the demand for their services on the part of low-value bulk commodities and high-value manufactured products, the railroads would have evolved a value-of-service rate structure in any event. Thus, the form of commodity price discrimination that encouraged the development of the West also maximized the railroads' profits.[3]

[3] This observation will be rigorously proved in section 3.2.3.

Regulation via the Crow's Nest Pass Agreement simply institutionalized these pricing policies while restraining the monopoly power of the railroads in other areas.

3.2.1 Freight Rates and Producer Incomes

Freight rates determine the difference between the market price of a given commodity and the farmer's received price. Hence, a general increase in freight rates has much the same effect as the imposition of a tax on a specific commodity, reducing the farmer's received price by the amount of the rate increase. In the short run, when the supply of agricultural commodities is fixed, the farmer has no choice but to absorb any rate increases. Farm incomes fall and railroad revenues rise by the same amount of the rate change.

The impact of rate increases on farm incomes can be seen in Figure 3.1, which shows the supply and demand curves of a commodity such as wheat. The short-run supply curve drawn is perfectly inelastic; the demand curves are drawn to be quite elastic. At the initial equilibrium, Q_0 bushels of wheat are produced and sold at a price P_0 per bushel. Suppose that railroads increase the rates on wheat. The market demand curve DD does not change, but so long as railroads are the only source of transport, the producers' derived demand curve D'D' falls by the amount of the rate increase to D"D". The received price falls from P_1 to P_2, and the farmer's revenue or income falls by the shaded area, which also represents the increase in the railroads' revenues. For the large portions of the West and southwest that lack

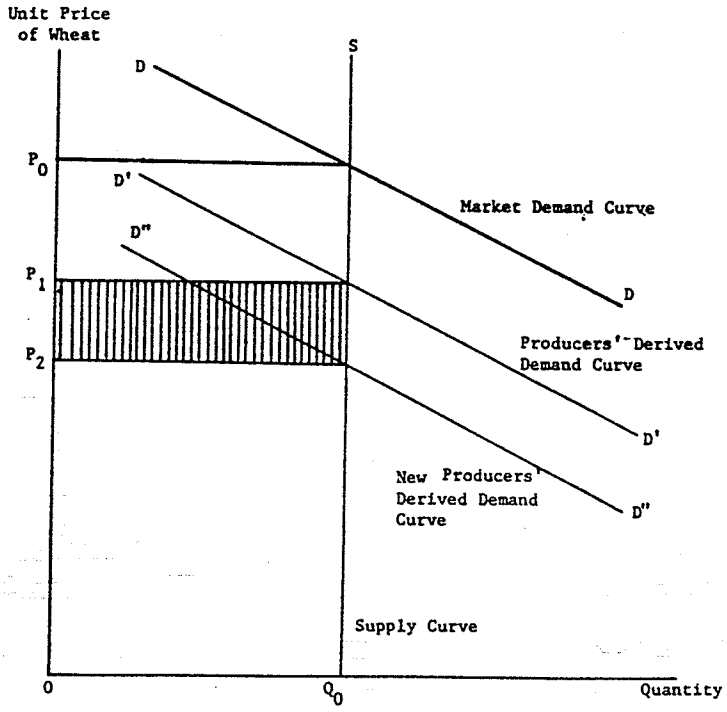

Figure 3.1

Effect of Rail Freight Rate Increases on Producer Incomes

alternative means of transport, this could be the expected outcome of a general rate increase.

Once producers have a chance to react to changes in received income, the impact of rate increases becomes less predictable. In general, the more elastic the demand curve relative to the supply curve, the more will the rate increases tend to be pushed back to producers. Moreover, the more elastic are both the demand and the supply curves, the more will output be reduced in response to rate increases. Thus, in a situation characterized by an elastic demand curve, an inelastic short run supply curve, and an elastic long-run supply curve, rate increases would initially be pushed back to producers who would then curtail production in response to the reductions in their incomes or would seek alternatives which have a lower proportion of freight costs relative to the final price of the goods.

It is likely that these demand and supply curves characterized western agricultural and raw materials markets at the turn of the century. Since western agricultural products and raw materials were competing with alternative sources of supply, the demand curves for these western commodities were quite elastic. Similarly, the short run supply curves of these commodities were quite inelastic, since production decisions are difficult to change in the short run. Consequently, rate increases on agricultural commodities and raw materials would have curtailed the development of the West by reducing producers' incomes. Although the need for low freight rates to maintain western agricultural and raw materials producers' incomes at a sufficiently high level

to encourage the development of the West was never explicitly stated, it was a real, if not implicit, consideration in the maintenance of low freight rates on agricultural products and raw materials.

The statement that value should play an important part in determining rates also implies that rates should be high on high-value commodities. Since the demand for high-value manufactured goods was typically inelastic, these high rates tended to be pushed forward to the consumers. Thus, the rate structure led to transfers between income groups as well as between different commodity groups. If not subsidized in the sense that they failed to cover the incremental costs associated with their transport, the low-value goods tended to make smaller contributions to overhead than high-value goods. Moreover, through the rate differentials, the western producers of agricultural commodities and raw materials tended to receive income transfers from the consumers of manufactured goods. Of course, to some extent these were one and the same, since the producers who could ship their goods out cheaply were also the consumers who had to pay high rates on their purchases of manufactured goods. However, it seems unlikely that the balance was complete. Not every consumer in the West was also a producer. Moreover, most of the consumption and production of manufactured goods took place in the eastern sections of the country. Hence, to a large extent, the cross subsidization was between regions and between income groups. The railroad rate structure was effectively used as a tax and subsidy to redistribute income to stimulate the development of the West.

Thus, during the initial period of regulation up to the 1950's, the interests of the railroads and of the western producers coincided. The rate structure that maximized the railroad profits was also the rate structure that maintained producers' incomes at a sufficiently high level to encourage the development of the West. This proposition is rigorously proved below.

3.2.2 Profit Maximization with Freight Rate Discrimination

Railways have to contend with two types of competition. One type is that presented by other modes of transportation for higher valued freight--e.g., trucks; the other is market competition for bulk commodities; i.e., competition in the market for the product carried which limits the ability of the commodity to bear transportation charges. The latter may induce the railroad to accept special rates as long as they cover, or more than cover, variable costs.

Like all other businesses, the railroads must earn enough total revenue to cover total expenses, including remuneration for capital costs. If they do not, they will go bankrupt or will have to be subsidized by the government (that is, by the taxpayers). It is a strongly argued proposition in economics that the most efficient use of a nation's economic resources requires that the price set for each good and service be equal to the cost of producing an additional unit of the goods and services (the marginal cost) in question. When the marginal cost is lower than the average cost, as is the case when railroads have substantial unused capacity, either the railroads must abandon marginal cost pricing or the government must cover some of the fixed costs.

Transportation rate structures have long contained elements of what is called "value-of-service" pricing which also refers to charging "what the traffic can bear." In effect, this system sets freight rates according to the shipper's and/or receiver's ability and willingness to bear the transportation cost. It is, after all, in the railroad's interest that the shipment take place. If the receiver can easily turn to local supplies, then he will resist absorbing increased transportation rates. If the distant supplier has to contend with a rigid cost structure, then he will be unable to bear high transportation rates. Thus, the joint effect of the demand for, and supply of, the products shipped will determine the cost and quantity shipped and who bears the cost of transportation. On the whole, higher-priced commodities are charged higher freight rates. For instance, agricultural products--excluding statutory grain and grain products--paid 1.82 cents per ton-mile in 1980; mining products, 2.17 cents; forest products, 3.34 cents; and manufactured and miscellaneous products, 4.14 cents (CTC, 1982).

3.2.3 The Freight Rate Discrimination Model

The analysis of discriminatory pricing is a straightforward application of the MR=MC rule, but in a sense it is diametrically opposite to the application of the rule to multi-plant monopoly. In the latter, plant marginal cost curves are aggregated to obtain the monopoly marginal cost, which is equated to marginal revenue. In price discrimination, submarket marginal revenue curves are aggregated to obtain the monopoly marginal revenue, to which marginal cost is equated.

The allocation of sales between the two markets (markets for manufactured goods and for agricultural goods) is the basic problem encountered by the price-discriminating monopolist, i.e., in our particular case, by the freight-rate-discriminating railroads. Suppose that the railroads have somehow correctly allocated the sale of q units of transportation service. Next, suppose that they decide to expand output and sales to q+1 units. In which market should the additional unit be sold? The answer should be obvious: the additional unit should be sold so as to increase total revenue by the greatest possible amount. This will occur, of course, if the unit is sold in the market with the higher marginal revenue corresponding to the prior allocation of the q units.

Generalizing, the total output to be sold should be allocated between the two markets in such a way that marginal revenue is the same in both markets. If marginal revenue were higher in market 1--manufactured goods--than in market 2--agricultural goods--for example, the railroads could augment their profits by shifting some units from market 2 to market 1. Maximum profit is obtained only when marginal revenue is the same in both markets.

This argument establishes the basis of allocating a given volume of sales between two markets. It also permits an easy explanation of the fundamental market condition required for profitable and meaningful freight rate discrimination.

Assume that the demand for the transportation service is in inverse form and may be written as:

$$p = f(q) \ , \ f'(q) < 0 \qquad (3.1)$$

where p and q denote price and quantity of the service, respectively. Thus, total revenue is:

$$pq = qf(q) \tag{3.2}$$

and marginal revenue is:

$$MR = \frac{d(pq)}{dq} = f(q) + qf'(q) \tag{3.3}$$

Price elasticity of demand is defined as:

$$\varepsilon = -\frac{dq}{dp}\,\frac{p}{q} = -\frac{1}{f'(q)}\,\frac{p}{q} = -\frac{p}{qf'(q)} \tag{3.4}$$

Now, factor p=f(q) from the right-hand side of expression (3.3), obtaining:

$$MR = p\left(1 + \frac{qf'(q)}{p}\right) \tag{3.5}$$

Substituting from (3.4) into (3.5) yields the following expression:

$$MR = p\left(1 - \frac{1}{\varepsilon}\right) \tag{3.6}$$

As previously shown, MR must be the same in each market. If ε were also the same in each market, p would necessarily be the same. In this case, the two submarkets would be indistinguishable since all revenue-connected magnitudes are the same. Consequently, profitable freight rate discrimination requires that the elasticity of demand differ between the two markets.

The first problem confronting a freight-rate-discriminating railway is the allocation of a given level of transportation ser-

vice between its markets. The second problem is determining the optimal level of sales and, therefore, the level of freight rates in each of the submarkets. For this calculation, cost data are required.

In Figure 3.2, AC and MC represent the (aggregate) unit and marginal cost of producing the monopolized transportation service. D_1D_1' and D_2D_2' are the submarket demand curves for manufactured and agricultural goods, respectively, and MR_1 and MR_2 are the corresponding marginal revenue curves. Aggregating the two marginal revenue curves, the railway marginal revenue curve MR is obtained. Next, invoking the MC=MR rule, the profit-maximizing output is $O\bar{q}$ units. The marginal revenue associated with this output is Om.

The market allocation rule, previously determined, requires that marginal revenue be the same in each submarket. Thus, Oq_1 units are sold in market 1 and Oq_2 units in market 2 ($Oq_1 + Oq_2 = O\bar{q}$). Furthermore, given the submarket demand curves, the freight rate in each submarket is determined. A rate of op_1 per ton-mile is charged in the market for manufactured products and a rate of op_2 per ton-mile is charged in the market for agricultural commodities.

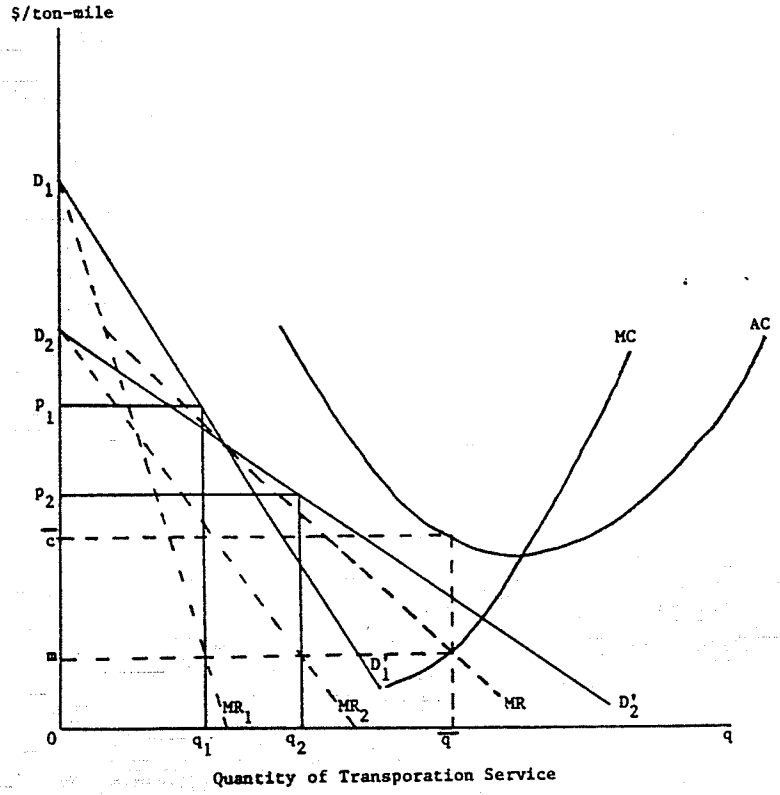

Figure 3.2

Profit Maximization with Freight Rate Discrimination

At any given output, it is apparent that demand is more elastic in market 2 than in market 1. Using this information in conjunction with the results above brings out an interesting, albeit rather obvious, point: the more elastic the submarket demand, the lower equilibrium price in the submarket. This proposition is easily proved.

First, recall that marginal revenue may always be written as:

$$MR = p\left(1 - \frac{1}{\varepsilon}\right) \tag{3.6}$$

Next, since marginal revenue must be equal in both markets, we have

$$MR_1 = MR_2 \tag{3.7}$$

where subscripts denote the market. Using expression (3.6) in expression (3.7), we obtain:

$$p_1\left(1 - \frac{1}{\varepsilon_1}\right) = p_2\left(1 - \frac{1}{\varepsilon_2}\right) \tag{3.8}$$

Since the market for transportation services for agricultural commodities is characterized by the higher price elasticity of demand, i.e., since $\varepsilon_2 > \varepsilon_1$, then:

$$\left(1 - \frac{1}{\varepsilon_2}\right) > \left(1 - \frac{1}{\varepsilon_1}\right) \tag{3.9}$$

Using inequality (3.9) in expression (3.8), the equality between the left- and right-hand sides requires that $P_1 > P_2$. This completes our proof of the proposition that the higher freight rate is charged in the market which the demand for transportation services is less elastic and the lower freight rate is charged in

the market in which the demand for transportation services is more elastic.

3.3 DIVERSIFICATION VIA FREIGHT RATE POLICIES

A detailed review of the specific problems with the Crow rates was presented in Chapter 2. It is beyond dispute that they are uneconomic. It is also well-recognized that they cause a lack of incentive both for railways and producers to rationalize the system. The fact that something must be done is universally recognized. As discussed previously, it is often alleged that industrial users of western agricultural commodities such as livestock feeders, and canola crushers are disadvantaged by the rate distortion (Harvey, 1980; Gilson, 1982; Wilson and Tyrchniewicz, 1980; Tyrchniewicz, 1984). As a corrective policy to remove existing anomalies in crop mixes and industrial locations, a one-time increase in statutory grain freight rates to cover full costs has been suggested.

This proposition fits in well with the traditional western concerns that the railway freight rates might discriminate against and interfere with efficient diversification and expansion of industry. These concerns, however, do not appear to be warranted.[4] An important feature of the ability of the railways to discriminate is that it works two ways. The freedom to in-

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[4] The implications of two comprehensive studies by P.S. Ross, et al. (1974) and MPS Associates (1976) cited in Heaver and Nelson (1977) were basically negative to the idea that freight rate differences and discrimination have actually been the controlling factor in whether industrial plants locate in the Prairies or not.

crease prices is also the freedom to reduce prices for traffic unable to bear higher rates. A profit-oriented firm has an incentive to lower rates to enable low-valued traffic to move as long as it covers variable costs. A great deal of western traffic, particularly grains, fits into this category of traffic unable to bear high freight charges. The flexibility of discriminatory pricing and the profit-orientation of railways have facilitated the growth of western Canada. This flexibility of discriminatory pricing and the profit-orientation of railways have implications for rate structure as well as rate levels. Railway pricing has a discriminatory rate structure, but the key issue is whether or not it would systematically distort efficient economic development. The logic, outlined briefly as follows, suggests otherwise (Waters II, 1983).

Railway pricing is expected to be consistent with efficient economic development and industrial diversification. The more profitable is an industry, the more it can afford to pay for transportation. So long as railways are free to practise value-of-service pricing, the efficient location of industry is in the railways' best interest. The selling price of a product is determined in the final market. The lower the cost of production, the greater the potential profit and the greater share of this potential profit that the railways could capture via discriminatory pricing. If processing raw materials at the site instead of at the market were more efficient, then more money could be made hauling processed goods rather than raw materials. If there were no difference, a value-of-service rate structure would have a

neutral effect on location (which is not necessarily the same as equal rates or markups, since there could be weight gain or loss in processing raw materials and different transport costs could be involved).

The desire for industrial diversification and increased processing and manufacturing can be different from an efficient allocation of resources, i.e., political and social aspirations can differ from economic efficiency. The free reign of value-of-service pricing will not be consistent with these goals. It is likely that many people fail to appreciate that the conflict between railway discriminatory pricing and industrial development objectives is not a question of economic efficiency but is a conflict between economic and social-political goals. This is not to downgrade the social objectives. But it is relevant to the question of the desirability of using freight rate policies as a mechanism of achieving noneconomic goals, especially since the pricing system of value-of-service is consistent with economic efficiency.

There are two grounds for questioning the use of freight rate policies. The first is that, as mentioned, freight rates generally constitute only a small portion of the total delivered costs of higher-valued processed or manufactured goods. The efficacy of freight rates in promoting their development is questionable. Even a high degree of interference with freight rates could be insufficient to achieve the desired developmental effects. The pursuit of noneconomic industrial developments is most effectively achieved by direct government assistance rather than via indi-

rect and uncertain measures such as freight rate policy. The second grounds for questioning freight rate policies for economic development goals concern the costs of interfering with an efficient pricing system. Not only are there the direct inefficiencies induced by causing freight rates to be uneconomic, there are the potentially high costs of interfering with the managerial incentives for efficiency in a value-of-service pricing system. This is a potentially serious cost.

3.4 CONCLUSIONS

The single most important conclusion emerging from the previous analysis is that railway pricing in western Canada has worked effectively. This is reflected in two ways. First, the railway rate structure has been effectively used as a tax and a subsidy to redistribute income. Second, the structure that has encouraged the development of the West has also been in the long-run, profit-maximizing interest of the railways.

A second general conclusion of this chapter is that although there is some causality between railway pricing and the economic development and industrial diversification of the West, it is not the only railway structure that determines the industrial structure of a region but also the cost and market structure of the industries that determines their ability to pay for transportation and, hence, the structure of a value-of-service rate system. It was argued that the workings of the railway rate structure are broadly consistent with the efficient allocation of resources, including promoting efficient industrial development of the West.

Finally, it is important to note that the performance of the Canadian grain handling system is of fundamental importance to western Canada. Despite all the interest in potential industrial diversification of western Canada, this does not alter Canada's comparative advantage in grain production. With growing world populations, there are good prospects for increased Canadian grain exports. Whatever other industrial options are available to western Canada, grain production, especially for export, will continue to be a major economic base. The level of economic activity in this traditional economic base of western Canada will be influenced significantly by the efficiency of and prices and service conditions in grain transportation. It will also be influenced by the structure and variability of the world grain market. This aspect will be addressed in the next chapter.

Chapter IV

THE STRUCTURE AND VARIABILITY OF THE WORLD WHEAT MARKET

4.1 INTRODUCTION

Annual variations in the price of wheat are mainly due to fluctuations in trade which, in turn, depend in large part on changes in production. Five of the largest exporters which together account for over 80 percent of world exports are the U.S., Canada, Australia, Argentina, and France. Their current exports are more than twice their domestic consumption. The principal market, therefore, in which the price of wheat is determined is the international market. For wheat, then, understanding world trade behaviour is essential to analyzing the nature of price variability. This chapter combines a review of the structure of the world wheat market with an analysis of the price variability in that market.

The organization of the chapter is as follows: the market structure of net exporters and how the pattern of trade has changed over the past 25 years will be examined in section 4.2; an overview of the market structure and change in centrally planned, less-developed, and developed market economies will be made in section 4.3; the sources of variability in the world wheat market are discussed in section 4.4; and the conclusions are presented in section 4.5.

4.2 THE MARKET STRUCTURE OF NET EXPORTERS

Wheat, as the major traded food grain, plays a critical role in making the food balance in many countries with domestic shortages of staple crops. It is also a major agricultural export of the developed world, especially the U.S., Canada, Australia and the European community. In 1983, exports of Canadian grains and oilseeds and their products accounted for 73 percent of total agrifood exports, with wheat and wheat flour alone generating 50 percent of all receipts from food and agricultural exports (Warley, 1985). In crop year 1984/85, world trade in wheat was estimated to be 104.4 million metric tons, compared to only 45 million metric tons in 1960/61 (IWC, 1960-1985).

Table 4.1 presents the market shares of major exporting countries and importing regions. The export side of the world wheat market, unlike the import side, is highly concentrated. Over the last 25 years, world exports have come principally from five countries: the U.S., Canada, Australia, France and Argentina. Although annual market shares have fluctuated, during this time Canada has generally accounted for about 20 percent of world exports; the U.S., 40 percent; Australia, 12 percent; and Argentina, 4 percent. France's export share increased from an average of 5 to 13 percent over the same period. Together, the five countries controlled on average 82 percent of world wheat exports in 1960/61 and 90 percent in 1984/85.

Table 4.1

Wheat Exporter Market Shares for Selected Years

	1960/61	1969/70	1979/80	1984/85
	percent			
Canada	22	17	16	17
United States	41	29	42	37
Australia	15	14	15	15
Argentina	2	4	4	7.5
France	3	10	11	13.5

Source: Computed from IWC, World Wheat Statistics (1960-85).

4.3 THE MARKET STRUCTURE OF NET IMPORTERS

Table 4.2 presents the market shares of importers and uses the broad import groups of the centrally-planned, less-developed countries. This table suggests that developed country imports have been declining relative to those in the less-developed and centrally-planned countries.

Brazil, Japan, Poland, China and the USSR accounted for about 45 percent of world net imports in 1984/85, and this compares to only 30 percent in 1960/61. The USSR and China are not only important importers of wheat but they are also large producers. The USSR tended to be a net exporter until 1972, when a domestic policy shift occurred. The Soviet Union decided to rely more on imported grain for feed to maintain domestic meat production. China, Brazil, Japan and Poland have been consistent net importers. All of these countries have state trading agencies which

govern wheat trade and domestic policies which have generally separated world prices from domestic consumer and producer prices (Schmitz, et al., 1981).

Table 4.2

Wheat Importer Market Shares for Selected Years

	1960/71	1969/70	1979/80	1984/85
	percent			
Less Developed Countries	41	46	52	50
Centrally Planned Countries	19	21	33	38
Developed Countries	40	33	15	12

Source: Computed from IWC, World Wheat Statistics (1960-85).

4.4 WORLD WHEAT PRICE VARIABILITY

The experience of the early 1970's demonstrated that the nature of the linkage between domestic grain markets through international trade is an essential factor in international price variability. Blandford (1983) has suggested that price variability in the international grain market is largely the product of quantitative variability in domestic markets.

The impact of domestic production fluctuations on world price and trade varies depending in which countries they originate. That is, the impact will depend on the size of the country in world trade and the nature of transmission of domestic production variability into trade variability. In each country, domestic

policies and trade restrictions will determine the relationships between production, trade and the responsiveness of the import demand (export supply) to world price. The trade response of each country, in turn, depends upon the trade responses of all other importers and exporters in the world market (and the domestic policies affecting these responses). Price variability will also depend upon the underlying supply and demand conditions (elasticities) in each country.

Most importing and exporting countries have domestic policies which are designed to stabilize or support farm incomes. The market is pervaded by state-trading and other non-tariff barriers which prevent the world market price signals from being passed through to domestic markets. The less the response of import demand/export supply to world prices, the more market adjustments are borne by the remaining price-sensitive market participants. The greater the incidence of trade restrictions, the lower the trade price elasticities of world demand and supply. The lower the elasticities, the more disproportionately large the price swings in response to small variations in supply and demand, i.e., the greater the price variability.[5]

To quote Gale Johnson:

> The agricultural policies of the industrialized countries are increasingly caught up in a vicious circle: they all contribute to the collapse of world prices and at the same time they are all condemned to protect themselves from the effects of low world prices in an ever uncompromising manner (Johnson, 1973).

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[5] See Fisher (1981) for a rigorous proof of these propositions.

To put the variability of wheat prices in perspective, nominal and real prices of world wheat for selected years are presented in Table 4.3. The nominal world price (U.S. Gulf port hard winter no. 2) was approximately 125 percent higher in 1984/85 than in 1960/61, but in real terms it declined nearly 50 percent.

Table 4.3

World Wheat Prices for Selected Years(a)

	1960/61	1969/70	1979/80	1984/85
	U.S. $/MT			
Nominal	62	53	171	152
Real	154	91	113	80

(a) Annual averages. Nominal price for U.S. hard winter no. 2, f.o.b. Gulf port. Real price calculated as nominal price deflated by world consumer price index, 1975=100.

Sources: IWC, World Wheat Statistics (1960-85); IMF, International Statistics Yearbook, 1984.

The structure of international markets exacerbates the problem of price stability for Canadian wheat farmers. Farm-gate prices in Canada are a close reflection of the international price, after taking into account the transportation costs to export markets. Table 4.4 indicates that the farm-gate prices on the Prairies became more volatile in the 1964-80 period than in the immediate postwar period. They now vary from year to year by some 25 percent, on average, whereas for many years after the Second World War they varied by only 15 percent. There is an explanation for this increased volatility that goes beyond the va-

garies of weather and crop failures. The increasing intervention by governments of major wheat exporting and importing countries in their agricultural sectors is making the equilibrating process between world demand and supply increasingly difficult.

Table 4.4

Volatility in Farm-Gate Wheat Prices on the Prairies

1926-80

	Average Variation in Wheat Prices (%)		
	1926-45	1946-63	1964-80
Manitoba	34.6	14.1	23.8
Saskatchewan	37.2	15.1	24.7
Alberta	37.2	15.4	24.5

Source: Economic Council of Canada, Western Transition, 1984.

It is not only prices that fluctuate; costs do too. This can result in temporary squeezes on net income or even in bankruptcies. In recent years, several factors have contributed to cost increases. Land prices have risen substantially over the past decade and many farmers operate under a high debt-to-equity ratio (Loyns and Carter, 1984). This in combination with relatively high interest rates, constitutes a burden for Prairie farmers. The recently decreed increase in the freight rate for statutory grain, which was discussed in Chapter II, will further increase the squeeze on net farm incomes.

In summary, income instability for Prairie farmers has many causes. Because wheat prices, in particular, determine the net income position of well over half of the Prairie farmers, wheat

price variations explain at least 50 pecent of the income instability (Economic Council of Canada, 1984).

4.5 CONCLUSIONS

Important structural change has taken place in the world wheat market over the past 25 years. There has been a marked shift in importer trade shares away from developed country importers toward centrally-planned and less developed countries. The exporter market shares have also changed, primarily due to the expanding role of the European Community. Several policy shifts and adjustments in trade behaviour have also occurred over this period. Many of these changes have resulted in increases in price variability in the world wheat market.

It is against this background that increases in grain freight rates have been decreed for Canadian farmers. The main question which this research has sought to answer is whether or not these increases will impact on Canada's share of the export wheat market. To analyze potential effects of new rates requires a model which includes two main exporters of wheat, i.e., Canada and the U.S. The nature of the model is the subject of the next chapter.

Chapter V

EXPORT DEMAND FOR CANADIAN WHEAT

5.1 INTRODUCTION

The estimated model to be used to examine the impact of changes in statutory grain freight rates on Canada's share of the export wheat market is the elasticity of substitution model. This chapter discusses the key issues in the development and specification of the model. The question of price responsiveness in export demand functions will be analyzed within the basic framework of this model. Although the validity of its underlying assumptions has been the target of criticism, it will be argued here that those assumptions are reasonable for this particular case study. It will be shown that Canada's market share will remain constant except as price ratios vary.

The analysis of the export demand for Canadian wheat will be extended to include an additional element affecting price response, time. The basic framework under which this objective will be accomplished is a simple partial adjustment model, which takes into account the fact that only a fraction of the desired quantity adjustment derived from a price change may take place in the current period and that the short-run and long-run price responses may be different.

Finally, "nonprice" preferences in the importing and exporting countries have been argued to play an important role explaining actual trade flows. A simple procedure developed by Ginsburg and Stern (1965) will be suggested to evaluate the magnitude of these preferences for Canadian vis-a-vis U.S. wheat exports to international markets. The results from the actual estimation will, however, be presented in the next chapter.

The organization of the chapter is as follows: the theoretical foundation of the model will be presented in section 5.2; the validity of the constant share norm will be established in section 5.3; the partial adjustment market share model will be discussed in section 5.4; the procedure to estimate "nonprice" preferences will be presented in section 5.5; the interpretation of the results will be addressed in section 5.6; and finally, the conclusions will be highlighted in section 5.7.

5.2 THEORETICAL FOUNDATION OF THE ELASTICITY OF SUBSTITUTION MODEL

The elasticity of substitution is defined with respect to movement along a single indifference curve with the assumption that all other relevant quantities are held constant.[6] This situation is shown in Figure 5.1, with II as an importer's indifference curve, A'B' as its original price line, and A"B" as its final price line:

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[6] This section is largely based on Morrissett (1953), Leamer and Stern (1970), and Richardson (1972, 1973).

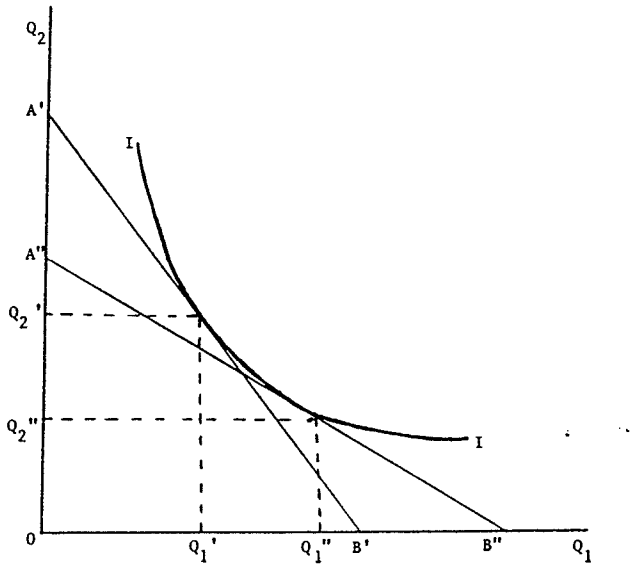

Figure 5.1

The Elasticity of Substitution Along a Single Indifference Curve

The elasticity of substitution may be estimated by:

$$\sigma = \frac{\Delta(Q_1/Q_2)}{Q_1/Q_2} \Bigg/ \frac{\Delta(P_1/P_2)}{P_1/P_2} = \frac{OQ_1'/OQ_2' - OQ_1''/OQ_2''}{OQ_1'/OQ_2'} \Bigg/ \frac{OA''/OB'' - OA'/OB'}{OA'/OB'} \quad (5.1)$$

where Q_1 and Q_2 are exports from two competing supply sources to some third market and P_1 and P_2 are their respective prices.

The value of σ will, in general, depend on the particular indifference curve and on the value of P_1/P_2. To propose an empirical definition, it is necessary to specify the conditions under which σ depends on the ratio P_1/P_2 alone. The proper requirement is that the slope of the indifference curve depend on Q_1/Q_2 and not on any scale factor. This, however, depends on the shape of the underlying utility function. It is well known from neoclassical demand theory that linear homogeneous functions and their monotonic transformations have this property. To put it in another way, the income elasticities of the two goods must be equal so that this condition is satisfied.

As noted above, the elasticity of substitution cannot be defined unless a further assumption regarding all other relevant goods is made: the proportional response of Q_1 and Q_2 to changes in the levels of all other goods must also be equal. This assumption coupled with the previous assumption is, in general, very restrictive, in the sense that commodities 1 and 2 must have demand functions that relate between themselves in a very particular way in order to satisfy the above two conditions. In simple words, the two commodities must be "very similar" but not "too similar," up to the point of being considered perfect substitutes in demand. For if commodities 1 and 2 are perfect substitutes, the importing country would purchase only the lower priced one, in which case $\sigma = -\infty$, except for the effect of the short-term disturbances and price uncertainties. Knowing this, there would be no real need to estimate it. On the other hand, if the two commodities are very different, it is highly unlikely--except for

a coincidence--that their demand functions will satisfy the preceding assumptions.

Elasticity of substitution studies in international trade have, in general, postulated a log-linear demand relationship between two countries' relative exports and their relative prices:

$$\log (Q_i/Q_j) = \beta_o + \beta_{ij} \log (P_i/P_j) + u \qquad (5.2)$$

where Q stands for quantity exported, P for prices, and i and j denote country i and country j. The coefficient β_{ij} is the constant elasticity of substitution and indicates the percent of change in the ratio Q_i/Q_j when there is 1 percent change in the ratio P_i/P_j. This can be easily seen by taking the partial derivatives of Equation (5.2) which yields:

$$\beta_{ij} = \frac{\partial \log(Q_i/Q_j)}{\partial \log(P_i/P_j)} \qquad (5.3)$$

Classical studies applying the elasticity of substitution in international trade include those of Tinbergen (1946), Chang (1948), Polak (1950), Morgan and Corlett (1951), MacDougall (1951, 1952), Zelder (1958), and Ginsburg (1969). Since the early 1950's [Morrissett (1953)], the elasticity of substitution model has been the target of criticism for the stringent con-

straints it requires in order to be able to uniquely relate the Hicksian theoretical concept with its estimates from market data. Regardless of those criticisms, the elasticity of substitution model is still popular in empirical work in international trade. In addition, recent research seems to indicate that the early criticisms are not so damaging as was initially believed. In particular, Richardson (1972) has found that "each of the constraints on individual demand functions required for the validity of Equation (5.2) are remarkably consistent with results from two broad sets of observations on manufactured exports." He concludes, "the concept of the elasticity of substitution may thus be in fact unexpectedly robust."

The main assumption underlying Equation (5.2) is that the importing country has a well-behaved indifference map. In view, however, of the well-known conceptual difficulties involved in such community indifference maps, it may be more fruitful to examine the elasticity of substitution in the framework of conventional demand analysis.

Consider the following demand equations, which can be thought now as export demand functions, and where all terms have been defined before, except P_n which is the general price level in the importing country of commodities other than i and j, including perhaps competing imports and Y which is money income in this country:

$$Q_i = f(P_i, P_j, P_n, Y) \quad \text{and}$$
$$Q_j = g(P_i, P_j, P_n, Y) \tag{5.4}$$

For purposes of simplification, let us assume constant elasticity approximations to (5.4):

$$Q_i = AP_i^{\alpha_i} P_j^{\alpha_j} P_n^{\alpha_n} Y^{\alpha_y} \text{ and}$$

$$Q_j = BP_i^{\beta_i} P_j^{\beta_j} P_n^{\beta_n} Y^{\beta_y} \qquad (5.5)$$

where the α's and β's refer to the elasticities of the respective variables. Let us rewrite (5.5) by dividing Q_i by Q_j:

$$\frac{Q_i}{Q_j} = \frac{A}{B} \frac{P_i^{\alpha_i - \beta_i}}{P_j^{\beta_j - \alpha_i}} P_n^{\alpha_n - \beta_n} Y^{\alpha_y - \beta_y} \qquad (5.6)$$

The elasticity of substitution may now be conveniently defined holding other prices P and money income Y constant. According to Equation (5.6), Q_i/Q_j will be functionally dependent on P_i/P_j only if the exponents of the price variables are equal:

$$\sigma = \alpha_i - \beta_i = \beta_j - \alpha_j$$

or

$$\alpha_i + \alpha_j = \beta_i + \beta_j \qquad (5.7)$$

$$MR = \frac{d(pq)}{dq} = f(q) + qf'(q)$$

Equation (5.7) asserts that the sum of the direct and cross elasticities of demand be the same for each commodity. This is quite

similar to the symmetry conditions discussed before in connection with the utility analysis, and the same conditions holds. Commodities Q_i and Q_j must be quite similar but not too similar.

In addition, it is evident from Equation (5.6) that there are two variables, P_n and Y, that do not appear in the regression equation (5.2). This is justifiable only when:

$$\alpha_n = \beta_n \quad \text{and} \quad \alpha_y = \beta_y \tag{5.8}$$

that is, when the cross-price elasticities with respect to other goods are comparable and the income elasticities of each commodity are also comparable. This implies roughly that the two commodities be alike in all economic respects except that they are not perfect substitutes.

In this chapter, we are interested in specifying a regression model to measure the elasticity of substitution between a third country wheat imports from two different sources. More specifically, our typical estimated equation will be of the form of (5.2), where Q_i and Q_j will refer to a third country imports of wheat from Canada and the United States. Although, one can hardly argue that wheat from Canada is not very similar to wheat from the U.S., the following question arises rapidly: Aren't they "too similar" in the eyes of the importer, so as to make the estimation of the elasticity of substitution between them unnecessary? This is clearly an empirical question and no amount of "logical" discussion can ever answer it. Yet some remarks are possible and those point to the conclusion that wheats from different sources are not perfect substitutes.

1. Not all wheat exporting countries are able to produce the same qualities of a particular wheat (Intercambio Limited, 1985) Hence, certain qualities are associated--in the eyes of the importers--with specific exporting countries. For example, the Canadian wheat is usually regarded as being of high quality.
2. Importers may have preferences for more reliable exporters vis-a-vis those transitory ones, regardless of the fact that the quality of the wheat from alternative sources might be quite similar.
3. An analysis of the past trends in wheat imports from different sources indicate that a temporary or moderate increase of one exporter's price does not usually result in the extinction of that exporter's market share, as would be the case if importers were totally indifferent regarding the wheat from different sources. Similarly, when the export price of a particular wheat exported from a given source has fallen relative to the price of a similar wheat from different sources, the cheaper wheat does not absorb all the market for that commodity. This situation raises the interesting question of import loyalty in world wheat markets (Wilson, et al., 1986) that will be explored in the next chapter.
4. The payment conditions required by different exporting countries may differ considerably and this may help to differentiate wheat from different sources in the eyes of the importing agency, even though from the consumer's point of view the wheats might be undistinguishable.

5. Political reasons might differentiate the wheat from different sources in the eyes of importing agency. For example, wheat imports from the U.S. are most likely not considered by some importing countries, e.g., Iran and Nicaragua, as perfect substitutes for Canadian wheat, even though from the consumer's point of view they may be.

In conclusion, the empirical evidence seems to suggest that wheats from different sources are not regarded by importing countries as perfect substitutes. Strict quality differences explain only part of this observation, whereas institutional and political factors, we believe, explain the most.

How well the parameters of the import demand functions (5.5) satisfy conditions (5.7) and (5.8) is an empirical question and some authors have suggested that empirical tests of those conditions should be performed before estimating equations like (5.2). Thus, Leamer and Stern (1970) suggest a regression of the form:

$$\log(Q_i/Q_j) = \beta_0 + \beta_1 \log P_i + \beta_2 \log P_j + \beta_3 \log P_n + \beta_4 \log Y + u \quad (5.9)$$

where the validity of conditions (5.7) could be examined by testing whether $\beta_1 = -\beta_2$ and $\beta_3 = \beta_4 = 0$ for (5.8). Although this procedure has an intuitive appeal its use is restricted in empirical studies of international trade due to problems of multicollinearity. In practice, multicollinearity between the c.i.f. import prices of the main wheat supplies is very high. This fact would simply preclude obtaining statistically significant estimates of the parameters of Equation (5.9). It is perhaps because of these

difficulties--or due to the lack of the additional data required by (5.9) vis-a-vis (5.2)--that virtually in all applications of the elasticity of substitution model in international trade, equations like (5.2) have been fitted directly, without an empirical test of the underlying assumptions of the model.

Other critics of the elasticity of substitution model (Morrissett, 1953; Meinken, et al., 1956) have suggested that Equations (5.5) should be fitted first, and if their estimated parameters do not satisfy conditions (5.7) and (5.8) there would be reasons not to use the simplified model given by (5.2). The above proposition can be rephrased as follows: why estimate the elasticity of substitution directly when, if certain assumptions hold, it can be derived from the parameters of the demand functions with respect to the magnitude of price and income elasticities? This is, clearly, a very legitimate question that deserves serious consideration. We believe, however, that there are some important arguments to be given in favour of estimating Equation (5.2) versus (5.5), which are all relevant for this particular study.

1. Equation (5.2) is more appropriate for cases of high multicollinearity between the explanatory variables of (5.5), which is typically the case between prices of close substitutes.
2. The data requirements for fitting Equation (5.2) are less than those for fitting (5.5), which is an advantage in studies of trade where data are hard to obtain. By using (5.2) there is no need to collect data on any variable

that has an equiproportional effect on Q_i and Q_j in Equations (5.5).

3. Once the elasticity of substitution has been estimated from Equation (5.2), the values of the own and cross price elasticities of the import demand functions (5.5) can be derived and measured by using some well accepted propositions in consumer demand theory (Harberger, 1957).
4. On the technical side, the estimation of the import demand functions such as (5.5) from time series data presents serious statistical problems which are likely to result in estimated price elasticities biased toward zero unless the export supply elasticities in the exporting countries are infinite. Some of the sources of bias noted by Orcutt (1950) are as follows:
   a) The error term is positively correlated with the prices included as explanatory variables, as a result of the simultaneous interaction between the corresponding supply and demand functions.
   b) Errors of measurement in the prices, and;
   c) Aggregation.

Under some reasonable assumptions, all three problems lead to underestimates of the price coefficients of the import demand functions.

These statistical problems affect also, of course, estimated equations of the form of (5.2). Yet there is a presumption that the estimates of the elasticity of substitution via (5.2) are

more stable than those obtained from the demand relations (5.5) as noted below.

> Disturbances to one of the (import) demand functions in (5.5) are likely to have their counterparts in disturbances to the other demand function. Accordingly, when we divide these (import) demand functions, the one disturbance will tend to cancel out the other and the elasticity of substitution relation [of Equation (5.2)] may be quite stable on the demand side. On the supply side, on the other hand, the individual disturbances reflect events in two different countries and are therefore less likely to cancel each other out. The increased stability on the demand side in the absence of the same on the supply side may, therefore, reduce the bias in the estimate associated with the simultaneous interaction of (export) demand and supply [Leamer and Stern (1970), parenthesis added].

In summary, we believe that there are some intrinsic advantages in estimating Equation (5.2) vis-a-vis the original import demand functions from which (5.2) is derived. However, the above statement is fully conditional on cases in which conditions (5.7) and (5.8) are likely to be satisfied.

A more pragmatic approach would be to ask ourselves the implications of violating the above conditions. It is sufficient to point out here that the exclusion of some relevant variables in Equation (5.2) will not preclude us from obtaining unbiased estimates of the elasticity of substitution, as long as the included price ratio P_i/P_j is uncorrelated with the excluded variables. This assumes, of course, that the error term in (5.2) is uncorrelated with the included price ratio.

5.3 CONSTANT MARKET SHARE MODEL

The basic form of the elasticity of substitution is described by the following relationship:[7]

$$\frac{Q_i}{Q_j} = f\left(\frac{P_i}{P_j}\right) \tag{5.10}$$

This relationship was shown to be equivalent to the demand for exports in a given market from two competing sources of supply.

Relationship (5.10) may be altered by multiplying through by P_i/P_j to obtain:

$$\frac{P_iQ_i}{P_jQ_j} = \frac{P_i}{P_j} * f\left(\frac{P_i}{P_j}\right) \tag{5.11}$$

This implies:

$$\begin{aligned} \frac{P_iQ_i}{P_iQ_i + P_jQ_j} &= \left(1 + \frac{P_jQ_j}{P_iQ_i}\right)^{-1} \\ &= \left\{1 + \left[\frac{P_i f(P_i/P_j)}{P_j}\right]^{-1}\right\}^{-1} \\ &= g\left(\frac{P_i}{P_j}\right) \end{aligned} \tag{5.12}$$

which indicates that country i's share of the market in question will remain constant except as P_i/P_j varies. This establishes the validity of the constant share norm and suggests that the

[7] See Thompson (1981) for further applications of constant market share model to agriculture.

difference between export growth implied by the constant-share norm and actual export growth may be attributed to price changes.

The economic significance of these market shares, however, can be understood in terms of the relationship between country i's share in an importing market and the total quantity of its exports into this market. This relation is described in the following identity:

$$Q_i = \left(\frac{Q_i}{Q_i + Q_j}\right) \times \left(\frac{Q_i + Q_j}{Q_t}\right) \times Q_t \qquad (5.13)$$

where:

Q_i and Q_j = the quantity of Canadian and U.S. wheat exports, respectively, which is imported by a selected country, and

Q_t = the total quantity of wheat imported by this country from all wheat exporting countries.

In order to explain the quantity of Canadian wheat exports, Q_i, not one but three factors are needed. The first term on the right-hand side of Equation (5.13), Canada's share of combined Canadian and U.S. wheat exports, determines how effectively Canadian wheat exports compete with those from the U.S. It is the variations in these Canadian market shares due to changes in freight rates that we shall seek to explain in this study. But it should be noted that these variations do not entirely determine changes in the quantity of Canadian wheat exports, for Canadian and U.S. combined share in the total import market is not fixed. A rise in either Canadian or U.S. export wheat prices

would cause the partial substitution of competing wheats from other wheat exporting countries. The middle term measures this influence. It is defined as Canadian and U.S. share in the total import market of the selected country. Moreover, to determine the quantity of Canadian wheat exports it is also necessary to know the total amount of wheat imported by this country. Total wheat imports, the final term in Equation (5.13), are not constant, insofar as a change in prices causes substitution between domestic and foreign wheats.

It is apparent that the importance of explaining these shares depends upon the quantity of Canadian and U.S. wheat exports relative to the total quantity imported. This, as noted in Chapter 4, is quite large for selected importing countries and it justifies in part our considering only these two countries. Furthermore, procedures applied to explaining the first ratio also can be applied to yield estimates of the second. In addition, the second and third terms in Equation (5.13) act to support the effects of the first. The market share elasticity estimates to be presented in Chapter VI, therefore, place a lower limit on the elasticity of the quantity of exports with respect to prices.

It is logical to analyze Canada's share of the export wheat market by first determining those variables which could be expected to influence the quantities of Canadian or U.S. exports taken separately. It is reasonable to expect that the demand by an importing country for Canadian or U.S. wheat would depend upon Canadian prices, U.S. prices, prices of wheats from third-country exporters, and domestic price and income levels within the

importing country itself. However, even if the separate demands for Canadian or U.S. exports would each depend upon all five factors, it does not follow that they are all required in an explanation of Canada's market share. In fact, because of the similarities in the quality of wheats from these two major wheat exporting countries, several plausible descriptions of export behaviour arise which greatly simplify the explanation of market shares.

It is reasonable to expect changes in domestic income and prices within the importing country or changes in the export prices charged by third countries to cause approximately equal percent variations in the quantity of imports from Canada and the U.S., respectively. Equal percent variations are probable as long as Canadian and U.S. wheat exports are of similar quality. To illustrate, if domestic income should rise, we would not expect the resultant increase in imports to favour relatively the wheat from Canada or the U.S., unless there was reason to suspect that particular differences were associated with differences in income elasticities. Since the present study is confined to wheat and since both exporting countries are highly specialized in wheat production, it seems reasonable to assume that the wheats imported from them are comparable and will not be subject to widely varying income elasticities. It follows in this light that if imports of wheat from Canada and the U.S. are close substitutes, their price elasticities with respect to changes in the prices of domestic or other imported wheats should also be nearly equal.

Formally, these elasticity conditions can be written as:

$$\varepsilon_{i\,P_n} = \varepsilon_{j\,P_n} \tag{5.16}$$

$$\varepsilon_{iy} = \varepsilon_{jy} \tag{5.14}$$

$$\varepsilon_{i\,P_d} = \varepsilon_{j\,P_d} \tag{5.15}$$

where:

ε_i and ε_j = the elasticity of the quantity of Canadian and U.S. wheat exports to an importing country with respect to income or prices,

y = total income within the importing country,

P_d = the domestic price of wheat within the importing country, and

P_n = the import price of wheat from a third exporter.

Equation (5.14) specifies comparable income elasticities, Equation (5.15) comparable price elasticities with respect to price of domestic wheat within the importing country, and Equation (5.16) comparable price elasticities with respect to prices of wheat imports from third countries. The equalities, of course, do not hold for changes in Canadian or U.S. prices. A rise in Canadian price will lower Canada's exports and most likely increase U.S. exports.

Equations (5.14) - (5.16) can be used to simplify the relation explaining market shares. If these three elasticity relations hold exactly, the income and domestic and third country wheat prices can be shown to have absolutely no influence on their re-

spective market shares and these variables can be excluded from the analysis. To demonstrate this proposition, we first define the elasticity of Canada's market share with respect to domestic income, Y, in the importing country as:

$$\varepsilon_{iy} = \frac{d(Q_i/(Q_i + Q_j))}{Q_i/(Q_i + Q_j)} \Bigg/ \frac{dy}{y} = \frac{d(Q_i/(Q_i + Q_j))}{dy} \times \frac{y}{Q_i(Q_i + Q_j)} \qquad (5.17)$$

The derivative in Equation (5.17) can be expressed as:

$$\frac{d(Q_i/(Q_i + Q_j))}{dy} = \frac{(Q_i + Q_j)dQ_i/dy - Q_i\,(dQ_i/dy + dQ_j/dy)}{(Q_i + Q_j)^2} \qquad (5.18)$$

It follows from the equality of income elasticities described in Equation (5.14) that:

$$Q_j \frac{dQ_i}{dy} = Q_i \frac{dQ_j}{dy} \qquad (5.19)$$

But when equation (5.19) holds, the numerator of the right side of Equation (5.18) is zero, and, therefore, the elasticity, ε_{iy}, equals zero. Market shares are invariant to regional income changes. The proof that market shares are also invariant to domestic and third country prices if Equations (5.15) and (5.16) hold is similar to the proof for income. It is, therefore, reasonable to eliminate domestic income, domestic prices, and third

country prices from the set of predictor variables. Market shares, thus, will explicitly depend in the present study upon Canadian-to-U.S. price ratio. The influence of price ratios on market shares can be formulated in various ways. For example, market shares can depend on the simple ratio P_i/P_j or on its logarithm log (P_i/P_j). Either of these is acceptable, but the latter will be used since it permits easy elasticity comparisons.

5.4 THE DYNAMIC MARKET SHARE MODEL

Up to now our analysis is based on the use of a static model, the elasticity of substitution model. It may be more realistic to assume that the response of imports to changes in prices is gradual, rather than instantaneous, due to factors such as institutional arrangements (contractual obligations), uncertainty as to the duration of the price change, imperfect knowledge of prices, inertia, etc.

We can now extend the static analysis by including the time dimension in the analysis of price responsiveness. More specifically, a partial adjustment market share model will be proposed as an appropriate and simple framework to meet the above objective.

One way of deriving the dynamic model is within the framework of partial adjustment or adaptive expectation models (Johnston, 1984). This model has been used by Capel and Rigaux (1974).

Define p(t) as the ratio of the prices of exporting country i and exporting country j where i=Canada and j=U.S. Also let $m_i(t)$ be Canada's share in a given wheat market at time t. Assume that

the optimal value of the export share of Canada in a given period t, $m_i^*(t)$, is given by:

$$m_i^*(t) = \alpha_0 + \alpha_1 p(t) \tag{5.20}$$

In addition, assume an adjustment function:

$$m_i(t) - m_i(t-1) = \delta (m_i^*(t) - m_i(t-1)) + u_i(t) \tag{5.21}$$

which postulates that in the current period the importing country will adjust only partially from its initial stage $m_i(t-1)$ to the optimal m (t). The size of δ the coefficient indicates the velocity with which market shares are adjusted. Combining (5.20) and (5.21) we obtain:

$$m_i(t) = \alpha_0 \delta + \delta_1 p(t) + (1 - \delta) m_i(t-1) + u_i(t) \tag{5.22}$$

which can also be derived within the framework of adaptive expectation models (Johnston, 1984). This model will be utilized in Chapter VI to predict the Canadian market shares in wheat in the long run.

5.5 NONPRICE PREFERENCES

It is a common proposition to argue that prices are important in determining trade flows but nonprice preferences such as long term agreements, commercial ties, credit availability, reliability of the exporter, trading block preferences, political favouritism, etc. are also important. The international trade in wheat is not an exception to this proposition. Because of this, an attempt will be made in the next chapter to measure the magnitude

of these nonprice preferences in order to determine both their magnitude and their bias between Canada and the U.S. as the main wheat suppliers in selected markets. The methodology to be used was first proposed by Ginsburg and Stern (1965), and later used extensively by Ginsburg (1969), in order to measure the magnitude of nonprice preferences affecting United States versus British exports of manufactured goods in the main importing countries of the world.

Assume that the following equation has been estimated by regression analysis.

$$\log Q_i/Q_j = \beta_0 + \beta_{ij} \log P_i/P_j + u \qquad (5.23)$$

where all terms have been defined before. Ginsburg and Stern's proposition is simply that the intercept of Equation (5.23) measures the influence of nonprice preferences on the market share of exporter i. In order to isolate nonprice preferences, the effect of import price differences on market shares must first be removed. This is accomplished by estimating the market shares that would have occurred if P_i and P_j were equal. Since $\log (P_i/P_j)$ is zero when $P_i = P_j$, nonprice preferences are measured by the coefficient. If $\beta_0 > 0$, we can interpret this as a measure of the extent of nonprice preference in favour of exporting country i. If there are no such preferences, we would expect $\beta_0 = 0$. A value of $\beta_0 < 0$ measures the preference for exporting country j over country i. Conceptually, this is Ginsburg and Stern's central proposition. Technically, though, their method is more com-

plex since it attempts to measure the differential effect of time, commodities, and regions on the size of nonprice preferences.

One of our objectives in the next chapter will be to measure the extent to which nonprice preferences affect Canada's market shares in international wheat markets, with particular emphasis to the Crow impact on those preferences. Evidently, the highly simplified nature of the procedure raises questions with respect to its usefulness to measure such a complex aggregate as the "nonprice preferences." Although a critical discussion of the method is not found in either of the above references, we are inclined to suggest that the validity of the procedure is highly dependent on the range of variations of the price ratio P_i/P_j. For if the observations P_i/P_j are typically clustered around values very different from 1, say .2 or 4, the value of the intercept β_0 indicating the hypothetical exports of country i in the event that $P_i = P_j$ is no more than a statistical extrapolation, empty of economic causality. On the other, if the same observation P_i/P_j fall typically in a range that includes 1, say 0.8-1.2, then the intercept becomes a more reliable estimator of the equal price market shares. Since this is the case in this study--price ratios are clustered around the value 1 for wheats exported by Canada and the U.S.--we would expect the method to provide reasonable approximations of the magnitude of nonprice preferences affecting Canadian wheat exports to selected markets.

5.6 THE INTERPRETATION OF THE RESULTS

A final note seems necessary with respect to the interpretation that should be given to the magnitude of the elasticity of substitution. An excellent discussion of this point is given in Morrissett (1953) and Meinken et al. (1956), and therefore we will briefly summarize their views, as they relate to this study.

If β_{ij} is the measure of σ, the relation between Q_i, Q_j, P_i, and P_j in the immediate neighborhood of a set of given values for these variables is approximated by;

$$\frac{Q_i}{Q_j} = \beta_0 \left(\frac{P_i}{P_j} \right)^{\beta_{ij}} \tag{5.24}$$

where all terms have been defined before and where β_{ij} is assumed to be negative.[8] It was originally proposed (Schultz, 1938) that high values of β_{ij} (i.e., more negative) were indicative that commodities i and j were substitutes in demand, whereas low values (i.e., less negative) would result from goods that were complementary. Later this proposition was rejected on grounds that the sole values of β_{ij} did not contain enough information about the demand schedules of commodities i and j as to determine whether the commodities were complements, substitutes or independent. Moreover, it was argued that even knowing a priori that

[8] According to Equation (5.7), the elasticity of substitution is the algebraic difference between the price elasticity of Q and the cross-elasticity of Q_i to P_j. Since the former is negative and the latter is positive for similar goods, thus it is expected that the values of σ estimated by this method be, as a rule, negative and not close to zero.

commodities i and j were substitutes, a given value of β_{ij} could correspond to substitutes that have quite different own and cross price elasticities (Meinken, et al., 1956). Although, there is little doubt that the above arguments are correct, their strength in the case of this study is considerably reduced, since i and j refer to the same commodity, but imported from different sources. Hence, the parameters of their respective import demand functions would be expected to be quite similar.

In the case of this study, a more relevant interpretation of β_{ij} is in terms of market value shares, which becomes evident after multiplying both sides of (5.24) by P_i/P_j and rewriting it as:

$$\frac{P_i Q_i}{P_j Q_j} = \beta_0 \left(\frac{P_i}{P_j}\right)^{\beta_{ij}+1} \qquad (5.25)$$

From (5.25) it can be seen that if $\beta ij = -1$, the market (value) shares between exports of a given grain from countries i and j will be constant, regardless of the changes in their relative export prices. Similarly, large negative values for βij indicate that market shares will react strongly to changes in relative prices. Positive values of βij, or negative values smaller than 1, in absolute value, will indicate a perverse response of the value shares with respect to relative prices.

Tinbergen (1946) suggests an appealing interpretation of ij, provided that certain conditions hold. In explaining the meaning of a value of -2 for β_{ij}, he wrote "this means that a 10 percent reduction in the export price level (of country i) only induces a

20 percent increase in the volume of (its) exports" [Tinbergen (1946), parentheses added)]. Morrissett (1953) shows that this interpretation requires that P and the income in the importing country remain constant. In the present study, and we suppose, in the case of other studies dealing with relatively homogenous commodities, the above conditions are unlikely to hold for a long period of time. Price retaliation does exist, and therefore the medium- and long-run effects could not be predicted by just looking at values of βij.

5.7 CONCLUSIONS

We have analyzed the price responsiveness of export demand functions for wheat to examine the impact of changes in statutory grain freight rates on Canada's share of the export wheat market. In order to accomplish this objective, both static and dynamic models were suggested. The static model was formulated via an elasticity of substitution model. In addition, the time dimension was added by formulating a partial adjustment market share model. From the above two models, Canada's export wheat market shares can be predicted. Subsequently, a method to measure the nonprice preferences was discussed.

In this study, our interest does not center entirely on the elasticity of substitution and market share elasticity, but on all influences that affect export wheat sales. We attempt to explain existing wheat trade patterns of Canada vis-a-vis the U.S. We have already argued that this is a situation in which it is useful to pose hypothesis in terms of the elasticity of substitution and its partial adjustment counterpart.

In the next chapter, we will utilize both these models to estimate the impact of changes in statutory grain freight rates on Canada's share of the export wheat market and quantify the methodological remarks mentioned throughout Chapter V.

Chapter VI

IMPACT OF CHANGES IN STATUTORY GRAIN FREIGHT RATES ON CANADA'S SHARE OF THE EXPORT WHEAT MARKET

6.1 INTRODUCTION

The main objective of this chapter is to analyze the impact of changes in statutory grain freight rates on Canada's share of the export wheat market. Canada and the U.S. are the major exporters competing in the world wheat market. It is, therefore, logical to analyze the problem with particular reference to the case of Canadian and U.S. wheat exports to selected import markets.

The model is estimated with annual data over the crop years 1959/60 to 1982/83. The following importing countries are considered: China, the USSR, Poland, Cuba, Japan, the U.K., West Germany, Italy, Belgium, Switzerland, Netherlands, India, Pakistan, Chana, Algeria, Egypt, Brazil, Peru, Jamaica, and Haiti. The estimates for the world total are also presented by including a residual market. The criteria used for selecting these countries were (a) to be an important wheat importer during the sample period 1959/60 - 1982/83 and (b) data availability.

The quantities of wheat imported by the importing countries and the world total import from Canada and the U.S. were obtained from IWC, World Wheat Statistics (1959-85). Direct quotations for c.i.f. and f.o.b. prices were obtained from the same source. The U.S. no. 2 dark northern spring 14% wheat was judged to be

equivalent to the no. 1 Canada western red spring wheat. The f.o.b. Gulf prices of the former and the average prices of the latter at Thunder Bay, St. Lawrence, Atlantic and Pacific ports were used in the estimation. Average Canadian farm prices were obtained from the Handbook of Field Crop Area, Yield, Production, Average Farm Price and Value, Statistics Canada (1953-83) and their U.s. counterparts were obtained from USDA, Agricultural Statistics (1950-83). The Crow and compensatory rates were computed from the estimates of the Snavely Report (1976-79).

The organization of this chapter is as follows: the estimates of the elasticity of substitution and market share elasticity for wheat between Canada and the U.S. are given in section 6.2; non-price preferences are measured in section 6.3; the impact on Canada's market share from changes in statutory grain freight rates are estimated in section 6.4; and the conclusions are presented in section 6.5

6.2 ESTIMATED ELASTICITIES OF SUBSTITUTION AND MARKET SHARE ELASTICITIES

The elasticity of substitution and the market share elasticity for wheat between Canada and the U.S. were computed from the following estimating equations:

$$\log \frac{Q_{it}}{Q_{jt}} = \beta_o + \beta^*_{ij} \log \frac{P_{it}}{P_{jt}} + \beta_2 T_t + u_t \qquad (6.1)$$

$$\log \frac{Q_{it}}{Q_{it} + Q_{jt}} = \alpha_o + \alpha^*_{ij} \log \frac{P_{it}}{P_{jt}} + \alpha_2 T_t + v_t \qquad (6.2)$$

where:

Q_{it} = the third country wheat imports from Canada in year t, in metric tonnes,

Q_{jt} = the third country wheat imports from the U.S. in year t, in metric tonnes,

P_{it} and P_{jt} = prices of wheat from Canada and the U.S. in year t, in U.S. dollars,

β^*_{ij} = the elasticity of substitution between wheat imports from the two countries,

α^*_{ij} = the market share elasticity between wheat imports from the two countries,

T_t = time trend, and

u, v = random errors.

It has been previously shown that Equation (6.1) is derived from market demand functions, and therefore the appropriate prices for explaining relative export shares are landed prices, that is, the prices faced by the importer agents in a specific importing country. From a practical point of view; however, all this means is that c.i.f. prices should be preferred to f.o.b. prices. Furthermore, if c.i.f. prices are to represent an adequate proxy of the actual price paid by the importer, import levies should, of course, be added to them.

However, in practice, researchers have often felt justified in using f.o.b. prices or f.o.b. unit values instead of the corresponding c.i.f. ones in the estimation of the elasticity of substitution in international trade (Ginsburg and Stern, 1965; Ginsburg, 1969; Keinin, 1967; Capel and Rigaux, 1974; etc.).[9] Since we are essentially interested in the impact of changes in grain

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[9] The price variables Fletcher and Just (1975) and Fletcher, Just, and Schmitz (1976) used to estimate U.S. wheat export demand were neither f.o.b. nor c.i.f. prices but rather the domestic prices received by U.S. farmers, i.e., farm gate prices.

freight rates on Canada's wheat market share, the elasticities of substitution and the market share elasticities computed in this study are estimated by using three price series: farm gate, f.o.b., and c.i.f. prices.

Results from fitting Equations (6.1) and (6.2) are reported in Tables 6.1 through 6.4. The predominance of quite large negative estimates of elasticity of substitution and market share elasticity is evidence of a substantial degree of responsiveness to relative prices on the part of wheat importing countries. Positive elasticity of substitution or market share elasticity reveals a perverse response of imports to changes in the price ratio of Canadian relative to U.S. wheats.

The estimates of the elasticity of substitution should be interpreted as follows. Suppose Canadian sales in an importing market are 100,000 tonnes and U.S. sales are 80,000 tonnes. Then, with an elasticity of substitution of -8.00 and no retaliation, the new level of Canadian sales is 104,000 tonnes for a 1 percent reduction in the price ratio. The quantity ratio changes by 10 percent to 1.35 from 1.25, and hence U.S. sales are 76,000 tonnes (Capel and Rigaux, 1974).

Table 6.1

Estimated Elasticities of Substitution and Market Share Elasticities between Wheats Imported from Canada and the U.S. in Selected Centrally-Planned Countries

1960-83

	Elasticity of Substitution						Market Share Elasticities					
	Relative Farmgate Prices	R^2	Relative f.o.b. Prices	R^2	Relative c.i.f. Prices	R^2	Relative Farmgate Prices	R^2	Relative f.o.b. Prices	R^2	Relative c.i.f. Prices	R^2
China	- .29 (- .08)(a)	.37	-78.91 (- 3.33)	.58	-24.91 (- .54)	.38	.43 (1.26)	.35	- 9.78 (- 4.99)	.68	- 3.72 (- .98)	.34
USSR	3.74 (.93)	.12	-38.14 (- 1.19)	.14	-10.51 (- .56)	.10	.14 (.33)	.16	- 3.20 (- .97)	.20	.024 (.01)	.16
Poland	.84 (.45)	.02	-18.56 (- 1.26)	.09	18.18 (.85)	.05	-.21 (-.28)	.05	- 4.50 (- .73)	.07	11.87 (1.39)	.13
Cuba	3.36 (1.50)	.56	-36.66 (- 2.12)	.60	-3.85 (.14)	.51	.45 (1.39)	.42	- 4.46 (- 1.75)	.44	1.76 (.45)	.37

(a) t-values are shown in parentheses. These values are calculated by dividing each coefficient by its standard error.

Table 6.2

Estimated Elasticities of Substitution and Market Share Elasticities between Wheats Imported from Canada and the U.S. in Selected Developed Countries

1960-83

	Elasticity of Substitution						Market Share Elasticities					
	Relative Farmgate Prices	R^2	Relative f.o.b. Prices	R^2	Relative c.i.f. Prices	R^2	Relative Farmgate Prices	R^2	Relative f.o.b. Prices	R^2	Relative c.i.f. Prices	R^2
Japan	- .25 (-1.11)(a)	.73	3.14 (1.80)	.75	2.00 (.75)	.72	- .13 (-1.03)	.74	1.69 (1.71)	.76	1.24 (.83)	.74
U.K.	- .79 (-1.15)	.15	3.51 (.61)	.12	6.32 (2.39)	.29	- .13 (-1.10)	.09	.12 (.12)	.04	1.14 (2.58)	.27
W. Germany	.67 (.69)	.67	-13.05 (-1.76)	.70	-3.63 (-.90)	.67	.72 (.95)	.59	-10.63 (-1.83)	.63	-3.81 (-1.22)	.60
Italy	.44 (.95)	.15	- 6.67 (-1.85)	.24	-8.12 (-1.54)	.20	.25 (.89)	.15	- 3.87 (-1.79)	.24	-4.50 (-1.41)	.20
Belgium	1.59 (1.26)	.54	-27.50 (-3.15)	.66	-6.56 (- .43)	.51	1.30 (1.15)	.40	-22.88 (-2.88)	.55	-10.94 (- .82)	.39
Switzerland	-.36 (- .62)	.24	5.65 (1.25)	.28	1.64 (.25)	.22	- .13 (- .52)	.19	2.70 (1.40)	.25	1.68 (.59)	.20
Netherlands	.29 (.35)	.30	-18.58 (-3.51)	.56	-13.81 (-1.52)	.37	.37 (.58)	.36	-15.36 (-3.77)	.61	-10.45 (-1.45)	.41

(a) t-values are shown in parentheses.

Table 6.3

Estimated Elasticities of Substitution and Market Share Elasticities between Wheats Imported from Canada and the U.S. in Selected Less-Developed Countries

1960-83

	Elasticity of Substitution						Market Share Elasticities					
	Relative Farmgate Prices	R^2	Relative f.o.b. Prices	R^2	Relative c.i.f. Prices	R^2	Relative Farmgate Prices	R^2	Relative f.o.b. Prices	R^2	Relative c.i.f. Prices	R^2
India	.46 (.21)(a)	.04	- .59 (- .03)	.04	-12.03 (-.47)	.05	.06 (.03)	.04	1.37 (.08)	.04	-10.10 (-.43)	.05
Pakistan	.17 (.19)	.35	10.84 (1.55)	.41	2.98 (.28)	.35	.24 (.29)	.34	9.33 (1.44)	.40	2.92 (.30)	.34
Ghana	.84 (.59)	.20	-16.14 (-1.46)	.26	-1.90 (-.11)	.19	.48 (.53)	.18	-5.77 (-.79)	.19	-.97 (-.09)	.17
Algeria	-1.83 (-.65)	.17	15.88 (.70)	.17	-32.44 (-1.00)	.19	-.86 (-.43)	.34	8.25 (.52)	.35	-20.68 (-.91)	.36
Egypt	-3.66 (-1.06)	.08	-31.84 (-1.15)	.09	-58.30 (-1.50)	.13	-3.43 (-1.13)	.11	-28.24 (-1.16)	.11	-50.71 (-1.47)	.14
Brazil	.27 (.13)	.74	- 9.45 (- .56)	.74	-37.62 (-1.62)	.77	.49 (.25)	.75	- 8.11 (-.51)	.75	-33.98 (-1.57)	.77
Peru	2.77 (1.13)	.19	-32.55 (-1.71)	.25	-44.00 (-1.60)	.24	2.63 (1.14)	.20	-31.09 (-1.73)	.26	-41.15 (-1.58)	.24
Jamaica	1.24 (.91)	.04	- 3.57 (.32)	.01	28.31 (1.90)	.15	1.14 (1.07)	.05	- 5.49 (- .63)	.02	20.25 (1.71)	.12
Haiti	4.53 (1.61)	.29	-44.57 (-2.03)	.33	-56.77 (-1.76)	.31	1.75 (1.00)	.38	-24.86 (-1.84)	.44	-39.31 (-2.06)	.46

(a) t-values are shown in parentheses.

Table 6.4

Estimated Elasticities of Substitution and Market Share Elasticities between Wheats Imported from Canada and the U.S. in the World

1960-83

	Elasticity of Substitution						Market Share Elasticity					
	Relative Farmgate Prices	R^2	Relative f.o.b. Prices	R^2	Relative c.i.f. Prices	R^2	Relative Farmgate Prices	R^2	Relative f.o.b. Prices	R^2	Relative c.i.f. Prices	R^2
The World	.28 (1.62)(a)	.35	-2.73 (-2.00)	.39	-.29 (-.15)	.27	.19 (1.67)	.37	-1.78 (-2.00)	.40	.15 (-.12)	.28

(a) t-values are shown in parentheses.

Significant negative coefficients (Table 6.1) were obtained for China (-78.91), USSR (-38.14), Poland (-18.56), and Cuba (-36.66). On theoretical grounds, the elasticities of substitution should be estimated by using the c.i.f. prices or c.i.f. unit values and their estimates should be significantly larger than their f.o.b. counterparts (Richardson, 1972). However, when relative c.i.f. prices were considered these countries were less responsive to price changes and one (Poland) revealed a perverse response. These are state-trading markets which are intuitively the least sensitive to relative price changes. However, our results show otherwise. This suggests that, on the one hand, there are potential gains obtainable for Canada by decreasing wheat prices. And, on the other hand, given that the c.i.f. elasticities of substitution are much smaller (in absolute values) than their f.o.b. counterparts, the centrally-planned economies exclude ocean transportation costs from their importing policy decisions. One possible explanation for this is that they use their own fleets. This is, however, not the case when domestic transportation, handling and marketing costs are considered. As reported in Table 6.1, the farm-gate elasticities of substitution and market share elasticities are by far smaller than their f.o.b. counterparts. For this group of countries, therefore, the appropriate prices in estimating Equations (6.1) and (6.2) seem to be f.o.b. prices as opposed to c.i.f. landed prices.

The results indicate that developed countries are not as responsive to relative f.o.b. prices as their centrally-planned counterparts. Amongst the seven countries analyzed (Table 6.2)

Belgium (-27.50) is the most responsive to price changes followed by the Netherlands (-18.58), West Germany (-13.05), Italy (-6.67), Japan (3.14), the U.K. (3.51) and Switzerland (5.65). The finding of perverse response on the part of the last three countries--Japan, the U.K. and Switzerland--suggests a potential for nonprice competition. Except for Italy, Japan and Switzerland, these countries are more responsive to f.o.b. price ratios than their corresponding relative c.i.f. prices. Farm-gate elasticities of substitution and market share elasticities, as well, follow the same path as in centrally-planned countries. In estimating the above two equations for developed countries, relative f.o.b. prices seem to be appropriate too.

Less-developed countries are not as responsive to relative prices as centrally-planned or developed countries (Table 6.3). Among this group Haiti (-44.57) is the most responsive to relative f.o.b. prices followed by Peru (-32.55), Egypt (-31.84), Ghana (-16.14), Brazil (-9.45), Jamaica (-3.57), India (-.59), Pakistan (10.84) and Algeria (15.88). The striking observation in this group is that in general these countries are more responsive to relative c.i.f. prices. The c.i.f. elasticities of substitution for these countries are -56.77 (Haiti), -44.00 (Peru), -58.30 (Egypt), -1.90 (Ghana), -37.62 (Brazil), 28.31 (Jamaica) -12.03 (India), 2.98 (Pakistan), and -32.44 (Algeria). These results fully confirm the theoretical expectations discussed above. They suggest that for less-developed countries ocean transportation costs are effectively a more important barrier to trade than for the previous two groups.

For the total world trade, the f.o.b. elasticity of substitution is -2.73 and the corresponding c.i.f. elasticity of substitution is -.29. This finding suggests that, in general, importers of Canadian wheat are more responsive to f.o.b. price ratios than their c.i.f. counterparts. The same applies to the f.o.b. versus the c.i.f. elasticity of market share. Binkley and Revelt (1981) suggest that transportation costs account for somewhere between 5 and 15 percent of delivered grain prices, depending upon the route and time period in question. Our findings confirm this observation and lead us to the conclusion that transportation costs are not a dominant factor in the international wheat trade, in the sense that possible changes in aggregate transport costs would be unlikely to bring about large changes in trade volumes and market shares.

In general, most of the estimated elasticities have the appropriate sign, negative, and are large in magnitude. Quite a few of them are statistically significant at a level of at least 10 percent.[10] The sign is expected, for as it was noted before, the elasticity of substitution is no more than the algebraic difference between the own and cross price elasticities of import demand. Whereas the former is always negative, the latter is expected to be positive, under the assumption that same wheats imported from different sources are good substitutes in demand. The large magnitude of the estimates is indicative of the fact

[10] These significant negative elasticities of substitution and market share elasticities may have an interpretation in terms of oligopolistic practices of the countries involved. An investigation of these hypotheses, however, is beyond this study.

that the (value) market share will react significantly in favor of Canada if the price ratio decreases. This behavior is what should be expected from highly homogeneous commodities, as is the case of most traded wheats.

From a strict statistical point of view, however, the estimates of Tables 6.1-6.4 are subject to at least three sources of bias, all in the same direction.

1. They contain a downward bias since they have been computed by using the quantity ratio instead of the price ratio as a dependent variable, and errors in the price variable will have this effect (Orcutt, 1950).
2. They contain a downward bias since they have been computed with the dependent variable including the zero-one market shares, i.e., those in which either Q_i or Q_j equalled zero were included in the estimation. It can be shown that the inclusion of them is responsible for a downward bias in the value of the elasticity of substitution (Ginsburg, 1969).
3. They contain a downward bias (due to simultaneity) in all those cases in which the assumption of infinitely elastic export supply is violated (Leamer and Stern, 1970).

Finally, the independent variables included in the model explain, in general, a rather low proportion of the total variation in Canada's market shares. Most of the equations have an R^2 statistic smaller than 50 percent. Yet, one should resist the temptation of concluding from this that the price mechanism does not

work in allocating a total level of imports among the competing countries supplying a particular import market. On the contrary, our results suggest very clearly that the price mechanism plays its role, as reflected by large negative values for the elasticity of substitution and market share elasticity in most of the equations. This could harly be a coincidence. The poor performance of the model in terms of goodness of fit should be interpreted as a direct consequence of the exclusion of some independent variables that do not have an exact equiproportional effect on both the numerator and denominator of the dependent variable. A brief review of empirical studies attempting to measure the elasticity of substitution with estimated equations similar to those used in this study reveals that, in general, the performance of the model in terms of goodness of fit is not good. This is true for trade in agricultural products (Capel and Rigaux, 1974) as well as for manufactured products (Kreinin, 1967; Ginsburg, 1969). This observation is, however, consistent with propositions advanced in this study before, in the sense that "nonprice" preferences are also of considerable importance in determining trade flows in wheat. The actual estimates of these preferences will be presented in the next section.

6.3 EQUAL PRICE MARKET SHARES

In Chapter V, it was suggested that equal price market shares might be used as a proxy for the magnitude of nonprice preferences. Specifically, it was shown that if the intercept of Equation (5.23), β_0 is greater than zero, we can interpret this as a measure of the extent of nonprice preferences in favour of Canada. If there are no such preferences we would expect $\beta_0 = 0$. A value of $\beta_0 < 0$ measures the preference for the U.S. over Canada. These shares should be interpreted as follows. Let Q_i and Q_j be the wheat exports from Canada and the U.S., respectively. Let also P_i and P_j be the c.i.f. export price of Canada and the U.S. respectively. Then, the "equal price market share" in the absence of nonprice preferences should be .5. Values above .5 indicate a nonprice preference in favour of Canada and values below .5 indicate a nonprice preference in favour of the U.S. Table 6.5 reports the values of the equal price market shares for Canadian wheat exported to selected markets and the world.

Table 6.5

Equal Price Market Shares for Canadian Wheat Exports to Selected Import Markets and the World

1960-83

	Country	Equal Price Market Shares
Centrally-planned	China	.81
	USSR	.63
	Poland	.51
	Cuba	.90
Developed	Japan	.37
	U.K.	.82
	West Germany	.46
	Italy	.48
	Belgium	.47
	Switzerland	.47
	Netherlands	.19
Less-developed	India	.13
	Pakistan	.12
	Ghana	.66
	Algeria	.29
	Egypt	.15
	Brazil	.19
	Peru	.16
	Jamaica	.44
	Haiti	.34
	The World	.34

The most fundamental observation that emerges from the results of Table 6.5 is that nonprice preferences are typically nonneutral, as reflected by equal price market shares that, in general, differ from .5. This reinforces the hypothesis advanced in Chapter V, in the sense that wheat cargoes from different exporting countries are not considered perfect substitutes in the importing country. This is only a reflection of the fact that those factors determining nonprice preferences--commercial ties, long-term agreements, credit availability, reliability of the exporter, trading block preferences, political favouratism, etc.--are unlikely to be the same among alternative exporters.

At a more specific level, out of the 20 countries surveyed in the study, only six--China (.81), USSR (.63), Poland (.51), Cuba (.90), the U.K. (.82), and Ghana (.66)--prefer Canadian wheat to the U.S. It was noted previously, however, that the first four countries of this group were the most responsive to price changes (Table 6.1) followed by Ghana (Table 6.3). The U.K. revealed a perverse response (Table 6.2). It is likely that U.S. credit and long term agreements do not cater to centrally-planned countries.

The nonprice preferences for Canadian wheat in developed countries are generally very close to .5 (Table 6.5). The relatively high values of nonprice preferences for these countries, suggest that there still exists some consumer loyalty to Canadian high quality wheat. However, due to larger yields, better quality wheats in the U.K. and North France, Chorleywood Baking Process and gluten supplementation, hard red spring Canadian wheats are being replaced and Canada's share in the EC will probably decline over time.

All the underdeveloped countries involved in the study, except Ghana (Table 6.5), have small values for nonprice preferences. These countries appear to favour U.S. wheat. One reason may be that the U.S. has exploited nonprice preferences through all sorts of market arrangements such as P.L. 480, selling for foreign currency, bilateral trade deals, barter deals for strategic supplies, credit, etc. Another reason may be that these countries do not get the same marketing services, e.g., preferred financial arrangements, as centrally-planned or developed importers do. The main implication of this is that the Canadian Wheat Board should develop credit programs matching those of the U.S. for these countries. It is important, however, to note that these preferences reflect both political and commercial ties and the equal price market shares tend to be larger in those regions strongly associated politically or commercially with either Canada or the U.S., but not with both countries.

The world nonprice preference is .34 (Table 6.5) implying that, in general, importing countries around the world are more loyal to U.S. wheat than Canadian. Canada should, therefore, develop new marketing strategies to increase its market share internationally.

6.4 ESTIMATED IMPACTS OF CHANGES IN STATUTORY GRAIN FREIGHT RATES ON CANADA'S WHEAT MARKET SHARE

The following estimating equations are used to predict Canada's market shares and the resulting changes in these shares from different grain freight rates.

Model I

$$\frac{Q_{it}}{Q_{it} + Q_{jt}} = \gamma_o + \gamma_{ij} \log \frac{P_{it}}{P_{jt}} + \gamma_2 T + \varepsilon_t \qquad (6.3)$$

Model II

$$m_j(t) = \alpha_o \delta + \alpha_1 \delta p(t) + (1-\delta) m_j(t-1) + \alpha_2 \delta T(t) + \varepsilon_j(t) \qquad (6.4)$$

where

$$m_j(t) = \frac{Q_{it}}{Q_{it} + Q_{jt}}, \text{ and}$$

$$p(t) = \frac{P_{it}}{P_{jt}}$$

Model I, Equation (6.3), is based on the use of the elasticity of substitution model. As discussed in Chapter V, this model is a static one and it may be more realistic to assume that the response of importers to changes in prices is gradual, rather than instantaneous, due to factors such as institutional arrangements (contractural obligations), uncertainty as to the duration of the price change, imperfect knowledge of prices, inertia, etc. This is the main reasoning behind the estimation of Equation (6.4) or Model II. This equation was proposed previously as an appropri-

ate and simple framework for including the time dimension in our analysis.

The above two equations will give separate estimates of market shares in selected markets. These estimates could be calculated from the farm-gate, f.o.b. and the c.i.f. price ratios, respectively. The differences in the first two estimates would measure the effects of railway freight rates and other internal marketing costs and the differences between the estimates from the f.o.b. and the c.i.f. price ratios would measure the impact of ocean freight rates and other external marketing costs. In this study, we focus on the former. That is, we first estimate the impact of transportation, handling and marketing costs (THMFOB) on market shares. The merit of the elasticity of substitution model and its dynamic version lies essentially in its power to estimate this impact. To isolate the impact of statutory (Crow) freight rates on market shares, we compute the differences in market shares between estimates from relative farmgate prices and those from the ratios of Canadian farmgate prices plus fixed freight rates (=$5.07 for wheat) to U.S. farm-gate prices. Finally, to estimate the impact of changes in statutory freight rates, we increase the Crow rates up to 100 percent compensatory rates (100% CR), 65 percent compensatory rates (65% CR) and 50 percent compensatory rates (50% CR), holding everything else constant, and calculate three separate estimates of market shares for any region. The differences in market shares between these three estimates and those from farmgate price ratios would measure the effects of differential transportion costs.

Western farmers producing grains for export receive a subsidy. The exact magnitude of this transfer and the impact of changes in it on Canada's market share, however, depend on the size of the Crow gap and the price sensitivity of the export demand for Canadian grains. It, therefore, involves an analysis of supply of and demand for grains. The focus of this thesis has been on the demand side and the impact of changes in grain freight rates on the supply side is ignored. The main underlying assumption is that the supply of wheat is perfectly elastic to price changes (Leamer and Stern, 1970).

The immediate impact of a change in statutory grain freight rates is a change in farmgate prices. In other words, being price-takers, farmers must incur the extra costs of moving grains to export positions. To estimate the magnitudes of these impacts within the context of the elasticity of substitution we should hold the farmgate prices constant. This is, of course, an unrealistic assumption. However, it will provide us with estimates of the magnitude of the change. The theoretical justification for this approach may be formulated by using a well-known theorem of production theory, Euler's theorem (Chiang, 1984). The basic postulates of this theorem are (a) each input is paid the rate of its marginal product, and (b) total output is just exhausted.

Assuming that the transportation service is a factor input, we may alternatively state our problem as estimation of the impact of changes in transportation share in the final output or output ratios. Clearly, since the base prices in our analysis are farmgate prices, the Crow rate or any compensatory rates should be

added to the base farmgate prices so we may estimate the impact of these rates on the final output ratios. To put it in another way, if according to Euler's theorem each factor is paid its marginal product and total output is just exhausted, the costs of each factor of production, e.g., transportation services, are captured by the price of output, i.e., wheat. That is why, in this study, we suggested a more relevant interpretation of market share elasticities in terms of market value shares (see section 5.6).

It is interesting to note that the condition of product exhaustion is equivalent to the condition that maximum long-run profit equals zero. Thus long-run total outlay equals long-run total revenue. Following the assumption of the marginal productivity theory, we are led to the startling conclusion that long-run profit equals zero regardless of the level of the product price.

Individual country estimates of market shares followed by estimates for the world are presented below. Footnotes are provided to report R^2 statistics, e.g., R^2 (f.o.b.) shows the measure of the goodness of fit when the price variables used are f.o.b. ones.

6.4.1 China

In 1982/83, China imported 4,242,000 tonnes of wheat and wheat flour from Canada and 4,186,000 tonnes from the U.S. This amounted to 20% of Canadian and 10% of U.S. Wheat exports in that year. The estimated impacts of transportation costs on Canada's

market share in China based on Models I and II in Equations 6.3 and 6.4 are reported in Tables 6.6-6.10 and 6.12-6.16, respectively. To highlight the results, however, we have retabulated the final columns of Tables 6.6-6.10 in Table 6.11 for Model I and those of Tables 6.12-6.16 in Table 6.17 for Model II and will follow the same procedure for other countries surveyed as well as the world.

The second columns (THMFOB) of both Tables 6.11 and 6.17 clearly show the sizable magnitude of transportation, handling, and marketing costs relative to market shares in single years. The same will not apply, though, when we isolate the impact of transportation costs. The single year shares will change by 0 percent to 4 percent with the exception of the years 1972-1975 in which the international prices of wheat were high. The magnitudes of changes in market shares of Canada and/or the U.S. are larger in Model I than in Model II when the Crow or different compensatory rates (50 percent, 65 percent and 100 percent) are considered. But even in Model I, these magnitudes are quite small. Moreover, the changes in Canada's market shares have both negative and positive signs, indicating that Canada's losses of market shares in one year may be offset by its gains in another. There is no significant impact on Canada's market shares when Model II is used. As noted previously, this is due to the introduction of the time dimension into our model and postulating that the response of importers to changes in prices is gradual and hence in the long-run they will make the corresponding adjustments.

The net impact of different scenarios are reported in the final row of Tables 6.11 and 6.17. The results suggest that over a period of 24 years (1960-1963) only 2 percent of Canada's market share in China can be attributed to the Crow benefit (Table 6.11). The corresponding figure for Model II is 1 percent (Table 6.17). According to Table 6.11, had the rates gone up to the full compensatory levels (100 percent CR), Canada would have been still able to maintain its share in the Chinese market (Net Impact = 0). The corresponding figure for Model II is -.02, i.e., erosion of its share by only 2 percent (Table 6.17).

Table 6.6

Estimated Impacts of Total Transportation(a), Handling and Marketing Costs on Canadian and U.S. Wheat Market Shares in China (Model I)

1960-83

Year	Shares as a Function of Relative f.o.b. Prices	Shares as a Function of Relative Farmgate Prices	Market(b) Share Differences (THMFOB)
1960	.93	1.02	-.09
1961	1.03	1.03	0
1962	.79	1.00	-.21
1963	.88	.96	-.08
1964	1.13	.94	+.19
1965	1.14	1.00	+.14
1966	.78	.99	-.21
1967	.80	.90	-.10
1968	1.03	.87	+.16
1969	.97	.86	+.11
1970	.87	.86	+.01
1971	.89	.80	+.09
1972	1.09	.84	+.25
1973	.75	.96	-.21
1974	.45	.73	-.28
1975	.78	.66	+.12
1976	.86	.63	+.23
1977	.90	.64	+.26
1978	.85	.71	+.14
1979	.65	.68	-.03
1980	.51	.63	-.12
1981	.29	.57	-.28
1982	.46	.54	-.08
1983	.52	.53	-.01

(a) These costs cover moving grains (wheat) from the farmgate to the export position.
(b) Figures in this column show the comparative advantage of transportation, handling and marketing costs of Canada over the U.S. They also show the effects of these costs on market shares (+ for Canada and - in favour of the U.S.).

Table 6.7

Estimated Impacts of Statutory Grain Freight Rates on Canada's Market Share in China (Model I)

1960-83

Year	Share as a Function of Relative Canadian Farmgate Price + $5.07 and U.S. Farmgate Price	Shares as a Function of Relative Farmgate Prices	Crow Rate Shares (CROW)
1960	1.01	1.02	-.01
1961	1.02	1.03	-.01
1962	.99	1.00	-.01
1963	.95	.96	-.01
1964	.93	.94	-.01
1965	1.01	1.00	+.01
1966	1.00	.99	+.01
1967	.91	.90	+.01
1968	.87	.87	0
1969	.87	.86	+.01
1970	.87	.86	+.01
1971	.81	.80	+.01
1972	.85	.84	+.01
1973	.99	.96	+.03
1974	.72	.73	-.01
1975	.65	.66	-.01
1976	.62	.63	-.01
1977	.64	.64	0
1978	.72	.71	+.01
1979	.68	.68	0
1980	.63	.63	0
1981	.57	.57	0
1982	.53	.54	-.01
1983	.53	.53	0

Table 6.8

Estimated Impacts of Changes in Statutory Grain Freight Rates on Canada's Market Share in China (Model I)

1960-83

Year	Shares as a Function of Relative Canadian Farmgate Price + 100% Compensatory Freight Rates and U.S. Farmgate Price	Shares as a Function of Relative Farmgate Prices	100% Compensatory Rate Shares
1960	.98	1.02	-.04
1961	1.01	1.03	-.02
1962	.98	1.00	-.02
1963	.93	.96	-.03
1964	.92	.94	-.02
1965	1.02	1.00	+.02
1966	1.02	.99	+.03
1967	.91	.90	+.01
1968	.88	.87	+.01
1969	.89	.86	+.03
1970	.89	.86	+.03
1971	.82	.80	+.02
1972	.88	.84	+.04
1973	1.03	.96	+.07
1974	.70	.73	-.03
1975	.63	.66	-.03
1976	.60	.63	-.03
1977	.63	.64	-.01
1978	.73	.71	+.02
1979	.69	.68	+.01
1980	.62	.63	-.01
1981	.55	.57	-.02
1982	.52	.54	-.02
1983	.52	.53	-.01

Table 6.9

Estimated Impacts of Changes in Statutory Grain Freight Rates on Canada's Market Share in China (Model I)

1960-83

Year	Shares as a Function of Relative Canadian Farmgate Price + 65% Compensatory Freight Rates and U.S. Farmgate Price	Shares as a Function of Relative Farmgate Prices	65% Compensatory Rate Shares (65% CR)
1960	.99	1.02	-.03
1961	1.01	1.03	-.02
1962	.98	1.00	-.02
1963	.94	.96	-.02
1964	.92	.94	-.02
1965	1.01	1.00	+.01
1966	1.01	.99	+.02
1967	.90	.90	0
1968	.88	.87	+.01
1969	.89	.86	+.03
1970	.89	.86	+.03
1971	.82	.80	+.02
1972	.87	.84	+.03
1973	1.02	.96	+.06
1974	.71	.73	-.02
1975	.63	.66	-.03
1976	.60	.63	-.03
1977	.64	.64	0
1978	.73	.71	+.02
1979	.68	.68	0
1980	.63	.63	0
1981	.56	.57	-.01
1982	.52	.54	-.02
1983	.52	.53	-.01

Table 6.10

Estimated Impacts of Changes in Statutory Grain Freight Rates on Canada's Market Share in China (Model I)

1960-83

Year	Shares as a Function of Relative Canadian Farmgate Price + 50% Compensatory Freight Rates and U.S. Farmgate Prices	Shares as a Function of Relative Farmgate Prices	50% Compensatory Rate Shares (50% CR)
1960	1.00	1.02	-.02
1961	1.01	1.03	-.02
1962	.98	1.00	-.02
1963	.94	.96	-.02
1964	.93	.94	-.01
1965	1.01	1.00	+.01
1966	1.01	.99	+.02
1967	.91	.90	+.01
1968	.88	.87	+.01
1969	.88	.86	+.02
1970	.88	.86	+.02
1971	.81	.80	+.01
1972	.86	.84	+.02
1973	1.01	.96	+.05
1974	.72	.73	-.01
1975	.64	.66	-.02
1976	.61	.63	-.02
1977	.64	.64	0
1978	.72	.71	+.01
1979	.68	.68	0
1980	.63	.63	0
1981	.56	.57	-.01
1982	.53	.54	-.01
1983	.52	.53	-.01

Table 6.11

Estimated Impacts of Transportation Costs on Canada's Market Share in China (Model I)

1960-83

Year	THMFOB(a)	CROW	100%CR	65% CR	50%CR
1960	-.09	-.01	-.04	-.03	-.02
1961	0	-.01	-.02	-.02	-.02
1962	-.21	-.01	-.02	-.02	-.02
1963	-.08	-.01	-.03	-.02	-.02
1964	+.19	-.01	-.02	-.02	-.01
1965	+.14	+.01	+.02	+.01	+.01
1966	-.21	+.01	+.03	+.02	+.02
1967	-.10	+.01	+.01	0	+.01
1968	+.16	0	+.01	+.01	+.01
1969	+.11	+.01	+.03	+.03	+.02
1970	+.01	+.01	+.03	+.03	+.02
1971	+.09	+.01	+.02	+.02	+.01
1972	+.25	+.01	+.04	+.03	+.02
1973	-.21	+.03	+.07	+.06	+.05
1974	-.28	-.01	-.03	-.02	-.01
1975	+.12	-.01	-.03	-.03	-.02
1976	+.23	-.01	-.03	-.03	-.02
1977	+.26	0	-.01	0	0
1978	+.14	+.01	+.02	+.02	+.01
1979	-.03	0	+.01	0	0
1980	-.12	0	-.01	0	0
1981	-.28	0	-.02	-.01	-.01
1982	-.08	-.01	-.02	-.02	-.01
1983	-.01	0	-.01	-.01	-.01
Net Impact(b)	0	+.02	0	0	+.01

(a) These costs include primary elevator, terminal elevator, railway freight and marketing charges. Primary elevator charges include handling charges, carrying charges and shrinkage; terminal elevator charges include storage charges and market charges include interest, bank and other charges plus Canadian Wheat Board administrative costs. Finally, other charges include demurrage, handling and stop-off, drying and additional freight on grain shipped from country stations to terminal positions (Canada Grains Council, Statistical Handbook).

(b) The net impact is defined to be the cumulative effect of differential costs. They are obtained by summing over the 24 rows in each column.

R_2^2 (f.o.b.) = .67
R_2^2 (farmgate) = .36
R_2^2 (CROW) = .37
R_2^2 (100% CR) = .41
R_2^2 (65% CR) = .40
R^2 (50% CR) = .39

Table 6.12

Estimated Impacts of Total Transportation, Handling and Marketing Costs on Canadian and U.S. Wheat Market Shares in China (Model II)

1960-83

Year	Relative f.o.b. Prices	Relative Farmgate Prices	Market Share Differences (THMFOB)
1960	.64	.62	+.02
1961	.89	.84	+.05
1962	.87	1.07	-.20
1963	.95	1.06	-.11
1964	1.14	1.04	+.10
1965	1.15	1.02	+.13
1966	.86	1.00	-.14
1967	.88	.99	-.11
1968	1.06	.97	+.09
1969	1.02	.95	+.07
1970	.94	.94	0
1971	.95	.92	+.03
1972	1.10	.90	+.20
1973	.83	.85	-.02
1974	.56	.81	-.25
1975	.62	.52	+.10
1976	.78	.65	+.13
1977	.95	.82	+.13
1978	.91	.80	+.11
1979	.73	.75	-.02
1980	.48	.55	-.07
1981	.31	.55	-.24
1982	.34	.37	-.03
1983	.39	.36	+.03

Table 6.13

Estimated Impacts of Statutory Grain Freight Rates on Canada's Market Share in China (Model II)

1960-83

Year	Shares as a Function of Relative Canadian Farmgate Price + $5.07 and U.S. Farmgate Price	Shares as a Function of Relative Farmgate Prices	Crow Rate Shares (CROW)
1960	.62	.62	0
1961	.85	.85	0
1962	1.07	1.07	0
1963	1.06	1.06	0
1964	1.04	1.04	0
1965	1.02	1.02	0
1966	1.00	1.00	0
1967	.99	.99	0
1968	.97	.97	0
1969	.95	.95	0
1970	.94	.94	0
1971	.92	.92	0
1972	.90	.90	0
1973	.87	.85	+.02
1974	.81	.81	0
1975	.51	.52	-.01
1976	.65	.65	0
1977	.82	.82	0
1978	.80	.80	0
1979	.75	.75	0
1980	.55	.55	0
1981	.55	.55	0
1982	.37	.37	0
1983	.36	.36	0

Table 6.14

Estimated Impacts of Changes in Statutory Grain Freight Rates on Canada's Market Share in China (Model II)

1960-83

Year	Shares as a Function of Relative Canadian Farmgate Price + 100% Compensatory Rate and U.S. Farmgate Price	Shares as a Function of Relative Farmgate Prices	100% Compensatory Freight Shares (100% CR)
1960	.62	.62	0
1961	.85	.85	0
1962	1.07	1.07	0
1963	1.05	1.06	-.01
1964	1.03	1.04	-.01
1965	1.02	1.02	0
1966	1.00	1.00	0
1967	.98	.99	-.01
1968	.97	.97	0
1969	.95	.95	0
1970	.94	.94	0
1971	.92	.92	0
1972	.90	.90	0
1973	.90	.85	+.05
1974	.81	.81	0
1975	.51	.52	-.01
1976	.64	.65	-.01
1977	.81	.82	-.01
1978	.80	.80	0
1979	.75	.75	0
1980	.55	.55	0
1981	.54	.55	-.01
1982	.37	.37	0
1983	.36	.36	0

Table 6.15

Estimated Impacts of Changes in Statutory Grain Freight Rates on Canada's Market Share in China (Model II)

1960-83

Year	Shares as a Function of Relative Canadian Farmgate Price + 65% Compensatory Freight Rate and U.S. Farmgate Price	Shares as a Function of Relative Farmgate Prices	65% Compensatory Rate Shares (65% CR)
1960	.62	.62	0
1961	.85	.85	0
1962	1.07	1.07	0
1963	1.05	1.06	-.01
1964	1.04	1.04	0
1965	1.02	1.02	0
1966	1.00	1.00	0
1967	.99	.99	0
1968	.97	.97	0
1969	.95	.95	0
1970	.93	.94	-.01
1971	.92	.92	0
1972	.90	.90	0
1973	.89	.85	+.04
1974	.81	.81	0
1975	.51	.52	-.01
1976	.65	.65	0
1977	.81	.82	-.01
1978	.80	.80	0
1979	.75	.75	0
1980	.55	.55	0
1981	.54	.55	-.01
1982	.37	.37	0
1983	.36	.36	0

Table 6.16

Estimated Impacts of Changes in Statutory Grain Freight Rates on Canada's Market Share in China (Model II)

1960-83

Year	Shares as a Function of Relative Canadian Farmgate Price + 50% Compensatory Freight Rate and U.S. Farmgate Price	Shares as a Function of Relative Farmgate Prices	50% Compensatory Rate Shares (50% CR)
1960	.62	.62	0
1961	.85	.85	0
1962	1.07	1.07	0
1963	1.05	1.06	-.01
1964	1.04	1.04	0
1965	1.02	1.02	0
1966	1.00	1.00	0
1967	.99	.99	0
1968	.97	.97	0
1969	.95	.95	0
1970	.93	.94	-.01
1971	.92	.92	0
1972	.90	.90	0
1973	.88	.85	+.03
1974	.81	.81	0
1975	.51	.52	-.01
1976	.65	.65	0
1977	.82	.82	0
1978	.80	.80	0
1979	.75	.75	0
1980	.55	.55	0
1981	.54	.55	-.01
1982	.37	.37	0
1983	.36	.36	0

Table 6.17

Estimated Impacts of Transportation Costs on Canada's Market Share in China (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.02	0	0	0	0
1961	+.05	0	0	0	0
1962	-.20	0	0	0	0
1963	-.11	0	-.01	-.01	-.01
1964	+.10	0	-.01	0	0
1965	+.13	0	0	0	0
1966	-.14	0	0	0	0
1967	-.11	0	-.01	0	0
1968	+.09	0	0	0	0
1969	+.07	0	0	0	0
1970	0	0	0	-.01	-.01
1971	+.03	0	0	0	0
1972	+.20	0	0	0	0
1973	-.02	+.02	+.05	+.04	+.03
1974	-.25	0	0	0	0
1975	+.10	-.01	-.01	-.01	-.01
1976	+.13	0	-.01	0	0
1977	+.13	0	-.01	-.01	0
1978	+.11	0	0	0	0
1979	-.02	0	0	0	0
1980	-.07	0	0	0	0
1981	-.24	0	-.01	-.01	-.01
1982	-.03	0	0	0	0
1983	+.03	0	0	0	0
Net Impact	0	+.01	-.02	-.01	-.01

R_2^2 (f.o.b.) = .81
R_2^2 (farmgate) = .61
R_2^2 (CROW) = .61
R_2^2 (100% CR) = .61
R_2^2 (65% CR) = .61
R^2 (50% CR) = .61

6.4.2 The USSR

In 1982/83, the USSR imported 6,953,000 tonnes of wheat and wheat flour from Canada and 3,036,000 tonnes from the U.S. This amounted to 33 percent of Canadian and 7 percent of the U.S. wheat exports in that year. The estimated impacts of transportation costs on Canada's market share in the USSR based on Models I and II are reported in Tables 6.18 and 6.19, respectively.

When the Crow rates are considered Canada's market shares change by 0 percent to 4 percent in Model I and by 0 percent to 1 percent in Model II. The magnitudes of changes in these shares based on Model I are larger than those based on Model II when the previous scenario or any other compensatory scenarios is considered. However, with the exception of the years 1972-1975 when the international prices of wheat were high, these magnitudes are themselves quite small (between 0 percent to 4 percent).

The results reported in the final rows of the two tables suggest that over the period of 1960-83 no portion of Canada's market share in the USSR may be attributed to the Crow benefit (Tables 6.18 and 6.19). In addition, if the freight rates had gone up to the full compensatory levels (100 percent CR), Canada would have lost 4 percent of its market share in the USSR based on Model I and 3 percent of its share in that market based on Model II. Both Models generate exactly the same estimates when rates go up by either 65 percent or by 50 percent of compensatory levels. Canada loses only 1 to 2 percent of its market share in the USSR when these two scenarios are considered (Tables 6.18 and 6.19).

Table 6.18

Estimated Impacts of Transportation Costs on Canada's Market Share in the USSR (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50%CR
1960	-.03	-.01	-.04	-.03	-.02
1961	+.01	0	-.02	-.01	-.01
1962	-.08	0	-.02	-.02	-.01
1963	-.03	-.01	-.03	-.03	-.02
1964	+.08	-.01	-.03	-.03	-.02
1965	+.05	+.01	+.03	+.02	+.02
1966	-.10	+.02	+.04	+.03	+.03
1967	-.05	0	0	0	0
1968	+.08	+.01	+.01	+.01	+.01
1969	+.05	+.01	+.02	+.02	+.01
1970	+.01	+.01	+.04	+.03	+.02
1971	+.04	0	+.01	+.01	0
1972	+.10	+.01	+.05	+.04	+.03
1973	-.13	+.04	+.11	+.09	+.07
1974	-.12	-.01	-.03	-.02	-.02
1975	+.06	-.02	-.06	-.04	-.04
1976	+.12	-.02	-.05	-.04	-.03
1977	+.12	-.01	-.02	-.02	-.01
1978	+.05	+.01	+.03	+.02	+.02
1979	-.02	0	+.01	+.01	+.01
1980	-.06	0	-.01	0	0
1981	-.12	-.01	-.03	-.02	-.02
1982	-.03	-.01	-.03	-.03	-.02
1983	0	-.01	-.02	-.01	-.01
Net Impact	0	0	-.04	-.02	-.01

R^2 (f.o.b.) = .20
R^2 (farmgate) = .15
R^2 (Crow) = .17
R^2 (100% CR) = .20
R^2 (65% CR) = .19
R^2 (50% CR) = .18

Table 6.19

Estimated Impacts of Transportation Costs on Canada's Market share in the USSR (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.04	-.01	-.01	-.01	-.01
1961	+.01	0	0	0	0
1962	-.03	0	0	0	0
1963	-.04	0	+.01	0	0
1964	0	0	0	0	0
1965	+.08	0	+.01	+.01	0
1966	+.02	0	0	0	0
1967	-.09	+.01	+.01	+.01	+.01
1968	-.08	0	0	0	0
1969	-.06	0	-.02	-.01	-.01
1970	-.05	-.01	-.02	-.02	-.01
1971	-.10	-.01	-.02	-.02	-.01
1972	+.03	0	-.01	-.01	0
1973	+.36	+.01	+.04	+.03	+.02
1974	-.03	0	+.01	0	0
1975	-.05	+.01	-.01	+.01	+.01
1976	-.04	0	-.01	-.01	-.01
1977	-.02	0	-.01	0	0
1978	+.14	0	-.01	0	0
1979	+.09	0	0	0	0
1980	+.01	0	+.01	0	0
1981	-.05	0	0	0	0
1982	-.10	0	0	0	0
1983	-.04	0	0	0	0
Net Impact	0	0	-.03	-.02	-.01

R^2 (f.o.b.) = .60
R^2 (farmgate) = .71
R^2 (Crow) = .70
R^2 (100% CR) = .69
R^2 (65% CR) = .69
R^2 (50% CR) = .70

6.4.3 Poland

In 1982/83, Poland imported 775,000 tonnes of wheat and wheat flour from Canada and 89,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share based on Models I and II are reported in Tables 6.20 and 6.21, respectively.

When the Crow rates are considered, Canada's market shares change by 0 percent to 4 percent in both Models I and II. The magnitude of changes in these shares based on Model I are generally larger than those based on Model II when the previous scenario or any other compensatory scenarios is considered. However, with the exception of the years 1972-75, when the international prices of wheat were high, these magnitudes are themselves quite small (between 0 percent to 2 percent).

The results reported in the final rows of the two tables suggest that over the period of 1960 to 1983, 1 percent of Canada's market share in Poland may be attributed to the Crow benefit (Tables 6.20 and 6.21). If the freight rates had gone up to 50 percent, 65 percent, and 100 percent of the compensatory levels, Canada would have lost 0 percent, 1 percent and 1 percent of the U.S. share in Poland, respectively (Table 6.20). Model II predicts an erosion of Canada's share in that market by 0 to 1 percent (Table 6.21).

Table 6.20

Estimated Impacts of Transportation Costs on Canada's Market Share in Poland (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.03	-.01	-.02	-.01	-.01
1961	0	0	-.01	0	0
1962	-.07	0	-.01	-.01	-.01
1963	-.03	0	-.01	-.01	-.01
1964	+.05	-.01	-.01	-.01	-.01
1965	+.05	+.01	+.02	+.01	+.01
1966	-.06	+.01	+.02	+.02	+.02
1967	-.03	0	0	0	0
1968	+.05	0	0	0	0
1969	+.03	0	+.01	0	0
1970	0	0	+.01	+.01	+.01
1971	+.02	0	0	0	+.01
1972	+.09	+.01	+.03	+.02	+.02
1973	-.05	+.03	+.06	+.05	+.04
1974	-.09	0	-.01	-.01	-.01
1975	+.03	-.01	-.03	-.02	-.02
1976	+.07	-.01	-.02	-.02	-.01
1977	+.07	-.01	-.01	-.01	-.01
1978	+.05	+.01	+.02	+.01	+.01
1979	-.01	0	0	0	0
1980	-.04	0	0	0	0
1981	-.10	-.01	-.02	-.01	-.01
1982	-.03	0	-.02	-.01	-.01
1983	-.01	0	-.01	-.01	-.01
Net Impact	+.04	+.01	-.01	-.01	0

R^2 (f.o.b.) = .05
R^2 (farmgate) = .02
R^2 (CROW) = .02
R^2 (100% CR) = .03
R^2 (65% CR) = .03
R^2 (50% CR) = .03

Table 6.21

Estimated Impacts of Transportation Costs on Canada's Market Share in Poland (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.04	0	0	0	0
1961	0	0	0	0	0
1962	-.06	0	0	0	0
1963	-.05	0	-.01	0	0
1964	+.03	0	0	0	0
1965	+.09	+.01	+.02	+.01	+.01
1966	-.04	0	0	0	0
1967	-.07	-.01	-.02	-.01	-.01
1968	+.02	0	-.01	-.01	-.01
1969	+.01	-.01	-.02	-.02	-.01
1970	-.01	-.01	-.01	-.01	-.01
1971	+.01	0	-.01	-.01	-.01
1972	+.13	0	+.01	+.01	+.01
1973	+.12	+.04	+.08	+.06	+.05
1974	-.08	0	0	0	0
1975	0	-.01	-.01	-.01	-.01
1976	0	-.01	-.02	-.02	-.01
1977	+.05	0	-.01	-.01	-.01
1978	+.08	+.01	+.01	+.01	+.01
1979	+.03	+.01	+.01	+.01	+.01
1980	-.02	0	+.01	+.01	+.01
1981	-.08	0	0	0	0
1982	-.07	-.01	-.02	-.01	-.01
1983	-.04	0	-.01	-.01	-.01
Net Impact	+.01	+.01	-.01	-.01	0

R_2^2 (f.o.b.) = .06
R_2^2 (farmgate) = .05
R_2^2 (CROW) = .05
R_2^2 (100% CR) = .04
R_2^2 (65% CR) = .04
R^2 (50% CR) = .04

6.4.4 Cuba

In 1982/83, Cuba imported 1,313,000 tonnes of wheat and wheat flour from Canada. Due to political reasons, however, it did not import any from the U.S. The estimated impacts of transportation costs on Canada's market share in Cuba, based on Models I and II, are reported in Tables 6.22 and 6.23, respectively.

When the Crow rates are considered, Canada's market shares change by 0 percent to 2 percent both in Models I and II. The magnitudes of changes in shares are generally larger in Model I than in Model II when the previous scenario or any other compensatory scenario is considered. However, these magnitudes are themselves quite small (between 0 and 4 percent).

The results reported in the final rows of the two tables suggest that over the period of 1960-83, a loss of 1 percent of Cuban market may be attributed to the Canadian statutory freight rates (Table 6.22). The corresponding figure based on Model II is nil (Table 6.23). Had the freight rates gone up to 50 percent, 65 percent, and 100 percent of the compensatory levels, Canada would have lost 0 percent, 2 percent, and 3 percent of its share to the U.S. in Cuban market (Table 6.22). Model II predicts no erosion of Canada's share in that market at all (Table 6.23).

Table 6.22

Estimated Impacts of Transportation Costs on Canada's Market Share in Cuba (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.01	-.01	-.03	-.02	-.01
1961	+.01	0	-.01	-.01	0
1962	-.08	-.01	-.02	-.02	-.01
1963	-.01	0	-.02	-.01	-.01
1964	+.10	0	-.02	-.01	-.01
1965	+.03	0	+.01	0	+.01
1966	-.13	+.01	+.02	+.01	+.01
1967	-.05	0	0	0	0
1968	+.08	0	+.01	0	0
1969	+.05	+.01	+.03	+.03	+.02
1970	0	+.01	+.03	+.03	+.02
1971	+.05	+.01	+.02	+.02	+.01
1972	+.08	+.01	+.03	+.02	+.01
1973	-.21	+.02	+.04	+.03	+.03
1974	-.12	-.01	-.02	-.02	-.01
1975	+.09	-.02	-.03	-.03	-.02
1976	+.15	-.01	-.02	-.01	-.01
1977	+.15	0	0	0	0
1978	+.04	0	+.01	+.01	+.01
1979	-.03	0	0	0	0
1980	-.07	0	-.01	-.01	-.01
1981	-.12	0	-.02	-.01	-.01
1982	-.01	-.01	-.02	-.01	-.01
1983	0	-.01	-.01	-.01	-.01
Net Impact	-.01	-.01	-.03	-.02	0

R_2^2 (f.o.b.) = .51
R_2^2 (farmgate) = .47
R_2^2 (CROW) = .48
R_2^2 (100% CR) = .51
R_2^2 (65% CR) = .50
R^2 (50% CR) = .49

Table 6.23
Estimated Impacts of Transportation Costs on Canada's Market Share in Cuba (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	0	0	0	0	0
1961	+.02	0	0	0	0
1962	-.03	0	0	0	0
1963	-.01	0	0	0	0
1964	+.03	0	0	0	0
1965	+.02	0	0	0	0
1966	-.04	0	0	0	0
1967	-.03	0	0	0	0
1968	+.01	0	0	0	0
1969	+.01	0	0	0	0
1970	0	0	0	0	0
1971	0	0	0	0	0
1972	+.05	0	0	0	0
1973	0	-.01	-.01	-.01	-.01
1974	-.04	+.02	+.02	+.02	+.02
1975	0	0	0	0	0
1976	-.02	0	0	0	0
1977	+.03	-.01	-.01	-.01	-.01
1978	+.03	0	0	0	0
1979	+.01	0	0	0	0
1980	-.01	0	0	0	0
1981	-.05	0	0	0	0
1982	-.01	0	0	0	0
1983	0	0	0	0	0
Net Impact	-.03	0	0	0	0

R_2^2 (f.o.b.) = .89
R_2^2 (farmgate) = .87
R_2^2 (CROW) = .87
R_2^2 (100% CR) = .87
R_2^2 (65% CR) = .87
R^2 (50% CR) = .87

6.4.5 Japan

In 1982/83, Japan imported 1,357,000 tonnes of wheat and wheat flour from Canada and 3,294 tonnes from the U.S. This amounted to 6.5 percent of Canadian and 8.5 percent of the U.S. wheat exports in that year. The estimated impacts of transportation costs on Canada's market share in Japan based on Models I and II are reported in Tables 6.24 and 6.25, respectively.

When the Crow rates are considered Canada's market shares change by 0 percent to 1 percent in both Models. The magnitudes of changes in these shares remain within the same range when different compensatory scenarios are considered (Tables 6.24 and 6.25).

The results reported in the final row of Table 6.24 suggest that over the period of 1960-83 2 percent of Canada's market share in Japan may be attributed to the Crow benefit. Model II (Table 6.25) predicts no gains or losses in that market. Had the freight rates gone up to the full compensatory levels (100 percent CR), or 65 percent CR, Canada would lost 1 percent of its share in Japan. The corresponding figure based on Model II for the above two scenarios is a loss of 3 percent in that market. Model I generates no losses and Model II predicts a loss of 2 percent when the final scenario (50 percent CR) is considered (Tables 6.24 and 6.25).

Table 6.24

Estimated Impacts of Transportation Costs on Canada's Market Share in Japan (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.01	+.01	+.01	+.01	+.01
1961	0	0	+.01	+.01	+.01
1962	+.03	0	+.01	0	0
1963	+.01	0	+.01	+.01	+.01
1964	-.03	0	0	0	0
1965	-.01	0	0	0	0
1966	+.03	0	-.01	-.01	-.01
1967	+.02	0	0	0	0
1968	-.02	0	0	0	0
1969	-.01	0	0	0	0
1970	0	0	-.01	-.01	-.01
1971	-.01	0	0	0	0
1972	-.02	0	-.01	0	0
1973	+.06	0	-.01	-.01	-.01
1974	+.03	0	0	0	0
1975	-.02	+.01	+.01	+.01	+.01
1976	-.05	0	0	0	0
1977	-.04	0	0	0	0
1978	-.02	0	-.01	-.01	-.01
1979	0	0	-.01	-.01	0
1980	+.02	0	0	0	0
1981	+.03	0	0	0	0
1982	0	0	0	0	0
1983	0	0	0	0	0
Net Impact	+.01	+.02	-.01	-.01	0

R_2^2 (f.o.b.) = .75
R_2^2 (farmgate) = .72
R_2^2 (CROW) = .73
R_2^2 (100% CR) = .74
R_2^2 (65% CR) = .74
R^2 (50% CR) = .73

Table 6.25

Estimated Impacts of Transportation Costs on Canada's Market Share in Japan (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.02	0	0	0	0
1961	0	0	0	0	0
1962	+.02	0	0	0	0
1963	0	0	0	0	0
1964	-.04	0	0	0	0
1965	-.02	0	0	0	0
1966	+.03	0	0	0	0
1967	+.02	0	0	0	0
1968	-.02	0	0	0	0
1969	-.02	0	-.01	-.01	-.01
1970	0	0	-.01	-.01	0
1971	-.02	0	-.01	-.01	-.01
1972	-.03	0	-.01	-.01	-.01
1973	+.07	0	-.01	-.01	-.01
1974	+.03	0	0	0	0
1975	-.02	0	+.01	+.01	+.01
1976	-.03	0	+.01	+.01	+.01
1977	-.04	0	0	0	0
1978	-.02	0	0	0	0
1979	0	0	0	0	0
1980	+.02	0	0	0	0
1981	+.03	0	0	0	0
1982	0	0	0	0	0
1983	0	0	0	0	0
Net Impact	-.02	0	-.03	-.03	-.02

R_2^2 (f.o.b.) = .75
R_2^2 (farmgate) = .73
R_2^2 (CROW) = .73
R_2^2 (100% CR) = .74
R_2^2 (65% CR) = .74
R^2 (50% CR) = .73

6.4.6 The U.K.

In 1982/83, the U.K. imported 1,068,000 tonnes of wheat and wheat flour from Canada and 562,000 tonnes from the U.S. This amounted to 5 percent of Canadian and 1.5 percent of the U.S. wheat exports in that year. The estimated impacts of transportation costs on Canada's market share in the U.K. based on Models I and II are reported in Tables 6.26 and 6.27, respectively.

When the Crow rates are considered, Canada's market shares change by 0 percent to 1 percent in both Models. The magnitudes of changes remain within the same range when the three different compensatory scenarios are considered (Tables 6.26 and 6.27).

The results reported in the final rows of the two tables suggest that over the period of 1960-83 between 1 and 3 percent of Canada's market share in the U.K. can be attributed to the Crow benefit (Tables 6.26 and 6.27). When the different compensatory rates are considered, Model I predicts gains of 1 percent (for 100 percent CR), 2 percent (for 65 percent CR) and 2 percent (for 50 percent CR) and Model II generates gains no gains or losses in the first two scenarios and a 1 percent gain in the last (Tables 6.26 and 6.27).

Table 6.26

Estimated Impacts of Transportation Costs on Canada's Market Share in the U.K. (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.02	0	0	0	0
1961	-.01	0	0	0	0
1962	0	+.01	+.01	+.01	+.01
1963	-.01	0	+.01	+.01	+.01
1964	-.01	+.01	+.01	+.01	+.01
1965	+.02	0	0	0	0
1966	+.03	0	0	0	0
1967	0	0	0	0	0
1968	-.01	0	-.01	0	0
1969	-.01	-.01	-.01	-.01	-.01
1970	+.01	0	-.01	-.01	-.01
1971	-.01	0	-.01	-.01	-.01
1972	+.01	-.01	-.01	-.01	-.01
1973	+.08	0	-.01	-.01	-.01
1974	0	0	+.01	+.01	+.01
1975	-.03	+.01	+.01	+.01	+.01
1976	-.03	+.01	+.01	+.01	+.01
1977	-.02	0	0	0	0
1978	+.02	0	0	0	0
1979	+.02	0	0	0	0
1980	0	0	0	0	0
1981	-.01	0	0	0	0
1982	-.01	+.01	+.01	+.01	+.01
1983	-.01	0	0	0	0
Net Impact	0	+.03	+.01	+.02	+.02

R_2^2 (f.o.b.) = .05
R_2^2 (farmgate) = .10
R_2^2 (CROW) = .11
R_2^2 (100% CR) = .12
R_2^2 (65% CR) = .12
R^2 (50% CR) = .11

Table 6.27

Estimated Impacts of Transportation Costs on Canada's Market Share in the U.K. (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.01	0	+.01	+.01	+.01
1961	0	0	+.01	+.01	0
1962	-.01	0	0	0	0
1963	-.01	+.01	+.01	+.01	+.01
1964	-.02	0	0	0	0
1965	+.01	0	0	0	0
1966	+.03	0	0	0	0
1967	0	0	0	0	0
1968	-.01	0	0	0	0
1969	0	0	-.01	-.01	0
1970	+.01	0	-.01	-.01	0
1971	-.02	-.01	-.01	-.01	-.01
1972	+.01	-.01	-.01	-.01	-.01
1973	+.11	0	-.01	-.01	-.01
1974	0	0	0	0	0
1975	-.02	+.01	+.01	+.01	+.01
1976	-.03	0	0	0	0
1977	-.02	0	0	0	0
1978	+.02	0	0	0	0
1979	+.01	0	0	0	0
1980	+.01	0	0	0	0
1981	0	+.01	+.01	+.01	+.01
1982	-.01	0	0	0	0
1983	-.01	0	0	0	0
Net Impact	+.04	+.01	0	0	+.01

R_2^2 (f.o.b.) = .08
R_2^2 (farmgate) = .15
R_2^2 (CROW) = .16
R_2^2 (100% CR) = .17
R_2^2 (65% CR) = .17
R^2 (50% CR) = .16

6.4.7 West Germany

In 1982/83, West Germany imported 1,000 tonnes of wheat and wheat flour from Canada and 14,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in West Germany, based on Models I and II, are reported in Tables 6.28 and 6.29, respectively.

When the Crow rates are considered, Canada's market shares change by 0 percent to 1 percent in both Models with the exception of the year 1973 in which the international prices of wheat were high and Canada's share increased by 2 percent (Table 6.29). The magnitudes of changes in these shares based on Model I are generally higher than those based on Model II when the previous scenario or any other compensatory scenario is considered. The year 1973 still remains an exception (Tables 6.28 and 6.29).

The results reported in the final row of Table 6.28 suggest that over the period of 1960-83 no portion of Canada's market share in West Germany may be attributed to the Crow benefit. Table 6.29 predicts a 1 percent gain in this market for Canada. If the freight rates had gone up to 100 percent CR, Canada would have lost 1 percent based on both Models. The corresponding figure for the other two scenarios is 0 percent, i.e., no gains or losses in that market (Tables 6.28 and 6.29).

Table 6.28

Estimated Impacts of Transportation Costs on Canada's Market Share in West Germany (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.03	0	-.01	-.01	-.01
1961	-.01	-.01	-.01	-.01	-.01
1962	-.05	0	-.01	0	0
1963	-.02	0	0	0	0
1964	+.04	0	-.01	-.01	-.01
1965	+.04	0	0	0	0
1966	-.03	+.01	+.01	+.01	+.01
1967	-.02	0	0	0	0
1968	+.03	0	0	0	0
1969	+.03	+.01	+.01	+.01	+.01
1970	+.01	0	+.01	+.01	0
1971	+.02	0	0	0	0
1972	+.07	0	+.01	+.01	+.01
1973	-.02	0	+.02	+.02	+.01
1974	-.07	0	-.01	-.01	+.01
1975	+.02	0	-.01	-.01	-.01
1976	+.04	0	-.01	-.01	0
1977	+.05	0	0	0	0
1978	+.04	0	+.01	+.01	0
1979	0	0	0	0	0
1980	-.03	0	0	0	0
1981	-.07	0	0	0	0
1982	-.03	-.01	-.01	-.01	-.01
1983	-.01	0	0	0	0
Net Impact	0	0	-.01	0	0

R^2 (f.o.b.) = .73
R^2 (farmgate) = .72
R^2 (CROW) = .72
R^2 (100% CR) = .72
R^2 (65% CR) = .72
R^2 (50% CR) = .72

Table 6.29

Estimated Impacts of Transportation Costs on Canada's Market Share in West Germany (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.01	+.01	+.01	+.01	+.01
1961	-.01	0	0	0	0
1962	-.06	0	0	0	0
1963	-.04	0	-.01	-.01	-.01
1964	+.03	0	0	0	0
1965	+.05	0	0	0	0
1966	-.04	0	0	0	0
1967	-.03	0	-.01	-.01	-.01
1968	+.03	0	0	0	0
1969	+.03	0	0	0	0
1970	+.01	0	0	0	0
1971	0	-.01	-.01	-.01	-.01
1972	+.08	+.01	+.01	+.01	+.01
1973	+.01	+.02	+.04	+.03	+.03
1974	-.07	0	0	0	0
1975	-.01	-.01	-.02	-.01	-.01
1976	+.04	0	-.01	0	0
1977	+.06	0	0	0	0
1978	+.03	0	0	0	0
1979	+.01	0	0	0	0
1980	-.02	0	0	0	0
1981	-.07	0	0	0	0
1982	+.01	0	0	0	0
1983	-.02	-.01	-.01	-.01	-.01
Net Impact	+.03	+.01	-.01	0	0

R_2^2 (f.o.b.) = .73
R_2^2 (farmgate) = .72
R_2^2 (CROW) = .72
R_2^2 (100% CR) = .72
R^2 (65% CR) = .72
R^2 (50% CR) = .72

6.4.8 Italy

In 1982/83, Italy imported 679,000 tonnes of wheat and wheat flour from Canada and 461,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in Italy, based on Models I and II, are reported in Tables 6.30 and 6.31, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 1 percent in both Models. The magnitudes of changes in the shares remain within the same range when different compensatory scenarios are considered, with the exception of the year 1973 in which wheat prices were high and Model II (Table 6.31) generates a 2 percent increase when either a 100 percent CR or 65 percent CR is considered.

The results reported in the final rows of Tables 6.30 and 6.31 suggest a 1 percent increase in Canada's share in the Italian market is due to Crow "benefit." Had the freight rates been changed, based on the full compensatory levels, Canada would have gained nothing (Model I) and would have lost 1 percent (Model II). The corresponding figures for 65 percent CR and 50 percent CR are 1 percent increase in Model I and 0 and 1 percent increase in Model II (Tables 6.30 and 6.31).

Table 6.30

Estimated Impacts of Transportation Costs on Canada's Market Share in Italy (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.02	-.01	-.01	-.01	-.01
1961	0	-.01	-.01	-.01	-.01
1962	-.05	0	-.01	-.01	-.01
1963	-.02	0	-.01	-.01	-.01
1964	+.06	0	0	0	0
1965	+.03	+.01	+.01	+.01	+.01
1966	-.07	0	0	0	0
1967	-.02	0	0	0	0
1968	+.05	+.01	+.01	+.01	+.01
1969	+.03	0	0	0	0
1970	0	0	+.01	+.01	+.01
1971	+.03	0	+.01	+.01	+.01
1972	+.06	+.01	+.01	+.01	+.01
1973	-.09	0	+.01	+.01	+.01
1974	-.07	0	0	0	0
1975	+.04	0	-.01	-.01	-.01
1976	+.07	0	-.01	0	0
1977	+.08	0	0	0	0
1978	+.03	0	0	0	0
1979	-.02	0	0	0	0
1980	-.03	0	0	0	0
1981	-.07	0	0	0	0
1982	-.01	0	0	0	0
1983	0	0	0	0	0
Net Impact	+.01	+.01	0	+.01	+.01

R^2 (f.o.b.) = .23
R^2 (farmgate) = .14
R^2 (CROW) = .14
R^2 (100% CR) = .16
R^2 (65% CR) = .16
R^2 (50% CR) = .15

Table 6.31

Estimated Impacts of Transportation Costs on Canada's Market Share in Italy (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	0	-.01	-.01	-.01	0
1961	-.01	-.01	-.01	-.01	-.01
1962	-.04	0	-.01	0	0
1963	0	0	0	0	0
1964	+.05	0	0	0	0
1965	+.03	0	0	0	0
1966	-.06	0	+.01	0	0
1967	-.02	0	0	0	0
1968	+.04	0	0	0	0
1969	+.03	+.01	+.01	+.01	+.01
1970	0	0	0	0	0
1971	+.02	0	0	0	0
1972	+.07	+.01	+.01	+.01	+.01
1973	-.11	+.01	+.02	+.02	+.01
1974	-.07	0	-.01	0	0
1975	+.03	0	-.01	0	0
1976	+.06	0	0	0	0
1977	+.07	0	0	0	0
1978	+.02	0	0	0	0
1979	-.01	0	0	0	0
1980	-.03	0	-.01	-.01	0
1981	-.07	0	-.01	-.01	-.01
1982	0	0	0	0	0
1983	+.02	0	+.01	0	0
Net Impact	+.02	+.01	-.01	0	+.01

R_2^2 (f.o.b.) = .22
R_2^2 (farmgate) = .16
R_2^2 (CROW) = .16
R_2^2 (100% CR) = .17
R_2^2 (65% CR) = .17
R^2 (50% CR) = .16

6.4.9 Belgium

In 1982/83, Belgium imported 27,000 tonnes of wheat and wheat flour from Canada and 129,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in Belgium, based on Models I and II, are reported in Tables 6.32 and 6.33, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 1 percent in both Models. The magnitudes of changes in these shares for different compensatory rates are between 0 to 3 percent, the latter figure corresponding to the year 1973 when the international prices of wheat were higher (Tables 6.32 and 6.33).

For the period of 1960-83, neither Models generates any loss or gain in Canada's market share in Belgium due to the Crow benefit (Tables 6.32 and 6.33). When 100% CR is considered, Model I still generates a loss of 2 percent in Canada's shares in that market and Model II predicts a 1 percent increase in the shares. The corresponding figures for 65% CR and 50% CR are decreases of the magnitudes of 2 and 1 percent based on Model 1 (Table 6.32) and no changes at all based on Model II (Table 6.33).

Table 6.32

Estimated Impacts of Transportation Costs on Canada's Market Share in Belgium (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.02	-.01	-.02	-.01	-.01
1961	0	-.01	-.01	-.01	-.01
1962	-.08	0	-.01	-.01	0
1963	-.02	0	-.01	-.01	-.01
1964	+.09	0	-.01	-.01	0
1965	+.04	0	0	0	0
1966	-.11	0	0	0	0
1967	-.04	0	0	0	0
1968	+.07	0	+.01	0	0
1969	+.04	0	+.01	+.01	+.01
1970	0	+.01	+.02	+.01	+.01
1971	+.05	+.01	+.02	+.02	+.01
1972	+.09	0	+.01	+.01	+.01
1973	-.15	+.01	+.01	+.01	+.01
1974	-.11	-.01	-.02	-.01	-.01
1975	+.07	0	-.01	-.01	-.01
1976	+.12	0	-.01	-.01	-.01
1977	+.12	0	0	0	0
1978	+.05	0	0	0	0
1979	-.02	0	0	0	0
1980	-.05	0	0	0	0
1981	-.11	0	0	0	0
1982	-.02	0	0	0	0
1983	0	0	0	0	0
Net Impact	+.01	0	-.02	-.02	-.01

R^2 (f.o.b.) = .77
R^2 (farmgate) = .73
R^2 (CROW) = .73
R^2 (100% CR) = .74
R^2 (65% CR) = .74
R^2 (50% CR) = .73

Table 6.33

Estimated Impacts of Transportation Costs on Canada's Market Share in Belgium (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.04	0	0	0	0
1961	+.01	0	-.01	-.01	0
1962	-.09	0	-.01	-.01	-.01
1963	-.03	0	-.01	0	0
1964	+.08	-.01	-.02	-.01	-.01
1965	+.06	+.01	+.01	+.01	+.01
1966	-.10	0	0	0	0
1967	-.04	0	0	0	0
1968	+.08	0	+.01	0	0
1969	+.05	0	0	0	0
1970	+.01	0	+.02	+.02	+.01
1971	+.04	0	0	0	0
1972	+.10	0	+.01	+.01	+.01
1973	-.16	+.01	+.03	+.02	+.02
1974	-.13	0	-.01	-.01	-.01
1975	+.06	0	-.01	0	0
1976	+.11	0	-.01	0	0
1977	+.12	0	+.01	0	0
1978	+.06	0	0	0	0
1979	-.02	0	0	0	0
1980	-.05	0	-.01	-.01	-.01
1981	-.11	0	0	0	0
1982	-.03	-.01	-.01	-.01	-.01
1983	0	0	0	0	0
Net Impact	-.02	0	-.01	0	0

R^2 (f.o.b.) = .78
R^2 (farmgate) = .72
R^2 (CROW) = .73
R^2 (100% CR) = .73
R^2 (65% CR) = .73
R^2 (50% CR) = .73

6.4.10 Switzerland

In 1982/83, Switzerland imported 151,000 tonnes of wheat and wheat flour from Canada and 120,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in Switzerland, based on Models I and II, are reported in Tables 6.34 and 6.35, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 1 percent in both Models. The magnitudes of changes in these shares for different compensatory rates are between 0 to 3 percent. The latter figure corresponding to the year 1973 when the international prices of wheat were high (Tables 6.34 and 6.35).

For the period of 1960-83, Model I predicts no impact on Canada's shares in Switzerland due to the Crow benefit, however, Model II generates a 1 percent increase in those shares. Both Models predict a 1 percent loss in Canada's shares in Switzerland from increasing the freight rates up to 100 percent CR (Tables 6.34 and 6.35). When the other two scenarios are considered, Model I predicts no changes in Canada's shares in Switzerland (Table 6.24) and Model II predicts a 1 percent decrease and a 1 percent increase in those shares for 65 percent CR or 50 percent CR, respectively (Table 6.35).

Table 6.34

Estimated Impacts of Transportation Costs on Canada's Market Share in Switzerland (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.01	0	+.01	+.01	0
1961	0	0	0	0	0
1962	+.04	0	+.01	+.01	0
1963	+.01	0	0	0	0
1964	-.05	0	0	0	0
1965	-.03	0	-.01	0	0
1966	+.05	-.01	-.01	-.01	-.01
1967	+.02	0	0	0	0
1968	-.03	0	0	0	0
1969	-.03	0	-.01	-.01	-.01
1970	0	0	-.01	-.01	0
1971	-.02	0	0	0	0
1972	-.05	0	-.01	-.01	0
1973	+.06	-.01	-.03	-.02	-.02
1974	+.06	+.01	+.01	+.01	+.01
1975	-.03	0	+.01	+.01	+.01
1976	-.05	+.01	+.01	+.01	+.01
1977	-.06	0	+.01	0	0
1978	-.02	0	0	0	0
1979	+.01	0	0	0	0
1980	+.02	0	0	0	0
1981	+.06	0	0	0	0
1982	+.01	0	+.01	+.01	+.01
1983	+.02	0	0	0	0
Net Impact	0	0	-.01	0	0

R^2 (f.o.b.) = .28
R^2 (farmgate) = .23
R^2 (CROW) = .24
R^2 (100% CR) = .25
R^2 (65% CR) = .25
R^2 (50% CR) = .24

Table 6.35

Estimated Impacts of Transportation Costs on Canada's Market Share in Switzerland (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.04	0	+.01	+.01	0
1961	-.02	0	0	0	0
1962	+.05	0	+.01	0	0
1963	+.01	0	0	0	0
1964	-.05	+.01	+.01	+.01	+.01
1965	-.03	0	0	0	0
1966	+.05	0	-.01	0	0
1967	+.03	0	0	0	0
1968	-.05	0	0	0	0
1969	-.04	-.01	-.01	-.01	-.01
1970	0	0	-.01	0	0
1971	-.03	0	-.01	-.01	-.01
1972	-.06	0	-.01	-.01	-.01
1973	+.11	0	-.02	-.02	-.01
1974	+.07	0	+.01	0	0
1975	-.04	0	+.01	+.01	+.01
1976	-.06	0	+.01	+.01	+.01
1977	-.07	0	0	0	0
1978	-.04	0	-.01	-.01	0
1979	0	0	-.01	-.01	0
1980	+.03	0	+.01	+.01	+.01
1981	+.07	0	0	0	0
1982	+.01	0	0	0	0
1983	0	+.01	+.01	+.01	+.01
Net Impact	-.02	+.01	-.01	-.01	+.01

R_2^2 (f.o.b.) = .41
R_2^2 (farmgate) = .36
R_2^2 (CROW) = .36
R_2^2 (100% CR) = .37
R_2^2 (65% CR) = .37
R^2 (50% CR) = .36

6.4.11 The Netherlands

In 1982/83, the Netherlands imported 17,000 tonnes of wheat and wheat flour from Canada and 562,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market shares in the Netherlands, based on Models I and II, are reported in Tables 6.36 and 6.37, respectively.

Canada's market shares change by 0 to 1 percent in both Models when the Crow rates are considered. The magnitudes of changes in these shares for different compensating scenarios remain within the same range in both Models with the exception of the year 1973 in which wheat prices were high. Model I generates changes between 2 to 3 percent (Table 6.36) and Model II generates changes between 2 to 4 percent (Table 6.37) in that year.

For the period of 1960-83, Model I predicts a 1 percent increase in Canada's market shares in the Netherlands due to the Crow benefit (Table 6.36) and Model II generates no losses or gains in market share (Table 6.37). Model I predicts no losses or gains in Canada's shares in Switzerland from increasing the freight rates up to 100 percent CR (Table 6.36) but Model II predicts a 2 percent decrease in those shares in that market (Table 6.37). When the other two scenarios are considered, Model I generates a 0 to 1 percent increase in Canada's share (Table 6.36) but Model II generates a 2 percent decrease and a 1 percent decrease in those shares for 65 percent CR or 50 percent CR, respectively (Table 6.37).

Table 6.36

Estimated Impacts of Transportation Costs on Canada's Market Share in the Netherlands (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.06	0	-.01	-.01	-.01
1961	-.01	0	0	0	0
1962	-.09	0	0	0	0
1963	-.06	0	-.01	-.01	-.01
1964	+.06	0	-.01	-.01	0
1965	+.08	0	+.01	+.01	0
1966	-.05	0	+.01	+.01	+.01
1967	-.04	0	0	0	0
1968	+.05	-.01	-.01	-.01	-.01
1969	+.04	-.01	0	0	0
1970	+.02	+.01	+.01	+.01	+.01
1971	+.03	0	0	0	0
1972	+.12	0	0	0	0
1973	+.01	+.01	+.03	+.02	+.02
1974	-.12	0	0	0	0
1975	+.01	0	-.01	-.01	-.01
1976	+.05	0	-.01	-.01	0
1977	+.08	0	-.01	0	0
1978	+.08	0	+.01	+.01	0
1979	+.01	+.01	+.01	+.01	+.01
1980	-.04	0	0	0	0
1981	-.13	0	-.01	-.01	0
1982	-.05	0	0	0	0
1983	-.02	0	0	0	0
Net Impact	-.03	+.01	0	0	+.01

R^2 (f.o.b.) = .35
R^2 (farmgate) = .14
R^2 (CROW) = .14
R^2 (100% CR) = .14
R^2 (65% CR) = .14
R^2 (50% CR) = .14

Table 6.37

Estimated Impacts of Transportation Costs on Canada's Market Share in the Netherlands (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.02	0	0	0	0
1961	-.04	0	-.01	-.01	0
1962	-.12	0	-.01	-.01	0
1963	-.04	0	0	0	0
1964	+.05	0	0	0	0
1965	+.11	0	+.01	+.01	+.01
1966	-.06	0	0	0	0
1967	-.03	0	0	0	0
1968	+.08	0	0	0	0
1969	+.04	0	-.01	-.01	-.01
1970	+.01	0	0	0	0
1971	+.04	0	0	0	0
1972	+.09	0	0	-.01	-.01
1973	+.01	+.01	+.04	+.03	+.02
1974	-.13	0	0	0	0
1975	+.04	0	0	0	0
1976	+.06	0	-.01	0	0
1977	+.10	0	-.01	-.01	-.01
1978	0	-.01	-.01	-.01	-.01
1979	0	0	0	0	0
1980	-.03	0	0	0	0
1981	-.21	0	0	0	0
1982	-.04	0	-.01	0	0
1983	0	0	0	0	0
Net Impact	-.09	0	-.02	-.02	-.01

R_2^2 (f.o.b.) = .36
R_2^2 (farmgate) = .14
R_2^2 (CROW) = .14
R_2^2 (100% CR) = .14
R_2^2 (65% CR) = .14
R^2 (50% CR) = .14

6.4.12 India

In 1982/83, India imported 54,000 tonnes of wheat and wheat flour from Canada and 4,288,000 tonnes from the U.S. This amounted to .25 percent of Canadian and 11 percent of the U.S. wheat exports in that year. The estimated impacts of transportation costs on Canada's market share in India, based on Models I and II, are reported in Tables 6.38 and 6.39, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 2 percent in Model I and by 0 to 1 percent in Model II. The magnitudes of changes in these shares based on Model I are larger than those based on Model II when the previous scenario or any other compensatory ones is considered. However, with the exception of the years 1972-75, when the international prices of wheat were high, these magnitudes are themselves quite small (between 0 to 4 percent).

The results in the final row of Table 6.38 indicate that over the period of 1960-83 only 1 percent of Canada's market share in India may be attributed to the Crow benefit. Model II predicts a 1 percent loss in that market resulting from the Crow (Table 6.39). If the freight rates had gone up to the full compensatory levels (100% CR), Canada would have gained no portion of the U.S. share in India based on Model I and would have lost 2 percent of its share in that market based on Model II (Tables 6.38 and 6.39). Both models predict gains or losses of varying degrees when rates go up by 65 or 50 percent of compensatory levels. According to Model I, Canada gains between 0 and 1 percent of its share in India when these two scenarios are considered (Table

6.38). The corresponding figures for Model II are losses of 2 percent and 1 percent, respectively (Table 6.39).

Table 6.38

Estimated Impacts of Transportation Costs on Canada's Market Share in India (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.03	-.01	-.02	-.02	-.01
1961	+.01	-.01	-.02	-.02	-.01
1962	-.02	-.01	-.02	-.02	-.01
1963	+.02	-.01	-.02	-.02	-.01
1964	+.07	0	-.01	-.01	-.01
1965	-.02	0	+.01	+.01	0
1966	-.10	+.01	+.01	+.01	+.01
1967	-.01	+.01	+.01	+.01	+.01
1968	+.05	+.01	+.02	+.01	+.01
1969	+.02	+.01	+.02	+.02	+.01
1970	-.02	+.01	+.03	+.02	+.01
1971	+.04	+.01	+.03	+.03	+.02
1972	0	+.01	+.03	+.02	+.01
1973	-.22	+.02	+.04	+.04	+.03
1974	-.04	-.01	-.03	-.02	-.02
1975	+.09	-.01	-.03	-.02	-.01
1976	+.12	-.01	-.02	-.02	-.02
1977	+.09	0	0	0	0
1978	-.02	0	+.01	+.01	+.01
1979	-.04	0	0	0	0
1980	-.04	0	-.01	-.01	0
1981	-.03	0	-.01	-.01	0
1982	+.02	-.01	-.02	-.01	-.01
1983	+.02	0	0	0	0
Net Impact	+.02	+.01	0	0	+.01

R_2^2 (f.o.b.) = .04
R_2^2 (farmgate) = .13
R_2^2 (CROW) = .15
R_2^2 (100% CR) = .20
R_2^2 (65% CR) = .19
R^2 (50% CR) = .17

Table 6.39

Estimated Impacts of Transportation Costs on Canada's Market Share in India (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.01	-.01	-.02	-.01	-.01
1961	0	-.01	-.01	-.01	-.01
1962	-.03	0	-.01	0	0
1963	-.01	-.01	-.02	-.01	-.01
1964	+.04	0	-.01	-.01	0
1965	-.01	+.01	+.01	+.01	+.01
1966	-.09	0	+.01	+.01	+.01
1967	-.02	0	+.01	0	+.01
1968	+.06	+.01	+.01	0	+.01
1969	+.01	0	+.02	+.01	+.01
1970	+.05	0	-.01	-.01	-.01
1971	+.03	+.01	+.02	+.01	+.01
1972	+.04	+.01	+.02	+.02	+.01
1973	-.20	+.01	+.03	+.03	+.02
1974	0	-.01	-.03	-.03	-.02
1975	+.06	-.01	-.03	-.02	-.02
1976	+.09	0	-.01	-.01	-.01
1977	+.07	0	0	0	0
1978	-.01	0	+.01	+.01	0
1979	-.04	0	+.01	+.01	+.01
1980	-.04	0	0	0	0
1981	-.05	-.01	-.01	-.01	-.01
1982	+.01	0	-.01	-.01	-.01
1983	+.01	0	0	0	0
Net Impact	-.06	-.01	-.02	-.02	-.01

R_2^2 (f.o.b.) = .13
R_2^2 (farmgate) = .19
R_2^2 (CROW) = .20
R_2^2 (100% CR) = .23
R_2^2 (65% CR) = .23
R^2 (50% CR) = .21

6.4.13 Pakistan

In 1983/83, Pakistan imported 29,000 tonnes of wheat and wheat flour from Canada and 259,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in Pakistan, based on Models I and II, are reported in Tables 6.40 and 6.41, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 1 percent in both models. The magnitudes of changes in these shares based on Model I are larger than those based on Model II when any of the three compensatory scenarios is considered.

The results in the final row of Table 6.40 suggest that over the period of 1969-83 Canada lost 1 percent of its share in India because of the Crow "benefit." Model II predicts no change in Canada's shares due to the Crow (Table 6.41). If the freight rates had gone up to the full compensatory levels (100% CR), Canada would have lost 3 percent of its share based on Model I and 1 percent based on Model II (Tables 6.40 and 6.41). For the other two scenarios Model I generates 3 percent and 1 percent loss of Canada's shares in India, respectively, and Model II predicts no gains or losses in that market in either cases (Tables 6.40 and 6.41).

Table 6.40

Estimated Impacts of Transportation Costs on Canada's Market Share in Pakistan (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.02	0	0	0	0
1961	0	0	+.01	0	0
1962	+.04	0	0	0	0
1963	+.02	0	0	0	0
1964	-.04	0	0	0	0
1965	-.03	0	0	0	0
1966	+.05	0	0	0	0
1967	+.02	-.01	-.01	-.01	-.01
1968	-.04	-.01	-.01	-.01	-.01
1969	-.02	0	-.01	-.01	0
1970	0	0	0	0	0
1971	-.02	0	-.01	-.01	0
1972	-.05	0	0	0	0
1973	+.05	-.01	-.01	-.01	-.01
1974	+.06	0	0	0	0
1975	-.03	0	0	0	0
1976	-.05	0	0	0	0
1977	-.06	0	0	0	0
1978	-.03	0	-.01	0	0
1979	0	0	0	0	0
1980	+.02	0	0	0	0
1981	+.06	+.01	+.01	+.01	+.01
1982	+.02	+.01	+.01	+.01	+.01
1983	0	0	0	0	0
Net Impact	-.01	-.01	-.03	-.03	-.01

R_2^2 (f.o.b.) = .44
R_2^2 (farmgate) = .33
R_2^2 (CROW) = .33
R_2^2 (100% CR) = .33
R_2^2 (65% CR) = .33
R_2^2 (50% CR) = .33

Table 6.41

Estimated Impacts of Transportation Costs on Canada's Market Share in Pakistan (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.01	0	0	0	0
1961	0	0	0	0	0
1962	+.05	+.01	+.01	+.01	+.01
1963	+.02	0	+.01	0	0
1964	-.05	0	0	0	0
1965	-.03	0	0	0	0
1966	+.05	0	0	0	0
1967	+.02	0	0	0	0
1968	-.03	-.01	-.01	-.01	-.01
1969	-.03	0	0	0	0
1970	0	0	0	0	0
1971	-.02	0	0	0	0
1972	-.04	0	-.01	0	0
1973	+.07	0	0	0	0
1974	+.05	0	0	0	0
1975	-.01	0	0	0	0
1976	-.06	0	0	0	0
1977	-.05	0	0	0	0
1978	-.03	0	-.01	0	0
1979	0	0	0	0	0
1980	+.01	0	0	0	0
1981	+.05	0	0	0	0
1982	+.01	0	0	0	0
1983	+.01	0	0	0	0
Net Impact	0	0	-.01	0	0

R^2 (f.o.b.) = .51
R^2 (farmgate) = .42
R^2 (CROW) = .42
R^2 (100% CR) = .43
R^2 (65% CR) = .42
R^2 (50% CR) = .42

6.4.14 Ghana

In 1982/83, Ghana did not import any wheat and wheat flour from Canada and the volume of wheat and wheat flour imported from the U.S. was only 24,000 tonnes. The estimated impacts of transportation costs on Canada's market share in Ghana, based on Models I and II, are reported in Tables 6.42 and 6.43, respectively.

Both Models predict that fluctuations in Canada's share in Ghana due to Crow rates are in the range of 0 to 1 percent. However, when the compensatory rates are considered these shares fluctuate more widely in Model I than in Model II (Tables 6.42 and 6.43), with the exceptions of the year 1973 in which international wheat prices were high and the first two scenarios generate a 2 percent increase in Canada's share in that market due to 100 percent CR or 65 percent CR (Model II).

The results in the final row of Table 6.42 indicate that no portion of Canada's market shares in Ghana over the period 1960-83 may be attributed to the Crow benefit. The corresponding figure in Table 6.43 is an erosion of Canada's shares in that market by as much as 1 percent over the same period. When the different compensatory rates are considered, Canada's shares erode by 3 percent for 100 percent CR and by 1 percent for 65 percent CR but do not change for 50 percent CR (Table 6.42). The corresponding figures based on Model II are a loss of 2 percent of Canada's shares in Ghana for the first two scenarios and of 1 percent for the last one (Table 6.43).

Table 6.42

Estimated Impacts of Transportation Costs on Canada's Market Share in Ghana (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.04	-.01	-.01	-.01	-.01
1961	0	-.01	-.01	-.01	-.01
1962	-.09	0	-.01	-.01	0
1963	-.03	0	-.01	-.01	0
1964	+.08	0	-.01	-.01	-.01
1965	+.06	0	0	0	0
1966	-.09	+.01	+.01	+.01	+.01
1967	-.04	0	0	0	0
1968	+.07	+.01	+.01	+.01	+.01
1969	+.04	0	+.01	+.01	0
1970	+.01	-.01	+.01	+.01	+.01
1971	+.04	+.01	+.01	+.01	+.01
1972	+.10	0	+.01	+.01	0
1973	-.10	0	+.01	+.01	0
1974	-.12	0	-.01	0	0
1975	+.05	0	-.01	-.01	-.01
1976	+.10	0	-.01	-.01	0
1977	+.11	0	0	0	0
1978	+.06	0	0	0	0
1979	-.01	0	0	0	0
1980	-.05	0	-.01	0	0
1981	-.12	0	-.01	-.01	0
1982	-.03	0	0	0	0
1983	0	0	0	0	0
Net Impact	0	0	-.03	-.01	0

R_2^2 (f.o.b.) = .31
R_2^2 (farmgate) = .21
R_2^2 (CROW) = .21
R_2^2 (100% CR) = .22
R_2^2 (65% CR) = .22
R^2 (50% CR) = .21

Table 6.43

Estimated Impacts of Transportation Costs on Canada's Market Share in Ghana (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.03	0	0	0	0
1961	0	0	-.01	-.01	0
1962	-.10	-.01	-.01	-.01	-.01
1963	-.04	0	0	0	0
1964	+.07	0	0	0	0
1965	+.06	0	0	0	0
1966	-.08	0	0	0	0
1967	-.04	0	0	0	0
1968	+.07	0	0	0	0
1969	+.04	0	0	0	0
1970	0	0	0	0	0
1971	+.03	0	0	0	0
1972	+.11	0	0	0	0
1973	-.07	+.01	+.02	+.02	+.01
1974	-.12	0	0	0	0
1975	+.04	0	0	0	0
1976	+.08	-.01	-.01	-.01	-.01
1977	+.10	0	0	0	0
1978	+.08	+.01	+.01	+.01	+.01
1979	-.01	0	0	0	0
1980	-.05	0	-.01	-.01	0
1981	-.13	-.01	-.01	-.01	-.01
1982	-.03	0	0	0	0
1983	-.01	0	0	0	0
Net Impact	-.03	-.01	-.02	-.02	-.01

R^2 (f.o.b.) = .31
R^2 (farmgate) = .20
R^2 (CROW) = .21
R^2 (100% CR) = .21
R^2 (65% CR) = .21
R^2 (50% CR) = .21

6.4.15 Algeria

In 1982/83, Algeria imported 483,000 tonnes of wheat and wheat flour from Canada and 610,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in Algeria, based on Models I and II, are reported in Tables 6.44 and 6.45, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 1 percent in both Models. The same will apply when the compensatory rates are considered with the exception of the years 1970, 1972 and 1973 in which the shares change by 2 percent when the 100 percent CR scenario is considered (Tables 6.44 and 6.45).

The results in the final row of Table 6.44 suggests that no portion of Canada's market shares in Algeria over the period of 1960-83 may be attributed to the Crow rates. Model II, as well, predicts no change in those shares due to the Crow benefit over the same period (Table 6.45). When the 100 percent CR is considered, Model I generates a 2 percent decrease in shares but Model II predicts a 1 percent decrease in Canada's market shares in Algeria. Neither models predicts any changes in those shares when the 65 percent CR or 50 percent CR are considered (Tables 6.44 and 6.45).

Table 6.44

Estimated Impacts of Transportation Costs on Canada's Market Share in Algeria (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	0	0	+.01	+.01	+.01
1961	0	+.01	+.01	+.01	+.01
1962	+.04	0	+.01	+.01	0
1963	+.01	+.01	+.01	+.01	+.01
1964	-.05	0	+.01	0	0
1965	-.01	0	0	0	0
1966	+.07	0	0	0	0
1967	+.02	0	0	0	0
1968	-.04	0	-.01	0	0
1969	-.02	0	-.01	-.01	0
1970	0	-.01	-.02	-.01	-.01
1971	-.03	0	-.01	-.01	-.01
1972	-.04	-.01	-.02	-.01	-.01
1973	+.11	-.01	-.01	-.01	-.01
1974	+.05	0	+.01	0	0
1975	-.05	0	0	0	0
1976	-.08	0	0	0	0
1977	-.07	0	-.01	-.01	0
1978	-.01	0	-.01	0	0
1979	+.01	0	0	0	0
1980	+.03	0	+.01	+.01	0
1981	+.04	0	0	0	0
1982	+.01	+.01	+.01	+.01	+.01
1983	-.01	0	0	0	0
Net Impact	-.02	0	-.02	0	0

R^2 (f.o.b.) = .14
R^2 (farmgate) = .13
R^2 (CROW) = .14
R^2 (100% CR) = .14
R^2 (65% CR) = .14
R^2 (50) CR) = .14

Table 6.45

Estimated Impacts of Transportation Costs on Canada's Market Share in Algeria (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.02	0	+.01	0	0
1961	0	0	0	0	0
1962	+.04	+.01	+.01	+.01	+.01
1963	+.01	0	0	0	0
1964	-.04	+.01	+.01	+.01	+.01
1965	-.03	0	0	0	0
1966	+.04	-.01	-.01	0	0
1967	+.02	0	0	0	0
1968	-.03	0	0	0	0
1969	-.03	-.01	-.01	-.01	-.01
1970	-.01	-.01	-.01	-.01	-.01
1971	-.02	0	-.01	0	0
1972	-.05	0	-.01	-.01	-.01
1973	+.07	-.01	-.02	-.01	-.01
1974	+.05	0	0	0	0
1975	-.03	0	+.01	0	0
1976	-.05	+.01	+.01	+.01	+.01
1977	-.06	0	0	0	0
1978	-.03	0	-.01	0	0
1979	+.01	0	0	0	0
1980	-.07	0	0	0	0
1981	+.05	0	+.01	0	0
1982	+.01	0	0	0	0
1983	0	+.01	+.01	+.01	+.01
Net Impact	-.13	0	-.01	0	0

R_2^2 (f.o.b.) = .15
R_2^2 (farmgate) = .14
R_2^2 (CROW) = .14
R_2^2 (100% CR) = .14
R_2^2 (65% CR) = .14
R^2 (50% CR) = .14

6.4.16 Egypt

In 1982/83, Egypt imported 22,000 tonnes of wheat and wheat flour from Canada and 3,120,000 tonnes from the U.S. This amounted to .1 percent of Canadian and 8 percent of the U.S. wheat exports in that year. The estimated impacts of transportation costs on Canada's market share in Egypt, based on Models I and II, are reported in Tables 6.46 and 6.47, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 4 percent in Model I and by 0 to 3 percent in Model II. The magnitudes of changes in these shares based on Model I are higher than those based on Model II when the previous scenario or any other compensatory scenarios is considered. The changes in Canada's shares are the highest in the year 1973 in which international wheat prices were high (Tables 6.46 and 6.47).

Model I generates increases of the magnitude of 2 percent in Canada's shares over the period of 1960-83 when the Crow is considered. A 2 or 1 percent decrease in these shares is predicted when the 100 percent CR, 65 percent CR or 50 percent CR are applied (Table 6.46). Model II, however, predicts increases in Canada's shares in Egypt over the same period when the Crow, 100 percent CR and 65 percent CR or 50 percent CR are considered (Table 6.47).

Table 6.46

Estimated Impacts of Transportation Costs on Canada's Market Share in Egypt (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.07	-.01	-.03	-.03	-.02
1961	0	0	-.01	0	0
1962	-.08	0	-.01	-.01	0
1963	-.06	-.01	-.03	-.02	-.02
1964	+.03	-.01	-.02	-.02	-.01
1965	+.09	+.01	+.03	+.03	+.02
1966	-.02	+.01	+.04	+.04	+.02
1967	-.03	0	0	0	0
1968	+.04	0	-.01	-.01	-.01
1969	+.03	0	0	0	0
1970	+.02	+.01	+.02	+.01	+.01
1971	+.01	-.01	-.01	-.01	-.01
1972	+.12	+.01	+.03	+.03	+.02
1973	+.09	+.04	+.12	+.10	+.07
1974	-.10	0	-.01	-.01	0
1975	-.01	-.01	-.04	-.04	-.02
1976	0	-.02	-.06	-.05	-.04
1977	+.05	-.01	-.03	-.02	-.02
1978	+.08	+.01	+.03	+.02	+.02
1979	+.02	+.01	+.02	+.02	+.01
1980	-.03	0	0	0	0
1981	-.11	0	-.02	-.01	-.01
1982	-.05	0	-.02	-.02	-.01
1983	-.02	0	-.01	-.01	-.01
Net Impact	0	+.02	-.02	-.01	-.01

R^2 (f.o.b.) = .05
R^2 (farmgate) = .03
R^2 (CROW) = .02
R^2 (100% CR) = .02
R^2 (65% CR) = .02
R^2 (50% CR) = .02

Table 6.47

Estimated Impacts of Transportation Costs on Canada's Market Share in Egypt (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.03	0	0	0	0
1961	-.02	+.01	+.01	+.01	+.01
1962	-.02	0	0	0	0
1963	-.02	0	0	0	0
1964	-.01	0	0	0	0
1965	+.05	0	+.01	+.01	+.01
1966	+.04	0	+.01	+.01	+.01
1967	0	0	0	0	0
1968	-.01	-.01	-.01	-.01	-.01
1969	0	-.01	-.02	-.01	-.01
1970	-.01	0	-.01	-.01	0
1971	-.03	0	-.01	-.01	0
1972	+.01	0	0	0	0
1973	+.20	+.03	+.07	+.06	+.04
1974	-.03	0	0	-.01	0
1975	-.04	0	-.01	-.01	-.01
1976	-.04	0	-.02	-.01	-.01
1977	-.02	0	-.01	-.01	-.01
1978	+.04	+.01	+.01	+.01	0
1979	+.02	0	+.01	+.01	+.01
1980	0	0	0	0	0
1981	-.03	0	0	0	0
1982	-.03	0	-.01	-.01	-.01
1983	-.02	0	-.01	0	0
Net Impact	0	+.03	+.01	+.02	+.02

R_2^2 (f.o.b.) = .21
R_2^2 (farmgate) = .24
R_2^2 (CROW) = .24
R_2^2 (100% CR) = .22
R_2^2 (65% CR) = .23
R^2 (50% CR) = .23

6.4.17 Brazil

In 1982/83, Brazil imported 1,494,000 tonnes of wheat and wheat flour from Canada and 2,0663,000 tonnes from the U.S. This amounted to 7 percent of Canadian and 5.25 percent of the U.S. wheat exports in that year. The estimated impacts of transportation costs on Canada's market share in India, based on Models I and II, are reported in Tables 6.48 and 6.49, respectively.

When the Crow rates are considered, Canada's market shares generally change by 0 to 1 percent in both models, with the exception of the year 1962 in which these shares increase by 4 percent in Model I (Table 6.48) and by 3 percent in Model II (Table 6.49). When the compensatory rates at different levels are considered, Canada's shares fluctuate almost exactly in the same range (Tables 6.48 and 6.49).

The results in the final rows of the two tables indicate that over the period of 1960-83, 7 percent (Model I) and 2 percent (Model II) of Canada's shares in Brazil may be attributed to the Crow benefit. Canada's market share gains due to the different compensatory rate are generally high (between 2 to 7 percent) based on the alternative model specifications (Model I and II in Tables 6.48 and 6.49).

Table 6.48

Estimated Impacts of Transportation Costs on Canada's Market Share in Brazil (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.03	+.01	+.01	+.01	+.01
1961	-.01	0	+.01	+.01	0
1962	0	+.04	+.04	+.04	+.04
1963	-.09	+.01	+.01	+.01	+.01
1964	+.01	+.01	+.01	+.01	0
1965	+.04	-.01	-.01	-.01	-.01
1966	+.01	0	0	0	0
1967	-.01	0	0	0	0
1968	+.01	0	-.01	-.01	0
1969	+.02	0	-.01	-.01	0
1970	+.01	-.01	-.01	-.01	-.01
1971	0	-.01	-.02	-.01	-.01
1972	+.06	-.01	-.01	-.01	-.01
1973	+.09	-.01	0	0	0
1974	-.05	+.01	+.01	+.01	+.01
1975	-.02	+.01	+.01	+.01	+.01
1976	-.02	+.01	0	0	0
1977	0	0	-.01	-.01	0
1978	+.05	0	0	0	0
1979	+.02	0	0	0	0
1980	0	0	+.01	+.01	+.01
1981	-.05	+.01	+.01	+.01	+.01
1982	-.03	0	0	0	0
1983	-.01	+.01	+.01	+.01	+.01
Net Impact	0	+.07	+.05	+.06	+.07

R^2 (f.o.b.) = .56
R^2 (farmgate) = .57
R^2 (CROW) = .57
R^2 (100% CR) = .57
R^2 (65% CR) = .57
R^2 (50% CR) = .57

Table 6.49

Estimated Impacts of Transportation Costs on Canada's Market Share in Brazil (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.04	0	0	0	0
1961	-.01	0	0	0	0
1962	-.01	+.03	+.03	+.03	+.03
1963	-.02	0	0	0	0
1964	0	0	0	0	0
1965	+.04	0	0	0	0
1966	+.01	0	0	0	0
1967	-.01	-.01	-.01	-.01	-.01
1968	+.01	0	-.01	-.01	-.01
1969	+.02	0	-.01	0	0
1970	+.02	0	0	0	0
1971	+.02	0	0	0	0
1972	+.04	0	-.01	0	0
1973	+.08	0	0	+.01	0
1974	-.04	0	0	0	0
1975	-.02	0	0	0	0
1976	-.03	+.01	0	0	0
1977	+.01	0	0	-.01	0
1978	+.02	0	0	0	0
1979	+.02	0	0	0	0
1980	0	0	0	0	0
1981	-.05	0	0	0	0
1982	-.02	-.01	+.01	+.01	+.01
1983	-.01	0	0	0	0
Net Impact	+.03	+.02	0	+.02	+.02

R^2 (f.o.b.) = .56
R^2 (farmgate) = .57
R^2 (CROW) = .57
R^2 (100% CR) = .57
R^2 (65% CR) = .57
R^2 (50% CR) = .57

6.4.18 Peru

In 1982/83, Peru imported 330,000 tonnes of wheat and wheat flour from Canada and 578,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in Peru, based on Models I and II, are reported in Tables 6.50 and 6.51, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 1 percent in both models. With the exception of the year 1973, the magnitudes of changes in these shares remain in the same range even when the three different compensatory levels are considered (Tables 6.50 and 6.51).

Neither models predicts changes in Canada's share in Peru over the period of 1960-83 caused by the statutory freight rates. However, when the compensatory rates are considered, Model I generates decreases in Canada's market shares by 2 percent and 1 percent in the first two scenarios and no changes in those shares via 50 percent CR levels (Table 6.50). Model II, as well, predicts a 1 percent decrease in Canada's shares in Peru when the 100 percent CR is in effect. The last two scenarios predict no changes in those shares at all (Table 6.51).

Table 6.50

Estimated Impacts of Transportation Costs on Canada's Market Share in Peru (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	0	0	-.01	-.01	0
1961	+.01	0	0	0	0
1962	-.04	-.01	-.01	-.01	-.01
1963	0	0	-.01	0	0
1964	+.05	0	-.01	-.01	0
1965	+.01	0	0	0	0
1966	-.06	0	0	0	0
1967	-.02	0	0	0	0
1968	+.04	+.01	+.01	+.01	+.01
1969	+.02	0	+.01	+.01	0
1970	0	+.01	+.01	+.01	+.01
1971	+.02	0	+.01	+.01	0
1972	+.03	0	+.01	+.01	0
1973	-.10	+.01	+.02	+.02	+.01
1974	-.05	0	+.01	0	0
1975	+.04	-.01	-.02	-.02	-.01
1976	+.07	-.01	-.01	-.01	-.01
1977	+.07	0	0	0	0
1978	+.02	0	-.01	0	0
1979	-.02	0	0	0	0
1980	-.02	0	0	0	0
1981	-.05	0	-.01	-.01	0
1982	0	0	-.01	-.01	0
1983	+.01	0	0	0	0
Net Impact	+.03	0	-.02	-.01	0

R^2 (f.o.b.) = .09
R^2 (farmgate) = .07
R^2 (CROW) = .07
R^2 (100% CR) = .08
R^2 (65% CR) = .08
R^2 (50% CR) = .08

Table 6.51

Estimated Impacts of Transportation Costs on Canada's Market Share in Peru (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.01	0	-.01	0	0
1961	+.10	0	-.01	-.01	-.01
1962	-.03	0	0	0	0
1963	-.01	0	0	0	0
1964	+.03	0	-.01	-.01	0
1965	+.03	+.01	+.01	+.01	+.01
1966	-.04	0	0	0	0
1967	-.01	0	0	0	0
1968	+.03	0	0	0	0
1969	+.02	0	+.01	+.01	0
1970	0	0	+.01	+.01	0
1971	+.01	0	0	0	0
1972	+.03	0	0	0	0
1973	-.06	0	+.02	+.02	+.01
1974	-.05	-.01	-.01	-.01	-.01
1975	+.02	0	-.01	-.01	0
1976	+.04	0	-.01	-.01	0
1977	+.05	0	0	0	0
1978	+.02	0	+.01	0	0
1979	-.01	0	0	0	0
1980	-.02	0	0	0	0
1981	-.04	0	-.01	0	0
1982	-.01	0	0	0	0
1983	0	0	0	0	0
Net Impact	+.09	0	-.01	0	0

R_2^2 (f.o.b.) = .19
R_2^2 (farmgate) = .17
R_2^2 (CROW) = .17
R_2^2 (100% CR) = .17
R_2^2 (65% CR) = .17
R^2 (50% CR) = .17

6.4.19 Jamaica

In 1982/83, Jamaica imported 24,000 tonnes of wheat and wheat flour from Canada and 99,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in Jamaica based on Models I and II are reported in Table 6.52 and 6.53, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 1 percent in both models. The magnitudes of changes in these shares based on Model I are larger than those based on Model II when the previous scenario or any other compensatory scenarios is considered. However, these magnitudes are themselves within the same range of 0 to 1 percent with the exception of the year and 1973 in which international wheat prices were relatively high (Tables 6.52 and 6.53).

Both models indicate that only 2 percent of Canada's market shares in Jamaica over the period of 1960-83 may be attributed to the Crow benefit. In addition, when the compensatory rates are considered, Model I predicts a 1 percent increase in those shares for the 50 percent CR scenario and no change in them for the 100 percent CR and 65 percent CR scenarios (Table 6.52). Model II predicts increases in the range of 2 to 3 percent in Canada's market shares in Jamaica (Table 6.53).

Table 6.52

Estimated Impacts of Transportation Costs on Canada's Market Share in Jamaica (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.03	-.01	-.01	-.01	-.01
1961	+.01	0	0	0	0
1962	+.03	0	-.01	-.01	-.01
1963	+.03	0	-.01	0	0
1964	0	-.01	-.01	-.01	-.01
1965	-.04	+.01	+.01	+.01	+.01
1966	-.02	0	+.01	0	+.01
1967	+.01	0	0	0	0
1968	0	+.01	+.01	+.01	+.01
1969	-.01	+.01	+.01	+.01	+.01
1970	-.01	+.01	+.01	+.01	+.01
1971	+.01	+.01	+.01	+.01	+.01
1972	-.04	+.01	+.02	+.01	+.01
1973	-.08	+.01	+.02	+.02	+.02
1974	+.04	0	-.01	0	0
1975	+.03	0	-.01	-.01	-.01
1976	+.02	-.01	-.01	-.01	-.01
1977	0	-.01	-.01	-.01	-.01
1978	-.04	0	0	0	0
1979	-.02	0	0	0	0
1980	0	0	0	0	0
1981	+.04	0	0	0	0
1982	+.03	0	-.01	-.01	-.01
1983	+.01	-.01	-.01	-.01	-.01
Net Impact	+.03	+.02	0	0	+.01

R^2 (f.o.b) = .10
R^2 (farmgate) = .11
R^2 (Crow) = .12
R^2 (100% CR) = .12
R^2 (65% CR) = .12
R^2 (50% CR) = .12

Table 6.53

Estimated Impacts of Transportation Costs on Canada's Market Share in Jamaica (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.01	0	0	0	0
1961	0	0	0	0	0
1962	-.01	+.01	+.01	+.01	+.01
1963	-.02	0	0	0	0
1964	-.01	0	0	0	0
1965	+.02	0	0	0	0
1966	+.01	0	0	0	0
1967	-.01	0	0	0	0
1968	0	0	0	0	0
1969	0	0	0	0	0
1970	0	-.01	-.01	-.01	-.01
1971	+.09	0	-.01	-.01	0
1972	+.02	0	0	0	0
1973	+.11	+.01	+.01	+.01	+.01
1974	-.01	0	0	0	0
1975	-.02	0	0	0	0
1976	-.02	0	0	0	0
1977	0	0	0	0	0
1978	+.02	0	0	0	0
1979	+.02	0	0	0	0
1980	0	0	+.01	+.01	+.01
1981	-.02	+.01	+.01	+.01	+.01
1982	-.02	0	0	0	0
1983	-.02	0	0	0	0
Net Impact	+.12	+.02	+.02	+.02	+.03

R^2 (f.o.b.) = .57
R^2 (farmgate) = .59
R^2 (CROW) = .59
R^2 (100% CR) = .59
R^2 (65% CR) = .59
R^2 (50% CR) = .59

6.4.20 Haiti

In 1982/83, Haiti imported less than 500 tonnes of wheat and wheat flour from Canada and 100,000 tonnes from the U.S. The estimated impacts of transportation costs on Canada's market share in Haiti based on Models I and II are reported in Tables 6.54 and 6.55, respectively.

When the Crow rates are considered, Canada's market shares change by 0 to 2 percent in Model I and by 0 to 3 percent in Model II. The magnitudes of changes in these shares based on Model I are generally larger than those based on Model II when the previous scenario or any other compensatory scenarios is considered. However, with the exception of the years in which the international prices of wheat were relatively high, these magnitudes are themselves quite small (between 0 to 5 percent).

The results reported in the final row of Table 6.54 suggest that over the period of 1960-63, only 1 percent of Canada's market share in Haiti may be attributed to the Crow benefit. The corresponding figure generated by Model II is 2 percent (Table 6.58). Neither models predicts any change in Canada's market shares in Haiti over the same period when 100 percent or 65 percent CR are in effect. Both models generate a 1 percent increase in those shares when the 50 percent CR is considered (Tables 6.54-6.55).

Table 6.54

Estimated Impacts of Transportation Costs on Canada's Market Share in Haiti (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	+.03	-.02	-.05	-.05	-.03
1961	+.03	-.01	-.04	-.03	-.02
1962	-.08	-.01	-.03	-.02	-.02
1963	+.03	-.01	-.03	-.03	-.02
1964	+.18	-.01	-.03	-.03	-.02
1965	-.01	0	+.01	+.01	+.01
1966	-.27	+.01	+.03	+.02	+.02
1967	-.06	+.01	+.01	+.01	+.01
1968	+.13	+.01	+.04	+.02	+.02
1969	+.06	+.02	+.06	+.05	+.03
1970	-.03	+.02	+.07	+.06	+.04
1971	+.10	+.02	+.06	+.05	+.04
1972	+.06	+.02	+.06	+.06	+.04
1973	-.54	+.01	+.04	+.05	+.03
1974	-.14	-.02	-.05	-.04	-.03
1975	+.21	-.02	-.05	-.04	-.03
1976	+.31	-.01	-.03	-.03	-.02
1977	+.25	0	0	0	0
1978	-.01	+.01	+.02	+.02	+.01
1979	-.09	0	0	0	0
1980	-.10	0	-.02	-.01	-.01
1981	-.13	-.01	-.03	-.03	-.02
1982	+.03	0	-.02	-.02	-.01
1983	+.04	0	-.02	-.02	-.01
Net Impact	0	+.01	0	0	+.01

R^2 (f.o.b.) = .20
R^2 (farmgate) = .29
R^2 (CROW) = .31
R^2 (100% CR) = .35
R^2 (65% CR) = .35
R^2 (50% CR) = .33

Table 6.55

Estimated Impacts of Transportation Costs on Canada's Market Share in Haiti (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.04	-.01	-.03	-.02	-.02
1961	+.01	0	-.01	-.01	-.01
1962	-.09	0	-.01	-.01	0
1963	-.03	0	-.01	-.01	0
1964	+.09	0	-.01	-.01	-.01
1965	+.06	+.01	+.02	+.02	+.02
1966	-.11	+.01	+.03	+.02	+.02
1967	-.05	0	+.01	0	0
1968	+.07	+.01	+.01	+.01	+.01
1969	+.04	+.01	+.02	+.02	+.01
1970	+.01	0	+.02	+.02	+.01
1971	+.07	0	-.01	-.01	-.01
1972	+.12	+.01	+.01	+.01	+.01
1973	-.15	+.03	+.07	+.06	+.04
1974	-.11	-.02	-.05	-.04	-.03
1975	+.07	-.02	-.04	-.04	-.02
1976	+.11	-.01	-.02	-.02	-.01
1977	+.12	0	-.01	0	0
1978	+.05	0	+.02	+.02	+.01
1979	0	0	0	0	0
1980	-.05	0	0	0	0
1981	-.13	0	-.01	-.01	-.01
1982	-.03	0	0	0	0
1983	-.01	0	0	0	0
Net Impact	0	+.02	0	0	+.01

R^2 (f.o.b.) = .74
R^2 (farmgate) = .71
R^2 (CROW) = .72
R^2 (100% CR) = .73
R^2 (65% CR) = .73
R^2 (50% CR) = .72

6.4.21 The World Total Trade

In 1982/83, Canada and the U.S. exported 21,120,000 and 39,315,000 tonnes of wheat and wheat flour, respectively. This amounted to 22 percent and 41 percent of the total world wheat exports in that year. The estimated impacts of transportation costs on Canada's share in the world wheat market based on Models I and II are reported in Tables 6.56 and 6.57.

The second columns (THMFOB) of both tables indicate that the magnitudes of the impact of the total transportation, handling, and marketing costs on Canada's market shares in single years are quite small--between 0 to 5 percent in Table 6.56 and between 0 to 3 percent in Table 6.57. These results, therefore, point to the fact that even the total transportation, handling and marketing costs exert only marginal pressures on market shares.

When the impact of the Crow is isolated, with the exception of the years 1961 and 1973 in Model I and the years 1960, 1964, 1973, and 1975 in Model II, neither models generates any change in Canada's market shares at all. However, the resulting market share differences in those years are such that they cancel each other and as a consequence both models predict that over the period of 1960-83, no portion of Canada's market shares worldwide may be attributed to the Crow benefit (Tables 6.56 and 6.57).

When the three different compensatory rates are considered, Model I generates still the same results as it did for the Crow (Table 6.56). Model II, however, predicts a marginal decrease in Canada's shares in the world wheat market over the same period by 2 percent when 100 percent CR or 65 percent CR is applied. The

results for the final scenario of 50 percent CR, though, are exactly the same as its corresponding Crow rate scenario, i.e., no change in Canada's market shares internationally (Table 6.57).

Table 6.56

Estimated Impacts of Transportation Costs on Canada's Market Share in the World (Model I)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	0	0	-.01	0	0
1961	0	-.01	-.01	-.01	-.01
1962	-.02	0	0	0	0
1963	0	0	0	0	0
1964	+.02	0	0	0	0
1965	0	0	0	0	0
1966	-.04	0	0	0	0
1967	-.02	0	0	0	0
1968	+.02	0	0	0	0
1969	+.01	0	+.01	0	0
1970	0	0	+.01	+.01	0
1971	+.01	0	0	0	0
1972	+.02	0	+.01	+.01	0
1973	-.05	+.01	+.01	+.01	+.01
1974	-.02	0	0	0	0
1975	+.02	0	-.01	-.01	0
1976	+.04	0	0	0	0
1977	+.03	0	0	0	0
1978	+.01	0	0	0	0
1979	-.01	0	0	0	0
1980	-.01	0	0	0	0
1981	-.03	0	-.01	-.01	0
1982	0	0	0	0	0
1983	0	0	0	0	0
Net Impact	-.02	0	0	0	0

R_2^2 (f.o.b.) = .38
R_2^2 (farmgate) = .34
R_2^2 (CROW) = .35
R_2^2 (100% CR) = .38
R_2^2 (65% CR) = .38
R^2 (50% CR) = .37

Table 6.57

Estimated Impacts of Transportation Costs on Canada's Market Share in the World (Model II)

1960-83

Year	THMFOB	CROW	100% CR	65% CR	50% CR
1960	-.01	+.01	+.01	+.01	+.01
1961	0	0	-.01	0	0
1962	-.02	0	0	0	0
1963	-.01	0	-.01	-.01	0
1964	+.01	-.01	-.01	-.01	-.01
1965	+.02	0	0	0	0
1966	-.02	0	0	0	0
1967	-.01	0	0	0	0
1968	+.02	0	0	0	0
1969	+.01	0	0	0	0
1970	0	0	0	0	0
1971	+.01	0	0	0	0
1972	+.02	0	0	0	0
1973	-.03	+.01	+.02	+.01	+.01
1974	-.03	0	-.01	-.01	0
1975	+.01	-.01	-.01	-.01	-.01
1976	+.02	0	0	0	0
1977	+.03	0	0	0	0
1978	+.01	0	0	0	0
1979	-.01	0	0	0	0
1980	-.01	0	0	0	0
1981	-.03	0	0	0	0
1982	0	0	0	0	0
1983	0	0	0	0	0
Net Impact	-.02	0	-.02	-.02	0

R^2 (f.o.b.) = .39
R^2 (farmgate) = .31
R^2 (CROW) = .32
R^2 (100% CR) = .34
R^2 (65% CR) = .33
R^2 (50% CR) = .33

6.5 CONCLUSIONS

One of the important conclusions emerging from the previous analysis is that the price mechanism works effectively in the international trade of wheat. This is reflected in large negative values for the estimated elasticities of substitution and market share elasticities that are indicative of the conclusion that relative export prices are an important factor in allocating a given volume of imports among the two major competing wheat exporting countries.

As expected, the nonprice preferences turn out to be typically non-neutral, as reflected by the magnitudes of the equal price market shares between Canada and the U.S. This finding is consistent with propositions advanced before in the study, in the sense that nonprice preferences are at least an equally important factor in determining trade flows in wheat.

The single most important conclusion of this chapter, however, is that the statutory grain freight rates have had very little or no impact on Canada's share of the export wheat markets in almost all the countries surveyed. The empirical analysis indicates that removing these rates and allowing them to increase up to full compensatory levels will only have a marginal impact on Canada's wheat market shares.

Chapter VII

SUMMARY AND CONCLUSIONS

The objective of this chapter is to summarize the main conclusions that emerge from this study. A more comprehensive discussion can be found in the concluding section of each previous chapter.

The structure of this chapter is as follows. First, the central objective of each section of the study is identified. Second, the basic methodology employed in accomplishing the objectives is briefly mentioned. And, third, the conclusions and policy implication that emerge from the analysis are presented. And fourth, the former conclusions are qualified by taking into consideration the limitations underlying the methodology employed. In addition, suggestions for related research that could contribute to improve the quality and/or broaden the scope of the conclusions are proposed.

7.1 STATUTORY GRAIN FREIGHT RATES AND DIVERSIFICATION

The demand for exports of a particular commodity from a given country is determined both by market forces and by institutional factors. We have argued that it is the institutional factors which provide the framework under which the effective demand materializes. We have reviewed the literature and analyzed the Crow problem within this broad context. After introducing the

social goals of the Crow and freight rate discrimination we suggested a simple theoretical framework for the analysis of the question of diversification via freight rate policies. Three main conclusions emerge from the literature review and the analysis. First, the Crow impact on the Prairies has meant a dominance of, and dependence on, production of statutory grains for export at the expense of other crops with a concomitant loss of economic output from lower levels of grain processing and livestock production. In addition, an inadequate transportation system has led to restrictive delivery quotas, higher storage costs, and less than potential grain production, thereby reducing total income from grain as well as income from associated activities. This conclusion needs, however, to be qualified due to the fact that most of the studies reviewed earlier are based on the technology, economic condition and policy environment of the mid 1970's. All of these have changed substantially over the last decade and, as suggested by Tyrchniewicz (1984), it is essential that a signifcant portion of future research efforts be directed towards analyzing factors influencing the levels of all crop and livestock production in all regions of Canada, not just the Prairies. An understanding of agricultural supply response is central to any assessment of changes in freight rates and further research in this area would make a substantial contribution.

Second, railway pricing in western Canada has worked effectively since it has been used as a tax and a subsidy to redistribute income. More importantly, the structure that has encouraged the development of the West has also been in the long-run, prof-

it-maximizing interest of the railways. And third, although there is some causality between railway pricing and the economic development and industrial diversification of the West, it is not only the railway structure that determines the industrial structure of a region, but also the cost and market structure of the industries that determines their ability to pay for transportation and, hence, the structure of a value-of-service rate system. We have, therefore, suggested that the workings of the railway rate structure are broadly consistent with the efficient allocation of resources, including promoting efficient industrial development of the West.

The main implication of the above conclusions is that the use of freight rate policies, e.g., a one-time increase in statutory grain freight rates as a corrective policy to remove existing anomalies in crop mixes and industrial locations should be questioned. Freight rate policies for economic development goals concern the costs of interfering with an efficient pricing system. Not only are there the direct inefficiencies induced by causing freight rates to be uneconomic, there are the potentially high costs of interfering with the managerial incentives for efficiency in a value-of-service pricing system. More importantly, freight rates generally constitute only a small portion of the total delivered costs of high-valued processed or manufactured goods. The efficacy of freight rates in promoting their development is, therefore, questionable. Even a high degree of interference with freight rates could be inefficient to achieve the desired developmental effects. To sum up, the pursuit of noneco-

nomic industrial developments is more effectively achieved by direct government assistance rather than via indirect and uncertain measures such as freight rate policy.

7.2 STATUTORY GRAIN FREIGHT RATES AND CANADAS SHARE OF THE EXPORT WHEAT MARKET

We have analyzed the impact of changes in statutory grain freight rates on Canada's share of the export wheat market with particular reference to the case of Canadian and U.S. wheat exports to selected markets. In order to accomplish the above objective, both static and dynamic models have been used. The static analysis was performed via an elasticity of substitution model. Subsequently, the time dimension was added by formulating a partial adjustment market share model which assumes that the response of imports to change in prices is gradual rather than instantaneous. From the two models the elasticities of substitution and the market share elasticities were directly obtained. To isolate the impact of statutory or different compensatory grain freight rates on wheat market shares we compared the shares obtained from relative farmgate prices with shares obtained from these prices plus fixed or different compensatory rates. We also determined the magnitudes of nonprice preferences for Canadian wheat in selected import markets. The following main propositions emerge from the analysis. First, the price mechanism works effectively in the international trade of wheat. This is reflected in large negative values for the elasticity of substitution and market share elasticity which indicate that relative ex-

port prices are an important factor in allocating a given value of imports among competing exporting countries, i.e., Canada and the U.S. It is also true that prices alone are unable to explain much more than a half of the variations in Canada's shares in wheat markets. This finding is consistent with the proposition advanced in the study, in the sense that "nonprice" preferences are also of considerable importance in determining trade flows in wheat. Less negative and large positive elasticities of substitution and market share elasticities were observed for several countries, e.g., Japan, which suggest that wheat freight rate increases may, at least partially, be passed forward. Elasticities considerably more negative were observed for the majority of the countries analyzed in the study, e.g., China, which imply that Canada may potentially gain in revenue by limiting wheat exports. However, the gain is likely to be, at least partially, offset by associated losses in other markets, given the uniform asking prices of the Canadian Wheat Board to all buyers which were assumed to be the case in this study. As suggested by Capel and Rigaux (1974), this raises the interesting theoretical and practical question of multiple pricing, the possibilities of which should be explored. Nevertheless, the finding of either small or weak responses on the part of several major importing countries analyzed suggests a potential for nonprice competition.

The single most important qualification of the above conclusions is the problem of retaliation. Retaliatory price policies by Canadian wheat competitors could substantially affect the magnitude of the price responsiveness of importers. Predicting the

extent of retaliation, however, is complex and a good understanding of the retaliatory practices among the major wheat exporters would clearly improve the possibility of making more analytical policy decisions related to the effectiveness of the price mechanism in allocating trade flows. It is in this area where further research is needed to broaden the scope of the conclusions. In addition, it is necessary to recognize the differences in wheat quality of the competitors involved. It was assumed that there are no inter-year changes in quality relationship between Canadian and U.S. wheats. If, however, this assumption is not valid and there is also a correlation between relative price and relative quality, the estimates of elasticity of substitution and market share elasticities will be biased. To improve the quality of the conclusions, therefore, future research should perform the analysis of price responsiveness in international trade of wheat in a three-dimensional framework, price, quantity and quality.

Second, the influence on market shares of factors other than relative prices was measured by means of the estimated intercept term at equal Canadian-U.S. prices. Nonprice preferences for Canadian wheat were high in all of the selected centrally-planned countries. They, therefore, suggest that there exists some importer loyalty to Canadian wheat. One explanation of this result might be that these importers favored Canada at equal prices because the quality of Canadian wheat was on the average superior to that from the U.S. Since it was not feasible to adjust wheat prices for variations in their quality compositions, we cannot determine the importance of this factor. Our results, generally,

indicate a considerable preference on the part of importing countries for U.S. wheat. A possible explanation is that U.S. commercial ties with wheat importing countries were stronger than those developed by Canada. Many of these countries were probably more familiar with U.S. products and markets, and many of their industries were significantly controlled by U.S. interests. This explanation is borne out to some extent in the results which indicate that the large Canadian disadvantage among less-developed countries was the primary cause of Canadian disadvantage in world wheat markets (see Table 6.5). A second possibility is that many of these countries are more strongly associated politically with the U.S. than Canada. The main implication of these results is that the Canadian Wheat Board needs to focus more attention on expanding markets in developing countries. As suggested by Tyrchniewicz (1984), the potential for barter trade and the trade-aid linkage may be prolific in this regard.

The above conclusions should be carefully qualified in the sense that the average Canadian import share at equal prices, although an important summary measure of import demand, does not by itself explain the determinants of nonprice preferences. Expected equal price shares varied widely from observation to observation, these variations depending upon the characteristics specific to a particular import market. Examining the causes of these variations will further illuminate the determinants of preferences for Canadian or U.S. wheats.

Third, the statutory grain freight rates have had very little or no impact on Canada's wheat market shares in almost all of the

countries analyzed. In addition, substitution of the different compensatory grain freight rates for the statutory ones will only have a marginal impact on Canada's wheat market shares. This, however, does not mean that the rates should be increased. To make a final judgment on this question, the following has to be taken into consideration:

1. Costs of other inputs such as capital, fertilizer, pesticides and crop expenses, and
2. Annual variations in the price of wheat which are mainly due to changes in trade flows and weather patterns.

Both models performed reasonably well in generating these results. However, it should be recognized at this point that the international wheat market structure may have changed over the period studied and the statistics on which the models were based may not have reflected this market fairly. Since both models are based on single equations, it is easy to determine the conditions that must hold for the parameters of the models to be stable (Pindyck and Rubinfeld, 1976). There exists a set of statistical tests (R^2, t-tests, etc.) that can be used to judge the significance of the models and their individual estimated equations. The regression equations can easily be evaluated based on their statistical fits, and directly used to produce forecasts.

Another limitation of this study is the underlying assumption of perfectly elastic supply of wheat to price changes. We made this assumption in order to estimate the price sensitivity of the export demand for Canadian wheat within the framework of the

elasticity of substitution model. The focus of the thesis was, therefore, on the demand side and the impact of changes in grain freight rates on the supply side was ignored. A more comprehensive examination of the problem should relax this assumption and include the analysis of all factors affecting supply and demand in Canada, its competitors and its customers. Developments in EEC farm policies, U.S. export policies, Japanese trade policies, USSR meat production targets, and world economic conditions will have a significant impact on Canada's exports, grain prices and the demand for transport services (Tyrchniewicz, 1984). Any future projections of Canada's share of international wheat markets should include these factors. More specifically, the following may be suggested for further research:

1. In the present study, export market shares were computed for just two countries, Canada and the U.S. This can be easily generalized to three or more wheat exporting countries. In general, if there are n countries, then the number of distinct two country demand equation which must be calculated is $n(n-1)/2$. These equations can, then, be combined in order to determine estimates of each exporting country's share in the exports of all n countries (Ginsburg, 1969).
2. A covariance model, i.e., pooling time series and cross-section data, can be developed to include all agricultural commodities, in all importing countries, over time. An equation may be formulated to express Canada's share of

combined Canada and U.S. in a specific year, of a specific commodity, to a specific country, as a regression on the relative price of the commodity in that year and country. Both the intercept and the slope of this regression equation vary among commodities, years and regions. Since the slope determines the elasticity of market shares due to the factors just mentioned, this formulation permits detailed analysis of the determinants of elasticities. The intercept measures the influence of nonprice preferences on Canada's market shares. In addition, a further price coefficient could be included in the formulation which measures the nonlinearities in the relation between market shares and relative prices. Separate elasticities can thus be calculated for particular price intervals (Leamer and Stern, 1970). This is a far more effective approach than the alternative method in this study. The interval variables permit the slope to vary according to relative prices, thus eliminating the need to assume a constant slope and elasticity, as required by the present study. Introducing regional variables both provides important information on regional market share influences and increases the number of observations and the degrees of freedom, causing a substantial reduction in standard errors. Covariance techniques permit us simultaneously to take into account the effects of year, commodity, and region on the intercept and slope of the market share relation. By simultaneously taking all factors into account, the error

variance is reduced and possible biases caused by neglect of possible interrelations among the sets of annual, commodity, and regional variables are eliminated. On the other hand, the gains from using regional data might be at least partially offset by the increased tendency for greater errors in measuring regional prices and market shares.

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