Economic Impacts of Privatizing the Marketing of Canadian Oats

By

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A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfilment of the Requirements
for the Degree of

MASTER OF SCIENCE

Department of Agricultural Economics and Farm Management

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PRIVATIZATION OF WESTERN CANADIAN OATS

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ECONOMIC IMPACTS OF PRIVATIZING THE MARKETING

OF CANADIAN OATS

BY

ROBERT W.R. MORRISSEY

A Thesis/Practicum submitted to the Faculty of Graduate Studies of the University of Manitoba in partial
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Robert W.R. Morrissey   © 1996

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Abstracts

In January of 1989, the Federal Government gave individuals and private companies full responsibility for the marketing of oats in the export and domestic market. This study attempts to provide insights regarding the Canadian grain marketing system and the impacts of centralized marketing for other cereal grains.

There has been a significant structural change in the Western Canadian oat industry. The intent of this study is to identify and measure some of the impacts and provide an assessment on how market performance has been affected. The underlying purpose is to assess the market performance of the Western Canadian oat industry following the change in market structure from central desk selling to open market trading.

Guided by a framework of analysis for market performance evaluations, specific economic criteria relevant to the Western Canadian oat industry that evaluate market performance in the context of market structure change are identified and examined. The report concludes that the main factors contributing to increased market efficiency was the removal of oats from under the CWB in 1989. The market restructuring has provided producers with greater market access. Furthermore, the change in the marketing structure of the Western Canadian oat industry from single desk selling to the open market, resulted in an adjustment to comparative advantage and to specialization signals

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Acknowledgements

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Finally, I would like to especially thank my wife Cecilia for understanding the time and financial constraints involved in Graduate school. It was more than often the case that she would care for our two sons, Jesse and Tyson, while I either studied or continued work on my thesis. Her encouragement and support will always be remembered.

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CHAPTER ONE
BACKGROUND AND RESEARCH
OBJECTIVES

Introduction

The Canadian Wheat Board (CWB) controls the sales of Western Canadian producers' wheat and barley for export and for human consumption. Until recently, the CWB had similar control over the sale of oats. In January of 1989, the Federal Government gave individuals and private companies full responsibility for the marketing of oats in the export and domestic markets. This was a controversial decision. Strong opinions were voiced for and against the continuing role of the CWB in the oats market. The policy change is now fully institutionalized, but the wisdom of the decision is still subject to debate. The nature of this debate however, often has more to do with the philosophical leanings of the participants regarding centralized selling versus open market competition, than the merits of the case. Oats have been traded openly now for five years, and therefore sufficient data should be available to undertake a market performance analysis. This analysis could provide valuable insights regarding the Canadian grain marketing system and the impacts of centralized marketing for other cereal grains.

History of CWB in the Western Canadian Oat Industry

The Board of Grain Supervisors (1917) and the first Canadian Wheat Board (1919) were established to market Canadian wheat under war-time economic conditions. The Board of Grain Supervisors, was created by the Canadian Government in 1917 to market all

wheat grown during the 1917 and 1918 crop years. The Board was assigned complete control over the purchase and subsequent sale of wheat for export. Following the 1918 crop year, the Board of Grain Supervisors was discontinued.

The first Canadian Wheat Board was designed as a temporary agency to market the 1919 prairie wheat crop. The 1919 CWB was directed to act as the Canadian farmer's representative in grain markets around the world. Its function was to sell wheat for export at prevailing world market prices during the immediate post-war period.

A prepayment scheme was devised because the 1919 CWB could not ascertain the realized price or value of the marketed wheat until its final sales. An initial payment was paid to producers upon delivery to primary elevators. Once all sales of the 1919 wheat crop had been realized, a final payment was distributed. Responsibility for any deficit resulting from this arrangement was to be absorbed by the federal government.

In 1920, the federal government disassembled the first endeavour of the Canadian Wheat Board, but not before the concept had won approval from producers and farming organizations. As a result, there was continued pressure on the federal government to re-establish the central marketing agency. After the federal government declined to do so, producers initiated their own central marketing organizations, taking the form of Wheat Pools.

Canadian Wheat Board Act 1935

The wheat pools encountered severe financial difficulties with the onset of the economic depression in 1929-1930 and the subsequent collapse of international wheat prices. Final realized prices for the marketed wheat were well below the initial payment made to producers. The federal government was compelled to intervene and guarantee the wheat pools financial credibility. The economic circumstances of the time lead to a re-enactment of the Canadian Wheat Board as a voluntary marketing agency for wheat. On July 5, 1935, the Canadian Wheat Board Act was passed stating that "any losses sustained by the new Wheat Board would be protected by the federal government and any additional profits would be returned to producers in the form of a final payment."

During the Second World War, the CWB marketing responsibilities were extended to market all Canadian grains, including oilseeds and Ontario corn. However, immediately following the war, the CWB returned to its sole marketing responsibility for Western Canadian wheat.

The Canadian Oat Industry (1935-1989)

In 1935, the CWB was established as a voluntary marketing board for export wheat. Producers had the option of delivering wheat to the CWB, or selling it privately on the open market. The government cancelled this option of selling wheat on the open market in 1943. It was at this time that the CWB took over sole marketing responsibility for wheat. In 1949,

the government extended the CWB's monopoly powers to include the marketing of barley and oats.[1]

The marketing system changed in 1974 when the domestic feed market was deregulated. Subsequently, producers could choose to deliver feed wheat, oats, and barley to the CWB, or sell their grain privately within Canadian boundaries. This arrangement persisted until August 1989, when CWB responsibilities for oats were entirely removed from the central desk control. Since this cessation, the marketing of oats has been handled exclusively through the open market. Naturally, the oats producers no longer receive the guaranteed floor price that was provided by the initial payment, nor the pooling of price risk that was created through the CWB.

The Government of Canada (1935-1989) through the CWB guaranteed an initial minimum price to oat producers prior to seeding the crop. The initial payment was, a floor price; any deficit incurred in marketing the crop was absorbed by the government.[2] At the end of the crop year, the final total revenues, less the initial payments and administration expenses, were distributed to oat producers.[3]

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[1] Grains & Oilseeds, Handling, Marketing, Processing., Canadian International Grains Institute, Third Edition, 1982.

[2] See Appendix 1.

[3] Grains & Oilseeds, Handling, Marketing, Processing., Canadian International Grains Institute, Third Edition, 1982.

Amendments to the Act

The Canadian Wheat Board Act, Amended in 1949, extended Board jurisdiction over oats and barley. In 1966, this jurisdiction over oats and barley became legislation. Later, in 1974, the sale of western grain for animal feeds within Canadian boundaries was removed from the sole jurisdiction of the CWB.

Removal of Oats from the CWB

A significant change to the Act occurred on January 19, 1989, when it was announced that effective August 1, 1989, "individuals and private companies will have full responsibility for the marketing of oats for the export market, for domestic human consumption and for feed. This would mean producers and the private trade, including the Pools' marketing agencies, will have the opportunity to market oats domestically and internationally." This disclosure contended that "oats is not among the same category as wheat and barley, wheat and barley are major crops exported in large quantities, and the Board pooling system works well for this purpose. On the other hand, the market for oats is becoming more specialized, with niche markets for small quantities of high quality product. For these markets, the industry is in the best position to capitalize on opportunities."[4]

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[4] Office of the Minister of State Grains and Oilseeds

Framework Of The Study

This study examines the effects of the structural change in the oat market following 1989, utilizing an industrial organizational framework of analysis. The period of analysis covers the Canadian oat market since 1980. The discussion involves two distinctive oat marketing stratagems: open market and central desk selling. The investigation probes the following topics:

> I) Policy Change
> ii) Market Structure
> iii) Features of Market Conduct
> iv) Market Performance

> The purpose of this study is to *assess the market performance of the Western Canadian oat industry following the change in market structure from central desk selling to open market trading.*

Problem Statement

There has been a significant structural change in the western Canadian oat industry. The intent of this study is to identify and measure some of the impacts and provide an assessment on how market performance has been affected.

Objectives

1.   The basic objective of this report is to analyze the performance of the Canadian Oat Industry over the past five years, and compare it to the 1980-1989 period of Canadian Wheat Board central desk selling authority.

2.   The specific objective is to develop a model that can be used to analyze the changes resulting from the reorganization in the market structure.

3.   The third objective is to analyze the effects of the Canadian Grain Commission's response (1989) to standardizing the grading system for oats.

Hypothesis

The stated hypothesis of this study is:

I)   *The policy change that removed the marketing responsibilities for Western Canadian Oats from central desk authorities to private marketing, resulted in greater market efficiency and provided Western Canadian grain producers with an opportunity of greater economic benefits.*

CHAPTER TWO
HISTORICAL PERSPECTIVES &
MARKET STRUCTURE

Introduction

The monopoly of the CWB in the Western Canadian oat industry changed in 1974 when the domestic feed market was deregulated. Subsequently, producers could choose to deliver feed wheat, oats, and barley to the CWB, or sell their grain privately within Canadian boundaries. This arrangement persisted until August 1989, when CWB monopoly over oats exports and domestic milling was ended. Since this cessation, the marketing of oats has been handled exclusively through the open market.

Market Structure of the Western Canadian Oat Industry

This section discusses two distinct market structures of the Western Canadian oat industry. The first section examines the market structure of the Western Canadian oat industry when oat marketing was under the monopoly authority of the Canadian Wheat Board. The second section examines the post-August 1989 market structure of the Western Canadian oat industry.

I) Market Organization Under Central Desk Selling

Figure 1 illustrates the marketing structure of the Western Canadian oat industry under the CWB. This diagram depicts the trade and monetary flows of oat commodities prior to 1989

Structure of the Western Canadian Oat Market Under Central Desk Authority: Trade and Monetary Flows
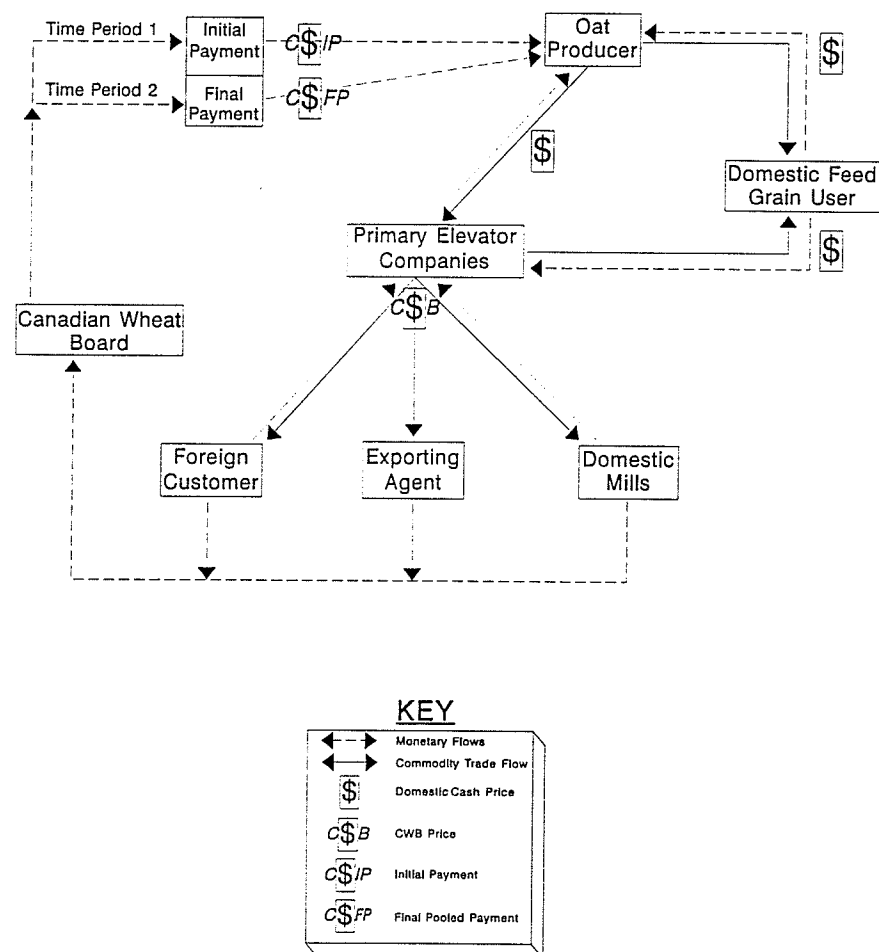
Figure 1

when the export market and domestic human consumption sales were controlled by the CWB.

The trade flow of feed oats within Canada between the producer, the primary elevator companies, and domestic feed grain users within is outlined. Ownership was transferred upon delivery, in return for monetary payment. Under these circumstances, the domestic cash price prevailed among transactions.

The remaining structural flows of Figure 1 demonstrate the control of the CWB over marketing of oats for food and export. When the CWB issued a quota, producers delivered directly to primary elevator companies in return for partial payment (time period one). According to Loyns and Kraut (1995), the CWB then took ownership of the oats and sales pooling of product returns began.

All sales other than domestic feed oats had to be approved through the CWB. For this reason, pricing forces, monetary flows, and the CWB pooled price were transmitted among primary elevator companies, domestic mills, accredited export agents, and foreign customers.

Oats destined for food or for export markets were delivered to primary elevators. This began the process of ownership transfer between the primary elevator companies, domestic food mills, and foreign customers. Accredited exporters of the CWB were often involved in

initiating foreign contracts, although price and quantity decisions were controlled by the CWB.

Monetary flows were then transmitted back to the oat producer via the CWB from exporting agents, domestic food mills, and foreign customer accounts. Local transportation, elevation, handling, and cleaning charges were then passed onto producers. Residual funds after CWB administration, marketing, storage, and lake shipping were returned to producers in the form of a final payment in time period two.

i) Marketing Stratagem of the CWB

The Canadian Wheat Board Act gives the CWB three major responsibilities. Western Canadian oats were included among these responsibilities prior to its removal from the CWB in August of 1989:[5]

> *-To market wheat, oats, and barley, grown in Western Canada, to the best advantage of grain producers.*
>
> *-To provide price stability to prairie grain producers through an annual "pooling" or price-averaging system.*
>
> *-To ensure that each producer obtains each year a fair share of the available grain market.*

In compliance with the Act, the CWB marketed oats in two distinct fashions. All sales were either made directly between the CWB and buyers, or sales were arranged between buyers

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[5] Grains & Oilseeds, Handling, Marketing, Processing. Canadian International Grains Institute. Third Edition 1982, p.94.

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and accredited agents of the CWB. However, as time progressed, the former arrangement predominated.

Sales could be made under individual contracts with customers, or under provisions of long-term agreements covering a period of several years. Long-term agreements presided over the majority of the contracts, "the Canadian Wheat Board was a forerunner in the development of long-term agreements and used them as part of its marketing program for many years. One important reason is, that as Canada's sole exporter of prairie-grown wheat, oats, and barley, the Wheat Board was in a position to provide supply assurances basic to such agreements."[6]

ii) Quota System

The CWB controlled the quantities and kinds of oats that producers delivered through a quota system.

The CWB utilized a quota system in order to secure the necessary supply of oats required for contract obligations. A delivery quota system utilized by the CWB had two objectives. The first, it ensured that all kinds and quantities of grain needed to meet sales commitments were

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[6] Grains & Oilseeds, Handling, Marketing, Processing. Canadian International Grains Institute. Third Edition 1982, p.95.

delivered when required. The second, the quotas ensured that each producer received a "fair share" of available markets.[7]

The quota system for oats attempted to achieve these objectives by controlling the quantities and kinds of grain producers delivered. The producer chose to assign any part of his quota base (the procedure of tying a producers delivery opportunities to farm acreage) to the delivery of a particular kind of grain. The number of acres assigned to each grain determined the quantity of grain that could be delivered to the primary elevator when a quota was announced.

Quotas specified the type and grade of oats that could be delivered. The quantity was stated in terms of the number of kilograms per acre.

iii) Exporting Oats

Prior to August 1989, domestic processors and domestic contracts (that required oats for human consumption) were compelled to deal exclusively with the CWB. For example, when domestic food processors required oats, they were compelled to secure the necessary supply directly from the CWB.

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[7] Grains and Oilseeds, Handling, Marketing, Processing. Canadian International Grains Institute. Third Edition, 1982, p.98

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Although export contracts were handled exclusively through the CWB, private grain companies registered as an accredited exporter with the Board were allowed to negotiate oat exporting contracts. Under these circumstances, the accredited agent was often compelled to disclose export contract details to the CWB if grain supplies were deemed limited. If approved, the CWB would finalize the sale. In many cases, the Canadian Government was required as a third party for export contracts. For example, if the importing country required financing arrangements, the Canadian Government would arrive at the appropriate terms. In any event, all sales abroad, whether initiated by accredited exporters or not, were required to proceed exclusively through the CWB for final approval. Ultimately, the export agent bought the required grain from the CWB, and then sold it abroad to its foreign client.

II) Organization Under the Open Market

Following the policy change in August of 1989, the structure of the Western Canadian oat market was drastically altered. The restructuring led to a reorganization of market functions. Figure 2 outlines the market structure of the Western Canadian oat industry under the open market regime.

Commodity Exchanges such as the Winnipeg Commodity Exchange (WCE) and the Chicago Board of Exchange (CBE) serve important roles in price discovery. Pricing forces and monetary flows are transmitted between the commodity exchanges and the various participants of the oat industry. Domestic cash prices are realized at the commodity exchanges on a daily basis. In addition, the WCE and CBE facilitate futures markets,

Current Structure of the Western Canadian Oat Market: Trade and Monetary Flows

KEY

◄ - ▶	Monetary Flows
◄—▶	Commodity Trade Flow
$	Cash Price
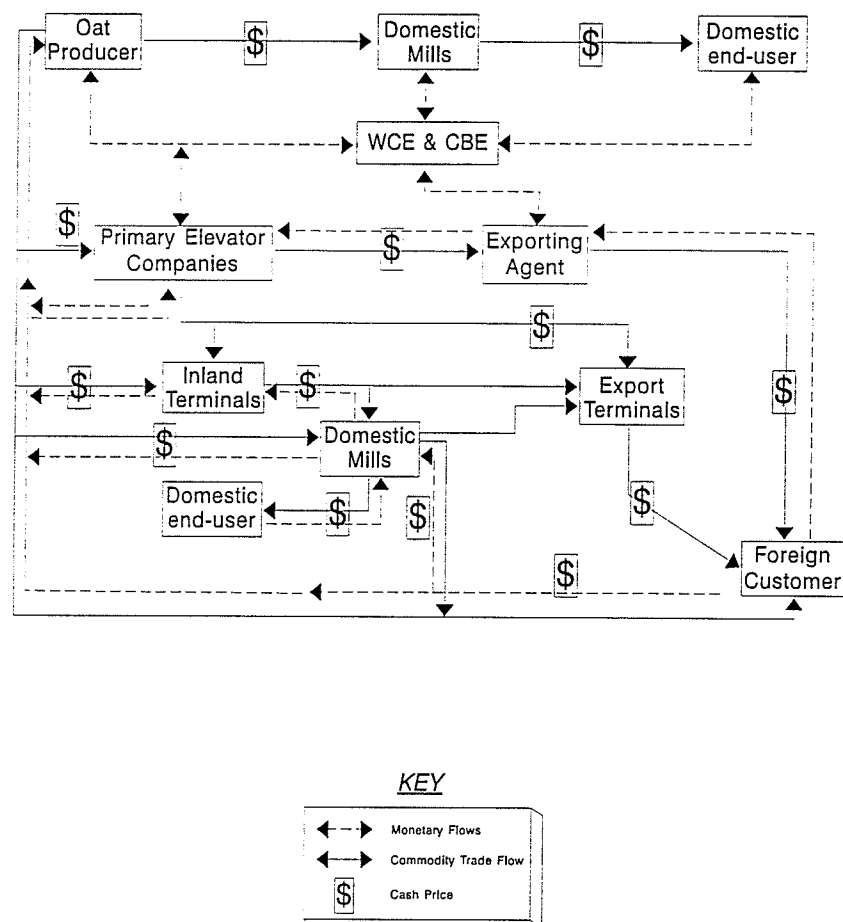
Figure 2

allowing all industry participants the opportunity to hedge against unexpected price fluctuations.

The balance of Figure 2, illustrates the trade flows, monetary flows, and cash prices between participants of the Western Canadian oat trade.

The status of the oat producer is probably the most significant contrast between the central desk selling market structure and the open market structure. In the model of the open market, the oat producer directly controls production and marketing decisions. Increased interaction between producer and market participants has been the result of the market restructuring. Oat producers can choose to sell direct to domestic mills, domestic end-users, commodity exchanges, primary elevator companies, export agents, and foreign customers.

Price formation is an important difference between Figure 1 and Figure 2 that is not illustrated, but is known to have occurred. Under the single desk market structure, price forces were generally transmitted "at, or near the CWB initial payment plus the expected final payment. This relationship between the off-board price and the expected pooled returns resulted from producer arbitrage between the CWB expected pool return and the domestic off-board price. Producers sold to whichever market was expected to yield them the highest return (CWB or off-board). As a result, the off-board price tended to follow the expected

pool return."[8]   In contrast, under the current open market structure, price forces are transmitted from the spot price, as well as from the futures market prices derived at the Winnipeg Commodity Exchange and the Chicago Board of Exchange.

Factors Motivating Oat Market Structural Reform

I) Government of Canada's Position

The decision to remove the monopoly jurisdiction of the CWB was made by the Government of Canada.[9] Government policy was based on the changing perception of oats as a product requiring the powers of the CWB.

The Government of Canada argued that oats had evolved from a mainstream commodity to become a specialty crop. Furthermore, the demand for oats had fallen very significantly since it was brought into the CWB in 1949. At one time production of oats was over 7 million tonnes, while average crops in recent years are approximately 2.5 million tonnes. The private trade is especially suited to dealing with specialty crops because they can direct small quantities effectively and contract with specific producers for particular oat varieties. "There are an awful lot of small buyers throughout the North American market who look for really special oats. The Canadian oats variety is actually quite good. It is high in protein

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[8] Canadian Wheat Board, Performance of a Single Desk Marketing Organization in the North American Barley Market, Revised December, 1992, p. 8.

[9] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture., Issue No. 8, Thursday, June 1, 1989. p. 14.

and it has a good bushel weight. There are also niche markets for specialty food products. This is something the private trade is especially suited to dealing with."[10]

It would appear that changing technology has played an important role in the fall of oats production. Specifically, the introduction of chemical herbicides for the control of wild oats (a particularly aggressive and undesirable weed) restricted the production of tame oats. "With the Trifluralins and Avidexes we need to use for weed control, you cannot grow oats after some of those chemicals are used. Oats has become very much a special crop, a special kind of crop to grow."[11] With this in mind, the new approach to the marketing of oats envisioned Canadian producers with the ability to choose to sell their grain through the CWB or directly to private domestic and export buyers.

When the volume of oats represented only one half percent of the CWB's operation (over the 1979 to 1989 period), there was concern that oats may have been squeezed between wheat and barley in terms of marketing, handling, and transportation. This would lead to improper market signals for oat market participants. The Canadian Government policy sought to

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[10] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture, Issue No. 8, Thursday, June 1, 1989. Honourable Charles Mayer p. 14.

[11] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture, Issue No. 4, Tuesday, May 9, 1989. p. 14. Honourable Charles Mayor.

change the market structure and provide more opportunities for producers to capture financial rewards in niche markets.

ii) Industry Position

Industry participants such as the Oat Producers' Association of Alberta, General Mills, Ogilvie Mills, Robin Hood Multifoods Inc., the Quaker Oats Company of Canada, the Alberta Wheat Pool, United Grain Growers, Cargill, and Feed-Rite of Winnipeg, supported the decision to remove oats from CWB jurisdiction. They felt that it was simply more efficient and cost effective to deal directly with individual producers. Security of supply was a main factor in favour of end-users decision to support the change in market structure. It was alleged that milling executives in London, Ontario "were delighted because the decision would lower the cost because the farm price of oats would be lower."[12]

Accredited exporters accounted for approximately seventy-five percent of the oats sold between 1986 to 1989. Therefore, the removal of oats from the CWB would simply streamline negotiations between producer and end-users. The argument used by these larger accredited agents of the Board such as United Grain Growers, Cargill, Parrish & Heimbecker, and the Alberta Wheat Pool was that the market was small and fragmented, and

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[12] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture, Issue No. 4, Tuesday, May 9, 1989, Mr. Althouse (Mackenzie) p. 46.

the marketing responsibilities are best served in the private trade.[13] Accredited exporters of the board felt that the decision was in line with recent patterns of trade.

iii) Position of the Producer

Although producers were not consulted formally regarding the removal of oats from the CWB, many had expressed their desire to respond to the demands of the developing niche markets in the oat industry. Obstacles such as quotas, permits, and the question regarding handling and transportation charges under the block shipping program, caused much frustration among producers because they were unable to deal directly with end-users.[14] Alberta growers were probably the most vocal proponents for the open market option. Their argument took upon a more detailed economic appraisal of the oat industry in terms of dual market pricing. Although the CWB focused mainly upon the export market, growers in Alberta felt that the board's actions impacted upon the domestic feed price of oats, which in turn influenced the input costs in other agricultural industries that use oats for feed. [15]

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[13] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture, Issue No. 17, Tuesday, June 27, 1989. Mr Hughes (Macleod) p. 17-20.

[14] Jones, Shelley, Look What We've Done With Our Oats, 1994 p. 6-8.

[15] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture, Issue No. 17, pp. 54-59.

Opposition Towards Oat Market Structural Reform

I) Canadian Wheat Board

The CWB responded negatively to the removal of oats from their marketing authority. The focus of their complaint appeared to be the manner in which this was done. "I want to say at the outset that neither the advisory committee nor the Board had any warning whatsoever. We had absolutely no indication from oat producers that they were unhappy with the manner in which their oats were being marketed. Furthermore, without discussing this issue with the advisory committee, the Board, or, more important, oat producers, a decree was issued that oats would be turned over to the private trade."[16] They were not disputing the Minister of Agriculture's authority to abolish their monopoly power, only that he did not have the "political support". In the Minister's opinion he did.

ii) Industry Position

Some opposition to the decision was expressed by proponents for small exporters. It was feared that with the removal of oats from the Board, the larger exporting companies such as Cargill, UGG, and the Pools would develop "some sort of strangle hold on supply".[17] Exactly how this would be achieved was not obvious, and was not explained.

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[16] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture, Issue No. 17. Tuesday, June 27, 1989., p. 5. Mr. Avery Sahl, Chairman, Canadian Wheat Board Advisory Committee.

[17] Oat Marketing and Processing, A Western Canada and Alberta Perspective for Alberta Agriculture., Peat Marwick Consulting Group, February, 1989. p. 46.

iii) Position of the Producer

Oats were removed from the CWB without vote or without consent. Therefore, questions concerning acceptable methods of conduct on behalf of the Government emerged. Many producers expressed fears that barley and wheat over time, would also be removed from the Board. "It was certainly a bombshell to producers. There is absolutely no doubt about that. The advisory committee took the action they did, as you know, asking for the Minister's resignation, which was not something we felt good about, but under pressure from producers and under the circumstances I think we had no alternative in fulfilling our mandate."[18]

Summary

This Chapter discusses two different market structures of the Western Canadian oat industry. The discussion is lead by a synopsis of the market organization under central desk selling. The structure of the Western Canadian oat market was drastically altered, following the policy change in August of 1989. Increased interaction between producer and market participants has been the result of the market restructuring.

The remaining portion of the Chapter discusses the factors that motivated the oat market structural reform. The decision to remove the monopoly jurisdiction of the CWB for oats was made by the Government of Canada. The policy decision affected industry participants

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[18] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture, Issue No. 17. Tuesday, June 27, 1989. Mr. Avery Sahl, Chairman, Canadian Wheat Board Advisory Committee. p. 11.

in different ways. This lead to debate over the advantages of central desk marketing and the marketing of oats through the open market.

CHAPTER THREE
LITERATURE REVIEW

Introduction

The purpose of this Chapter is to identify and to examine the literature that helps to contribute towards the economic performance analysis of the Western Canadian oat industry.

Relevance of Reviewed Literature To This Study

Imperfect competition, monopoly, and gradations of monopoly have been the focus of work in industrial organization for quite some time, and the impact on consumer welfare of policies developed in these markets has been the basis for a long history of market evaluation.[19]

The principal objective of market intervention has been to create mechanisms that help correct market deficiencies. Other types of market intervention include the substitution towards socially oriented decision making processes when private decision making is found not to be effectively monitored within the market structure.

Recent studies have attempted to evaluate the market performance of the CWB with respect to the single desk marketing of Western Canadian barley and oats. For the most part, these

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[19] See Carter (1993), Jones (1994), Strychar (1994), Scherer (1970), Schmitz (1993), Turvey (1994), Veeman (1993), Brooks (1993), CWB Performance Analysis (1992).

studies have had to hypothesize upon the economic outcome of moving from single desk selling towards an open market.

Regardless of the underlying market structure that predominates these studies, a number of hypotheses and economic performance evaluation techniques may prove to be useful for the examination of the Western Canadian oat industry.

The literature contained in this review can be separated into four areas:

I) Market Structure, Market Conduct, and Market Performance
ii) Economic Rationale for Single Desk Marketing
iii) Economic Rationale for an Open market
iv) Neutral Studies Regarding the Market Structure

I) Market Structure, Market Conduct, and Market Performance

Structural market change and the associated implications for market performance is addressed by Turvey et. al. (1993). The purpose of Turvey's study is to review the economics of structural change in agriculture. In his analysis of market structure, Turvey provides a schematic model that demonstrates the relationship between market structure, market conduct and market performance in institutional development. Figure 3 duplicates Turvey's analytical model.

Although Turvey's emphasis is focused primarily upon the forces behind structural change, he does provide an excellent analysis of industry structure and explains why the structure and conduct of the market dictate market performance. Among the factors affecting structural

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Relationship of Structure, Conduct & Performance

Structural Change Factors
- Technology Change
- Economic Growth
- Related Market Structure
- Fiscal Policy
- Political Decisions

Structure
- Market Concentration
- Entry & Exit
- Market Integration
- Government Participation
- Industry Maturity

Conduct
- Product Differentiation
- Pricing Policies
- Pricing Strategy
- Product Strategy
- Responsiveness to Change

Performance
- Efficiency
- Stability
- Equity
- Output
- Growth in Output

Figure 3
Source: Turvey et. al. 1993

change are such things as technology change, economic growth (related to events like a change in product demand), demographics, or political decisions resulting in institutional changes. In his discussion regarding structural market change, Turvey insists that the change itself must be permanent and irreversible, "In order to be structural change, the change in composition of the aggregate indicators for the organizations or institutions must be permanent and irreversible rather than a transitory or reversible change that may result from temporary scarcities or temporary exogenous shocks."[20]

Elements of market conduct such as pricing strategies, product differentiation, product strategy, and responsiveness to change, reflect the underlying market structure. Turvey explains that the market structure determines market conduct and thus directly affects market performance. "The ultimate performance of the industry depends on both the structure and conduct"[21] Elements of market structure affecting market conduct and performance include such things as the concentration of buyers and sellers, ease of market entry and exit, and market integration, "the structure of an industry in terms of concentration and integration between markets is influenced not only by the causal factors, but also by the conduct of the industry as captured by pricing policies and product differentiation. The manner in which prices are set is determined by the nature of the market so that conduct of the industry is a

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[20] Turvey, C. G., Goddard, E., Weersink, A., and Chen. K., Economic of Structural Change in Agriculture, Canadian Journal of Agricultural Economics, 41 (4) Part 1, p. 475.

[21] Ibid. p. 482.

function of its structure."[22] Government participation can also influence the underlying market structure, "There are a number of government policies aimed at the agricultural sector specifically or at the economy as a whole that can influence industry structure."[23]

Turvey et. al. argue that market performance should be evaluated in terms of the following performance attributes; allocative efficiency, price and/or revenue stability, equity, output, and growth in output. Although specific analytical tests of market performance are not provided, Turvey does develop the necessary framework that is required to conduct a market performance evaluation.

Specific analytical tests of the testable criteria outlined by Turvey can be derived from supplementary studies that evaluate the market performance of the highly debated continental barley market, and from oat market performance analyses.

The next three sections of this Chapter examine a number of studies that evaluate the economic merits and weaknesses of single desk marketing versus the open market.

ii) Economic Rationale for Single Desk Marketing

Among the various rationale offered by those who argue for single-desk selling, the most important argument is that there are price premiums to be had from exerting market power

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[22] Ibid.

[23] Ibid.

in certain markets. "Without single-desk control over exports, the structural premiums in these markets would rapidly be bid away by competition among multiple sellers."[24] Harvey Brooks of the CWB contends, "The assertion that the CWB cannot price to market is a simple error of fact and one that results in a gross underestimate of the benefits of single-desk selling in export markets. The CWB's ability to price to market is easily verifiable by asking any private trader of export barley who knows that these price differentials exist and why."[25]

The goal of Brooks' analysis is to determine the effects of changing the marketing system for barley from single desk selling to a continental barley market. In essence, Brooks argues that the Carter study commissioned by the Federal Government to examine the potential benefits of a continental barley market, is seriously deficient in its analysis and that many of Carter's assumptions are highly questionable.

Brooks raises a number of thought provoking issues in his analysis of the barley export market. Of particular interest is his analysis of the relationship between export volumes and the potential impact that these volumes could have on prices. Brooks describes the potential offshore revenue impact as a result of an increase in barley exports to the U.S. Pacific Northwest. In his analysis, Brooks comments on the importance of not only taking into

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[24] Brooks, H., First, Let's Assume We Have a Can Opener., Canadian Journal of Agricultural Economics 41 (1993) 271-281.

[25] Ibid.

consideration the overall impact on price (and the resulting revenue impact), but also the effect of the U.S. Export Enhancement Program (EEP) on barley prices. In his discussion of the EEP, Brooks concludes that the real issue at hand is the effect of the EEP on relative levels of U.S. and offshore prices, and if the net returns on sales into the U.S. are higher, then the CWB will sell barley in the U.S.

Brooks' article cautions against the use of excessive quantitative modelling techniques that are supported by questionable underlying assumptions. In addition, he points out that there are many economic intricacies that must be considered when comparing the performance of single desk selling versus the open market, and that mathematical modelling simply cannot capture many of the economic relationships that exist in a complex market structure.

A study by Schmitz, Gray, and Ulrich (1993) (hereafter called the Schmitz study) also examines the move from single desk marketing towards a continental barley market. Their focus is to determine the potential effects on the gross revenue of barley producers following a change in the market structure.

The analysis begins by providing an examination of the supply and demand forces behind the Western Canadian feed and malting barley markets. Building from the supply and demand framework, the authors begin to make price and premium comparisons based on the theoretical concept that a monopolist has the potential to extract higher than normal returns from the marketplace. Two types of price comparisons are made, the first examines final

realized CWB pool returns against average annual Minneapolis cash prices, while the second utilizes a weighted average price for malting and feed barley received by U.S. farmers. Volumes sold for contracted barley and barley sold in the cash market are then weighted in order to be more compatible with CWB data. Based on these two types of price comparisons, Schmitz concludes that the CWB was able to obtain substantial price premiums from malting barley sales.

The Schmitz study, also examines the impact of the EEP on Canadian feed barley export revenues. The study charges that the EEP introduces a market distortion that enables the CWB to arbitrage between markets. In order for the CWB to maximize returns from barley sales in the presence of the EEP, it has to charge different prices in different markets. The study concludes saying that the CWB does not require market power in order to charge these different prices.

Schmitz attempts to forecast producer returns and the effect on CWB pricing that would result from a change in the market structure from single desk selling towards a continental barley market. Schmitz concludes that a change in the market structure would result in a reduction of producer market revenue. The greatest loss in market revenue would likely occur in the malting barley market.

In December, 1992, the CWB released a detailed performance analysis examining the performance of a single desk marketing organization in the context of the North American

Barley Market. The paper outlines the economic and trade implications of removing CWB export permit controls for sales of barley to the United States and exclusive CWB jurisdiction over sales of malting barley in the domestic market. This study argues that the single desk approach to marketing is an important advantage in maximizing total export revenue, and given accurate information, barley growers will recognize the strengths of the current marketing system in all markets, including the United States.[26]

The CWB study provides an extensive overview of the North American barley market. An examination into the malting barley production in Canada and the United States establishes the essential components of the North American barley market and describes the inter-relationships between malting and feed barley in Canada and the United States. Exports of malting barley, and the impact of the EEP on Canadian exports (to the U.S.), are also examined. Impacts of the EEP on exports to the United States, help explain the economic implications of removing exclusive CWB jurisdiction over malting barley sales.

"One of the key advantages of having a single desk seller is that this provides a mechanism to strategically rank market alternatives to maximize sales revenue. The CWB continuously ranks returns from all potential barley markets, including the United States, and maximizes

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[26] The Canadian Wheat Board, Performance of a Single Desk Marketing Organization in the North American Barley Market, Revised December, 1992. p. 38.

sales into these markets that yield the highest net return to producers."[27] While explaining the advantages for a single desk seller, the CWB study cautions against comparing the U.S. spot price to the CWB initial payment. The first point made is that the initial payment provides only partial information, and that producers more than often receive an adjusted and final payment. The second point refers to the fact that initial payments reflect expected returns for an entire crop year, and that spot prices change daily. The CWB concludes that the U.S. spot return should not be used as a price signal on which to base sales decisions to the U.S. Sales decisions should be based on the relative returns attainable from all alternative markets.

The market structure of the proposed continental barley market is considerably different from the market structure of the Western Canadian oat industry. This makes it difficult to draw parallels between the two markets. For one, the pricing relationships among individual grains are dependant on differing factors. For example, according to Brooks, "the single most important marketing factor for determining U.S. barley demand is the barley/corn price ratio. The CWB had argued that if the price of barley is close to, or above, the price of corn, the demand for barley is inelastic, as increased consumption/usage of barley would primarily occur through substitution of barley for corn in feed rations; ie., significantly lower barley prices would be needed to displace corn in the feed rations. As the price of barley prices

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[27] The Canadian Wheat Board, Performance of a Single Desk Marketing Organization in the North American Barley Market, Revised December, 1992. p. 22.

goes to a discount to corn, one would expect the demand to be much more elastic."[28] On the

other hand, the price for oats depends upon, the particular destined market and upon the

substitutability of oats in feed rations in relation to its protein and fibre content. Secondly,

the grain itself is vastly different and the proposed continental barley market structure is

considerably different than the market change that occurred for oats. Thirdly, a myriad of

economic relationships under a continental barley market makes it far too complicated to

draw parallels that can be used in the analysis of the complete removal of oats from under

a single desk selling structure.

The studies mentioned so far, are limited to speculating on the potential implications of a

policy change that would alter the single desk marketing responsibilities of the CWB. The

study at hand however, is not confined to the same limitation. Oats were entirely removed

from under CWB jurisdiction, and its market performance can be examined utilizing similar

economic criteria found in the literature that focuses on the continental barley market debate.

iii) Economic Rationale for an Open Market

Differing views regarding efficiency costs associated with a single-desk selling market

structure have been the focus of a number of studies promoting open market trading.[29]

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[28] Brooks, H., First, Let's Assume We Have a Can Opener., Canadian Journal
of Agricultural Economics 41 (1993), p. 279.

[29] See Carter (1993), Jones (1994), Strychar (1994), Scherer (1970).

Scherer (1970), considers the magnitude of the social losses associated with monopolistic market structure and conduct. Essential to Scherer's consideration of the several dimensions of performance appraisal is allocative efficiency, efficiency of resource use, equity of income distribution, progressiveness, and macroeconomic stability. Scherer maintains that one adverse consequence of monopoly is the assertion that prices are held above competitive levels when monopoly power exists. This can lead to a misallocation of resources that results in welfare loss.

Scherer provides a model that allows for the calculation of welfare loss attributable to monopolistic resource misallocation. The model itself focuses on the relative price distortion under monopoly, or the rate by which the monopoly price deviates from the competitive price. This model is considerably different than standard models that calculate welfare losses, in that typical models hinge on monopolistic output restriction. This is particularly useful for evaluating the Western Canadian oat industry because although the CWB may have restricted sales into particular export markets, it did not necessarily restrict the amount of oats that could be delivered by Western Canadian oat producers.

Colin Carter's study of the continental barley market proposal (1993), argues that certain practices such as cost pooling and a philosophy of serving the needs of all producers are not conducive to cost minimization. He suggests that any financial advantages associated with single-desk selling, such as price premiums associated with market power, have to be weighed against the costs of having a single-desk selling arrangement in place. Carter

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concludes that the CWB has little ability to extract premiums based on market power, from either U.S. or off-shore barley markets. His arguments in relation to the United States, are based on the reasoning that U.S. import demand is relatively elastic.[30]

Price distortions are also commonplace with a single-desk agency. Carter (1993) argues that producers are able to choose whether to sell to the CWB or to the offboard market, and as a result, the expected return from the CWB arbitrages the offboard market, and CWB activities essentially determine the domestic feed prices. The CWB has the potential because of its monopoly position, to cause large and unexpected changes in the domestic market sales. These actions directly affect prices, making efficient private arbitrage difficult.

The focus of Carter's study attempts to measure the benefits of a single-desk exporter by utilizing a pricing-to-market test in order to determine whether or not the CWB has enough market power to be able to charge different pries in different export markets for barley, at the same point in time. The results of this test indicate that there is no evidence of pricing to market for CWB barley into the United States, Japan, FSU, and Saudi Arabia.

A more indirect test of market power that estimates trade elasticities is also employed by Carter. This second test argues that the presence of a very high price elasticity of demand

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[30] See Veeman (1993), and Carter (1993). For example, Carter's estimate of U.S. barley import demand elasticity is -19.0.

for barley sales into the United States demonstrates that there is no economic evidence of CWB market power.

Although Carter's study on the continental barley market draws few parallels with the performance evaluation of the Western Canadian oat industry, many dimensions of the barley market are useful when considering appropriate testable criteria for the oat market analysis. To illustrate, Carter establishes his framework of analysis based on the economic principle that a single desk can price discriminate by charging different prices in different markets at the same point in time. In order to establish his testable criteria, Carter provides an analysis of the world barley trade, export trends, a Canadian supply and demand analysis, and the United States Export Enhancement Program.

More applicable to the evaluation of the Western Canadian oat industry is Carter's examinations of Canadian prices and domestic pricing efficiency. Carter compares CWB prices for feed barley against Alberta non-Board prices. The results suggest that the average CWB price was three percent higher than the open market price.[31] A similar comparison was made between CWB pooled returns and Minneapolis feed barley prices. Discounting the final producer payment to reflect the time value of money, Carter demonstrates that over the

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[31] Carter, C., an Economic Analysis of A Single North American Barley Market, Submitted to the Associate Deputy Minister Grains and Oilseeds Branch Agriculture Canada, March 31, 1993. p. 19.

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1975 to 1992 period, the Minneapolis price was four percent higher that the price Canadian farmers received from the CWB.[32]

In a more recent article, Jones (1994) examines some of the economic impacts of removing oats from under the CWB marketing jurisdiction. The article essentially discusses the resulting positive impacts of moving from single desk selling towards an open market. Jones argues that forward contracting and the ability to utilize the futures market have provided new pricing opportunities that did not exist under single desk marketing.

The pricing opportunities in the open market have guaranteed a steadier revenue per acre than did the CWB system. In addition, pre-pricing on the futures has reduced risk by allowing farmers to access different quality markets. This has enabled producers to practice price pooling on-farm. The article makes claim to the fact that the CWB's focus on volume sales impeded innovation and creativity in the market place for commodities like oats. Although Jones' article examines only what has occurred in the oat industry since the structural change in the marketing of oats, it does raise a number of important issues that need to be examined more closely.

Following the removal of oats from under the CWB, the Canadian Grain Commission (CGC) "responded to the private industry's request to bring Canada's grading system for oats more

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[32] Ibid.

in line with the United States."[33] One could argue that the grade change would have taken place if oats had remained under the Board. However, Strychar (1994), argues that while the CGC makes the ultimate decision on grades, it took input from a "market sensitive" private trade to initiate changes to the system.

Strychar also discusses the pricing efficiencies of an open market. In his discussion Strychar makes the claim that the CWB restricted their selling to two to three months forward. He argues that as a result of the CWB sales stratagem, producers lost both market share and price opportunities. The open market has allowed Canada to capture more of the U.S. market since 1989.[34]

The remainder of Strychar's article identifies a number of efficiency gains as a result of changing the market structure. Among these is the argument that forward contracting has given producers more flexibility to sell different qualities of oats and this success is a direct result of producers quickly taking advantage of changing market conditions. Strychar adds, "Big infrastructures, designed to deal with large volumes and distant buyers, can dilute communications between producers and end-users, the two most important groups in a market."[35]

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[33] Strychar. R., (1994) Canadian Oats, A Success Story. p. 3.

[34] Ibid. p. 5.

[35] Ibid. p. 5.

Strychar concedes that it is difficult to assess the impact of opening the oat market to the private trade because it is difficult to quantify the exact return producers are now receiving compared to those under the CWB. He concludes his article by saying "in the end, the price producers receive is the best success indicator".[36] Although price is an important indicator when examining market success, an appropriate evaluation of the Western Canadian oat industry must include a further analyses of available grade varieties and of trade volumes.

The studies by Carter, Schmitz, and Brooks that examine the CBM were unable to evaluate the performance of barley on the open market. Their studies utilized economic theory in order to provide insight on the hypothesized market performance of barley as a result of changing the marketing structure from a single desk market structure to a CBM.

On June 3, 1993, Hon. Charles Mayor, Minister of Agriculture announced that effective August 1, 1993 the North American barley market would move towards a continental barley market. The policy change was short lived, and on September 10, 1993, only forty-one days later, the Federal Court of Canada ruled that the Order in Council did not have the authority to terminate CWB authority over barley sales to the United States.[37]

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[36] Strychar. R., (1994) Canadian Oats, A Success Story. p. 5.

[37] Clark, Stephen, J., (1994) Single Desk Selling by the Canadian Wheat Board: Does it Have an Impact? Canadian Journal of Agricultural Economics 43 (1995) p. 227.

Between August 1, and September 10, 1993, the marketing of Western Canadian barley operated under a CBM. The structural change in the market between August 1 and September 10, 1993, is the focus of Clark's (1995) analysis. Clarke utilizes the structural break in the marketing system in order to test the predictions made by Carter, the CWB, and Schmitz regarding barley feedgrain prices as a result of moving from single desk marketing towards a CBM. Carter's study assumes that barley feedgrain prices would remain the same as under the CWB. Schmitz and the CWB studies on the other hand, argue that the move from single desk selling towards a CBM would result in lower feed barley prices.

The period between August 1, and September 10, 1993, reflect a structural change in the barley market. Clark uses this period to test for structural breaks in barley feedgrain prices and in the equilibrium price relationship among feedgrain prices. A structural break in barley prices and the equilibrium relationship among feedgrain prices would support the Schmitz and CWB performance analyses. Failure to find a significant structural break in these price series would cast doubt on the Schmitz and CWB studies. The latter case, would thus support Carter's prediction that the feedgrain price would remain unchanged under the two marketing structures.

Clark tests[38] for unit roots on price series for wheat, oats, and barley. Empirical evidence is provided on price series data that suggests a single stable relationship among feedgrain

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[38] Phillips-Perron [Phillips (1987) & Perron (1988)] and Dickey-Fuller (1981).

prices. The analysis demonstrates that the structural change in the Western Canadian barley market did not result in a change in the long-run equilibrium relationship among feedgrain prices. Clark concludes that single desk selling by the CWB has no impact on the North American feed barley market.

Although Clark's analysis is unique in that it evaluates a "true" change in the market structure, it is debatable whether forty-one days (the period on CBM) is a sufficient amount of time for producers, for supply, and for prices to adjust and to react to a new marketing system. According to Turvey (1993), the temporary change from single desk selling to a CBM, would not constitute structural market change.

iv) **Neutral Studies Regarding Monopoly Central Desk Selling**

In response to Carter and Schmitz, Michele Veeman (1993) addresses the continental barley market debate. In Veeman's words, "the papers and reports present quite different conclusions, as might be expected from the considerable differences in their assumptions, both explicit and implicit." The differences between Carter and Schmitz are viewed by Veeman to be a result of the difficulties associated with avoiding biases in social science research. Ultimately based upon different value premises, hence different assumptions and methodology, the two papers reached considerably different conclusions.[39]

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[39] Veeman, Michele, A Comment on the Continental Barley Market Debate, Canadian Journal of Agriculture Economics 41 (1993) 283-287.

Focusing on Carter's estimation of U.S. import demand elasticity, Veeman noted that even though excess demand for Canadian barley in the U.S. pointed towards elastic demand, Carter's ad hoc specification and over-rigorous test of the Board's ability to price differentially by market was inappropriate.[40]

With respect to Schmitz, Veeman questions the underlying assumptions and conclusions leading to the differing views of whether there are efficiency costs associated with single desk selling. "Most economists would expect that competition to service a larger number of traders, and their incentives to pursue alternative transportation and handling procedures, should reduce marketing costs, at least to some degree. This possibility is ignored by Schmitz." Veeman continues, "this assumption was not ignored by Carter but the assumption that he (Carter) applied in order to obtain an estimate of potential cost savings (that elevator handling costs would be avoided by trucking) has been criticized as unrealistic of likely behaviour."[41]

Veeman concludes, "I conclude like many observers, that allowing numbers of traders to seek market opportunities for barley across the U.S.-Canadian border will likely lead to

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[40] Ibid.

[41] Ibid.

increased sales to this market. In addition, some hard to quantify gains in efficiency are likely to be achieved and may lower marketing costs."[42]

The purpose of Veeman's article was not to provide additional analyses of the CBM, but rather to identify the problems associated with the underlying methodology that Veeman and Carter employ in their analyses. Veeman's critical comments remind researchers of the difficulties associated with avoiding biases.

Summary

Turvey's analytic model of the relationship between market structure, conduct and performance provides the necessary framework to undertake an evaluation of market performance following a change in market structure. Allocative efficiency, price and/or revenue stability, equity, output, and growth in output, are identified by Turvey as being the essential performance attributes that need to be examined in order to evaluate the market performance of an industry following a structural change in the market.

Turvey's analysis does not provide specific tests of market performance. Analytical tests of the testable criteria that are identified by Turvey, can be derived from supplementary studies that examine market performance in the context of a change in the market structure. A number of studies that provide different rationales concerning central desk selling are

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[42] Veeman, Michele, A Comment on the Continental Barley Market Debate, Canadian Journal of Agriculture Economics 41 (1993) 283-287.

examined above. These studies fit into the performance evaluation mould developed by Turvey. Figure 4 concludes this Chapter by expanding on Turvey's framework of analysis and by supplying specific testable criteria of market performance that demonstrate the relationship between market structure, conduct and performance.

The Carter (1993), Scherer (1970), Jones (1994), Strychar (1994), and Clark (1995) studies provide specific tests of market performance lending support for an open market. Brooks (1993), Schmitz (1993), and the CWB performance analysis (1992), use similar performance evaluation measures to demonstrate the merits of single desk marketing. Veeman (1993) does not provide specific tests of market performance, but she does outline a number of crucial elements that need to be considered when evaluating market structure, conduct and performance. The market performance of the Western Canadian oat industry can be evaluated following Turvey's recipe for conducting a market performance evaluation. In order to capture the appropriate economic criteria, the Western Canadian oat industry performance analysis must turn to studies like those discussed in this review. These studies can aid in the market performance evaluation of the Western Canadian oat industry by providing the essential economic criteria that need to be examined, and by providing specific tests of market performance.

Figure 4 lists the economic criteria examined by each study discussed in this Chapter. These studies evaluate the economic merits and weaknesses of single desk marketing versus the open market. Figure 4 thus combines Turvey's analytic framework with specific

Relationship of Stucture, Conduct & Performance:
Performance Evaluating Criteria

Structural Change Factors
- Technology Change
- Economic Growth
- Related Market Structure
- Fiscal Policy
- Political Decisions

Structure
- Market Concentration
- Entry & Exit
- Market Integration
- Government Participation
- Industry Maturity

Conduct
- Product Differentiation
- Pricing Policies
- Pricing Strategy
- Product Strategy
- Responsiveness to Change

Brooks (1993)
- Pricing to Market
- Export Market Analysis
- Export Volumes & Price Relationship
- Effect of EEP
- Price Analysis

Schmitz (1993)
- Gross Revenue
- Supply & Demand Forces
- Price & Premium Comparisons
- Effect of EEP
- Producer Returns

Performance
- Efficiency
- Stability
- Equity
- Output
- Growth in Output

Veeman (1993)
- Price Differentials
- Efficiency Costs
- Revenue
- Exports

CWB (1992)
- Production Analysis
- Inter-relationship Among Grains
- Exports
- Effect of EEP
- Net Producer Return
- Price Analysis

Carter (1993)
- Market Power
- Price Differentials
- Demand Elasticity
- Export Trend
- Effect of EEP
- Supply & Demand Analysis
- CWB vs. Offward Prices
- Producer Returns

Scherer (1970)
- Welfare Loss Calculations
- Monopoly & Open Market
- Price Differentials

Jones (1994)
- Pricing Opportunities
- Revenue Potentials
- Reduced Risk
- Innovation & Creativity

Strychar (1994)
- Effect of Grade Change
- Pricing Opportunities
- Market Share
- Exact Producer Returns
- CWB vs. Offboard Prices

Clark (1995)
- Price Relationship
- CWB vs. Offboard Prices
- Price Analysis
- Relationship Among Grains

Figure 4
Source: Turvey et. al. 1993

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performance testing criteria that is relevant to the market evaluation of the Western Canadian oat industry. Although these studies draw different conclusions regarding the economic merits and weaknesses of single desk marketing versus the open market, it is interesting to note that each study uses similar performance evaluation measures in order to demonstrate their rationales.

The task now, is to develop a framework of analysis that can be used to evaluate the market performance of the Western Canadian oat industry. This is achieved by utilizing Turvey's framework of analysis for market performance in conjunction with the specific economic evaluating criteria that have been identified by the studies contained in this literature review.

CHAPTER FOUR
A THEORETICAL FRAMEWORK
FOR ANALYSIS

Introduction

The basic objective of this study is to compare the performance of the Canadian Oat Market over the past five years (1990-1994), with its performance under the Canadian Wheat Board during the 1980-1989 period. In this Chapter, a model is developed that can be used to evaluate the effects on market performance following a structural change in the market organization of the Western Canadian oat industry. The analytic model considers testable criteria, based on observable data.

The intention of this Chapter is to select the appropriate testable criteria that can be used to evaluate the market performance of the Western Canadian oat industry, and to derive at economic hypotheses that would be expected resulting from a change in the market structure.

Framework of Analysis

There is a large catalogue of testable performance criteria for the analysis of market performance.[43] The criteria selected for this study follow a general framework for industrial

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[43] See Carter (1993), Jones (1994), Strychar (1994), Scherer (1970), Schmitz (1993), Turvey (1994), Veeman (1993), Brooks (1993), CWB Performance Analysis (1992), and Clark (1995).

market structure and for economic performance evaluations that is outlined by Turvey (1993).

Turvey (1993), provides a framework of analysis for evaluating market performance following a permanent and irreversible change in the underlying market structure. His model identifies the contributing factors such as economic growth, political decisions, and fiscal policies, that lead to changes in market structures. The model explains why in institutional development, the market structure determines market conduct and thus directly affects market performance. Turvey identifies economic efficiency, stability, equity, output, and growth in output, as being the essential economic criteria that need to be evaluated when examining the market performance of an industry following a structural change in the market.

The structural change in the underlying marketing structure of the Western Canadian oat industry became effective August 1, 1989. The structural change conforms to Turvey's definition of what constitutes industrial market change. The change from single desk selling to open marketing resulted from an abrupt political decision based on technological change and economic growth in the Western Canadian oat industry.[44] So far, the decision to remove oats from the jurisdiction of the CWB has been permanent and has not been reversed.

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[44] See Office of the Minister of State Grains and Oilseeds, January 19, 1989.

Turvey's model develops the necessary framework that is required to conduct a market performance evaluation of the Western Canadian oat industry following a change in the underlying market structure. Allocative efficiency, price and/or revenue stability, equity, output, and growth in output are identified in his model as being the essential performance attributes that need to be examined in order to conduct a market performance evaluation. His model for conducting market performance evaluations is applied to the economic performance evaluation of the Western Canadian oat industry. Guided by Turvey's framework of analysis for market performance evaluations, specific economic criteria have been extracted from supplementary studies that evaluate market performance in the context of market structure change.[45]

A.   **Welfare Loss**

B.   **Demand Forces and Changes in Consumption Patterns**

C.   **Exports**

D.   **Supply and Disposition**

E.   **Producer Returns**

F.   **Product Differentiation**

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[45] These are discussed in the previous Chapter and specific criteria that evaluate market performance have been presented in Figure 4. The criteria chosen for the economic performance evaluation of the Western Canadian oat market have been derived directly from studies by Turvey (1993), Carter (1993), Jones (1994), Strychar (1994), Scherer (1970), Schmitz (1993), Turvey (1994), Veeman (1993), Brooks (1993), CWB Performance Analysis (1992), and Clark (1995).

A) Welfare Loss

"One adverse consequence of monopoly, the theory of welfare economics instructs, is the misallocation of resources. By raising price above marginal costs, monopolists restrict output, divert resources to less pressing demands, and reduce consumer welfare."[46]

Figure 5, provides a frame of reference for examining welfare loss. Consumers' surplus is gained on all infra-marginal units of output. Every unit sold, except the final unit, the consumer is just on the margin between buying and not buying. Total consumers' surplus is therefore measured by the area bounded by the demand curve. A horizontal line reflecting the competitive price, *(Pc)* is the lower bound. Total consumer surplus is *(PcEF)*. At a higher monopoly price *(Pm)*, and restricted output, the total consumers' surplus is only *(PmBF)*. The consumers' surplus loss under monopoly is the trapezoidal area *(PcEBPm)*. The dead-weight welfare loss is defined by the shaded triangular area *(AEB)*. If the demand function is not linear, the area *(AEB)* will not be strictly triangular, but a triangle provides a good approximation.[47]

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[46] Scherer, F.M., Industrial Market Structure and Economic Performance, Rand McNally, Chicago, 1970, p. 400.

[47] Scherer, F.M., Industrial Market Structure and Economic Performance, Rand McNally College Publishing Company, Chicago, 1970. p. 401.

Welfare Loss Attributable to Monopolistic Resource Misallocation
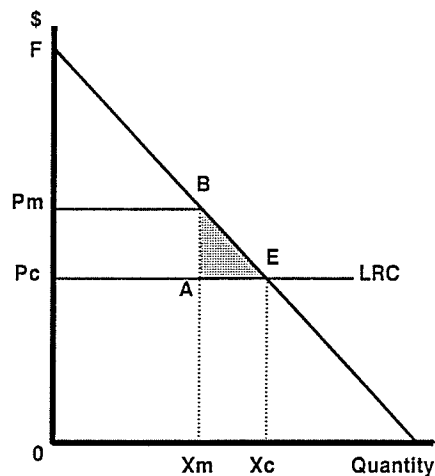
Welfare Loss Calculation:

Welfare Loss = W

$$W = .5 \triangle P \triangle Q \qquad\qquad 1$$

The distortion price between Monopoly and Competition is given by rate (t)

(t) = distortion rate

$$t = \frac{\triangle P}{P} \qquad\qquad 2$$

Also elasticity of demand (Ed) is measured by:

$$Ed = \frac{\triangle Q}{Q} \bigg/ \frac{\triangle P}{P} \qquad\qquad 3$$

Substituting (t) into (Ed):

$$Ed = \frac{\triangle Q}{Q} \bigg/ t$$

Solving for $\triangle Q$

$$\triangle Q = (Ed)Qt \qquad\qquad 4$$

From equation 2, we know that

$$\triangle P = tP \qquad\qquad 5$$

Substituting $\triangle Q$ and $\triangle P$ into W

$$\boxed{W = .5PQ(Ed)t^2} \qquad\qquad 6$$

Following Scherer (1970), the dead-weight welfare loss attributed to a single desk monopoly

seller can be defined as follows:

$$W = .5 \, \Delta P \, \Delta Q.$$
(1)

Where ΔP represents the deviation between the monopoly price and competitive price and

ΔQ is the amount by which the monopoly output differs from the competitive output. The

relative price distortion under monopoly, or the ratio by which the monopoly price deviates

from the competitive price, is then defined as:

$$t = \frac{\Delta P}{P}$$
(2)

Ignoring signs and assuming the ΔP *and* ΔQ are small, we define the elasticity of demand to

be approximately:

$$\varepsilon_d = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} \; which \; is \; the \; same \; as \; \frac{\frac{\Delta Q}{Q}}{t}$$
(3)

rearranging:

$$\Delta Q = \varepsilon_d t Q$$
(4)

Substituting $Pt = \Delta P$ and Equation 4 into Equation 1 we obtain:

$$W = .5 \, P \, Q \, \varepsilon_d t^2$$
(5)

Thus, the dead weight welfare loss due to monopoly rises as a quadratic function of the relative price distortion t and as a linear function of the demand elasticity $\mathscr{E}d$.

Equation 5 encompasses four unknown variables that can be extracted from the available data. Pricing data can be found from CWB quotation prices over the 1979-1989 period. Likewise, from Equation 2, the distortion rate between monopoly and competition can be calculated from the percentage difference between the monopoly and competitive prices over the same period. With this in mind, the distortion rate t, is calculated from WCE cash grain prices and CWB quotation pricing data.

Several statistical studies have been made of the short-run economic impacts of monopolistic practices. These impacts include: business inefficiency, resource misallocation arising from competitive deficiencies, and market imperfections.[48] In general, monopolistic price-output distortions are found to give rise to societal losses ranging from less than 1 percent to as much as 12 percent of the gross national product. Scherer's study (1970), produced the most explicit sources of output loss associated with the exercise of market power. He admits however, that each of his individual estimates is subject to a margin of error. Scherer's estimates, which are higher than estimates of other experts in the field, demonstrate that the static annual monopoly loss is rather small, perhaps even trivial and sometimes

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[48] See Scherer F.M., "Industrial Market Structure and Economic Performance", Rand McNally & Company, 1970.

inconsequential. Nonetheless, there is considerable evidence to suggest that a monopoly, like a single desk selling regime, can lead to a loss of consumer welfare.[49]

The CWB controlled all sales of Western Canadian oats for human consumption. Therefore, the welfare loss attributed to monopoly desk control within Canadian boundaries can be made utilizing domestic human consumption data as a proxy for Q, quantity sold[50], in Equation 6 of Figure 5.

Employing Scherer's (1970) reasoning, the welfare loss is calculated assuming unitary elastic demand for oats used for human consumption. In addition to Scherer's rationality,[51] low and high range approximations of the elasticity of demand are provided in order to demonstrate the relationship between the elasticity of demand and welfare losses. The welfare loss calculations are made in Chapter Five.

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[49] Ibid.

[50] Since all sales of oats for human consumption were required to be approved by the CWB, data rendering domestic human consumption usage for #1 C.W., will provide an appropriate proxy to total sales made for these purposes within Canadian boundaries.

[51] Because Scherer estimated the welfare loss resulting from monopoly control over a number of industries, exact computations for elasticity estimates could not be made. Instead, Scherer assumed a unitary elastic demand across industries. In addition, because the welfare loss rises as a linear function of the demand elasticity, precise estimations are not always required.

Scherer (1970) submits that "welfare losses due to resource misallocation can be a consequence of monopolistic price-output distortions."[52] Based on Scherer's reasoning, the following hypothesis can be formulated:

Hypothesis: *The single desk marketing responsibilities of the CWB for oats destined to the domestic human consumption market, resulted in Canadian consumer welfare losses.*

B) Demand Forces and Changes in Consumption Patterns

Schmitz (1993) and Carter (1993), provide analyses of the underlying supply and demand forces behind the Canadian barley market. Their analyses of the demand forces and changes in consumption patterns provide the initial groundwork of their market performance analyses. Turvey (1993), explains in his analysis of the economics of structural change in agriculture, that changes in the market structure result in changes in the industrial composition of output. Turvey also argues that the change in market structure can also affect the particular commodity that is traded and with whom it is traded. For this reason, it is essential to examine the domestic composition of oat usage in Canada and try to ascertain whether the demand in Canada has changed as a result of the change in market structure.

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[52] Scherer F.M., "Industrial Market Structure and Economic Performance", Rand McNally & Company, 1970.

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In September of 1989 the Canada Grains Council sponsored a symposium[53] that brought together Canadian oat industry participants in an effort to discuss the essential aspects of the industry and to participate in the strategic development planning of the future Canadian oat market under a market driven system. Conclusions of the 1989 symposium projected that the potential food market would likely grow because of the nutritional food value offered from oats.[54] Based on this premise, an examination of the composition of oat usage in Canada and of the possible changes in consumption patterns in Canada is necessary.

Turvey's proposition that a change in the market structure can lead to a change in industrial composition is contemplated in the context of the Western Canadian oat industry. Total domestic use of oats in Canada is comprised of oats used for animal feed, oats used for human consumption, and finally, seed requirements. This is the data that is used in order to determine whether Turvey's proposition is applicable to the Western Canadian oat industry.

Hypothesis: *The change in the marketing structure of the Western Canadian oat industry resulted in a change in the composition of total domestic oat usage.*

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[53] Oat Symposium Proceedings, September 6 and 7, 1989. Sir John Carling Building, Ottawa, Canada.

[54] Canada Grains Council, Agriculture Canada, Oat Symposium Proceedings, September 6 and 7, 1989, Sir John Carling Bldg., Ottawa.

C) Exports

Exports are deemed one of the primary economic performance indicators of market structure evaluations.[55]

Veeman (1993), concluded in her comment on the continental barley market debate that by allowing the market structure to permit a number of traders to seek market opportunities across the United States - Canadian border, would likely result in increased sales to this market.

In January, 1989, an article was released by the office of the Minister of State Grains and Oilseeds explaining their position regarding the new marketing structure for oats. In this article, oat market opportunities in the context of the open market are discussed. Focussing primarily upon the export opportunities of the open market, the article asserts that the "opening up the marketing of oats to the industry and individual producers provides increased opportunity for producers to capitalize on these developing specialty markets for smaller quantities of higher quality product."[56]

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[55] See Carter (1993), Schmitz et. al. (1993), Brooks (1993), CWB Performance Analysis (1993), and Veeman (1993).

[56] Information, Office of the Minister of State Grains and Oilseeds, For Immediate Release: p. 2.

The Honourable Charles Mayer, following his decision to move oats to the open market, also commented on increased export opportunities, "We firmly believe that there are more opportunities for individuals out there, smaller companies, the cooperatives, individual cleaning plants, farmers on their own, to go ahead and pick oats, process oats and sell oats to the United States by themselves."[57]

Led by Turvey's analytic model of market performance and based on the above predictions of export opportunities under the open market, an examination of export flows over two distinctive marketing periods is undertaken. Specifically, exports of Canadian oats over the period of 1981 to 1994 are examined. Total exports, oatmeal exports, rolled oats exports, and final destinations are considered.

Hypothesis: *The change in the marketing structure of the Western Canadian oat industry from single desk selling to the open market, resulted in increased exports of Canadian oats to the United States and to the rest of the world.*

D) Supply and Disposition

Supply and disposition are important economic performance measures when considering the geographical distribution of economic activity.[58] Carter (1993), and Turvey (1993), address this aspect of performance efficiency in the context of agricultural structure change from one

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[57] House of Commons, Minutes of Proceedings and Evidence of the Standing Committee on Agriculture, Issue No. 4, Tuesday, May 9, 1989, p. 14.

[58] Carter (1993), and Turvey (1993).

market system to another. Turvey concentrates his analysis on this matter in terms of evaluating market structure performance by the geographical distribution of economic activity. Although Turvey's analysis is directed more towards the number and size of family farms, he does consider the re-distributional effects on where output is produced following a change in the market structure.

In his analysis of the continental barley market, Carter places great emphasis on the major reallocations in economic costs and benefits relative to those that existed prior to a major policy change. Carter points out that there are gainers and losers as a result of market restructuring, but maintains that favourable economic distortions are solely the consequence of a regulatory framework. Carter argues that a move from single desk selling towards the open market would involve an adjustment to comparative advantage and to specialization signals, and that production would become geographically concentrated.

In Carter's report, he argued that "a continental malt barley market would cause the permit and quota system on malt barley to disappear, triggering the potential to achieve economic efficiencies with the system, to the benefit of producers."[59] In particular, he felt that there would be a reduction of barley production in some areas, a switching from malting barley to feed in other areas, and greater specialization in malt by producers who maintain a comparative advantage. Under the CWB, Carter argued that barley was being grown in areas

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[59] Carter, C., An Economic Analysis of a Single North American Barley Market, March, 1993, p. 23.

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where it otherwise would not. "The permit system used to operate the quota system on malting deliveries, has led to a large amount of malting barley production resulting in malt barley acreage on farms being determined in relation to the expectation of one or two carlots rather than how the expected value of malting barley competes with other crops in the rotation. In economic terms, this distorts use of farm resources."[60]

The geographic distribution of the Western Canadian oat industry can be examined prior to, and following the change in marketing structures. Efficiency costs pertaining to market performance can be addressed by examining the comparative advantage among oat growers, oat growing regions, and potential end-user markets. Specific crop district data obtained from Prairie provincial agricultural offices for the 1986-1994 crop years, demonstrate the changes in seeded area, harvested area, yield, and oat production.

These patterns provide an important reference base for the analysis of the Western Canadian oat industry. The geographic economic efficiency of the industry can be addressed by tracing oat production and supply over time. A Prairie provincial area analysis can also demonstrate shifts in production and supply in response to various market conditions. In addition, it is important to determine whether significant changes have resulted following the change in marketing methods. Chapter 5 provides the necessary information for this analysis.

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[60] Carter, C., An Economic Analysis of a Single North American Barley Market, March, 1993, p. 23.

The following hypothesis is formulated using Carter's (1993) theoretical framework for evaluating the efficiency component of market performance in terms of comparative advantage and geographic distribution of economic output;

Hypothesis: *The change in the marketing structure of the Western Canadian oat industry from single desk selling to the open market, resulted in a reduction of oat production in some areas and greater specialization by some producers in good oat growing areas. Higher quality oat production destined for the human consumption market would be expected to increase in those areas maintaining a comparative advantage. By adjusting to comparative advantage and to specialization signals, oat production should become geographically concentrated in favour of good oat growing regions.*

E) Producer Returns

Following Schmitz's (1993) rationale, theory demonstrates that a monopolist has the potential to extract higher than normal returns from the marketplace. Based on this premise, Schmitz attempts to ascertain whether the CWB was able to extract higher than normal returns from the Canadian and U.S. markets for malting barley. He does so by looking at two comparisons of returns received by Canadian and U.S. producers of malting barley.

The first comparison uses historic Minneapolis malting barley prices relative to prices paid by the CWB to farmers.[61] The second type of comparison Schmitz uses is a comparison of annual differences using weighted average prices for malting and feed barley received by

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[61] The Minneapolis price data is simple averaged annual prices converted to Canadian dollars at the Bank of Canada average noon spot rate from June 1st - June 1st. The CWB final realized pool price are basis in store Thunder Bay.

U.S. farmers. The series includes prices received for contracted barley and prices received in the cash market weighted by the volumes sold under each marketing method. Schmitz argues that such a weighted average of prices is more compatible with the CWB data and provides a truer picture of the average incentive that exits to grow malting barley in the U.S. As a result of these price comparisons, Schmitz concludes that the CWB was able to obtain substantial price premiums for barley sales.[62]

Carter also compares CWB prices received by farmers against domestic feed barley prices over a seventeen year time frame. In this series, Carter finds that the average CWB price was 3 percent higher than the open market. In a second comparison, Carter compares CWB returns to Minneapolis feed barley prices. His calculations reveal that, on average, over the 1975-1992 period, the Minneapolis price was 4 percent higher than the price Canadian farmers received from the CWB.[63]

The CWB has argued that the initial payment is only a partial payment of producer returns and that producers should compare their total CWB payments to U.S. spot returns.[64] In order to demonstrate that the presence of a price pooling system in Western Canada has provided

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[62] Schmitz, A., Gray, R., Ulrich, A., A Continental Barley Market: Where are the Gains?, Canadian Journal of Agricultural Economics 41:260.

[63] Carter, C., The Economics of a Single North American Barley Market, Canadian Journal of Agricultural Economics 41:248.

[64] Brooks, H., First, Let's Assume We Have a Can Opener., Canadian Journal of Agricultural Economics 41:272.

a measure of price stability to the domestic user and processor of feedgrains, the CWB provides a comparison of intra-crop year price variability of the Alberta off-board barley market and state average barley prices in Montana.[65] The CWB argues that a price relationship exists between the average Alberta off-board market price and the CWB final return. This comparison concludes that the off-board price tracks the pool return with relatively small discounts and premiums, whereas the Montana state barley prices are nearly twice as variable as barley prices within Alberta.[66]

"In Western Canada, feed wheat, barley and oats form a feedgrain complex. All of these crops are used as livestock feed. Within the feeding requirements of livestock, these feedgrains can also substitute for one another. This implies that an equilibrium relationship should exist among feedgrain prices. One would not expect the feedgrain prices to wander too far from one another since, if they did, relatively cheap feedgrain would be substituted for relatively more expensive feedgrain. This in turn, would lead to an increase in the demand (and therefore the price) of the cheaper feedgrain and a decrease in the demand (and

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[65] The variability of domestic barley prices are compared against the Montana price series using a simple standard deviation of monthly average prices within each crop year. Canadian Wheat Board, Performance of a Single Desk Marketing Organization in the North American Barley Market, Revised December, 1992, Table 5, p. 47.

[66] The Canadian Wheat Board, Performance of a Single Desk Marketing Organization in the North American Barley Market, Revised December, 1992, p. 8.

therefore the price) of the relatively more expensive feedgrain until the equilibrium

relationship among feedgrain prices is reestablished."[67]

Clark argues that there exists an equilibrium price relationship among feedgrain prices, and

while these relationships exist due to economic forces, these relationships also reflect

prevailing government policies. In the context of his study, Clark applies the Lucas (1976)

critique[68] to the Western Canadian feedgrain market in order to determine whether the CWB

had an impact on market prices. Specifically, Clark argues that if single desk selling by the

CWB has no impact, the Lucas critique would be irrelevant because single desk selling

would not affect the equilibrium relationship among feedgrain prices. In order to test his

hypothesis, Clark uses daily Saskatchewan Wheat Pool street prices for feed wheat, feed

barley and oats.

The Canadian Wheat Board Act gave the CWB responsibilities directly related to the prices

paid to oat producers.[69]

> -To market wheat, oats, and barley, grown in Western Canada, to the best advantage
> of grain producers.

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[67] Clark, J.S., Single Desk Selling by the Canadian Wheat Board: Does it have
an Impact? Canadian Journal of Agricultural Economics 43 (1995) 228.

[68] The Lucas critique argues that if a government policy influences an
equilibrium relationship, then this policy must be built into that equilibrium
relationship.

[69] Grains & Oilseeds, Handling, Marketing, Processing. Canadian
International Grains Institute. Third Edition 1982, p. 94.

*-To provide price stability to prairie grain producers through an annual "pooling"
or price-averaging system.*

An examination of oat producer returns should be viable from the available data. Similar

comparisons of cash grain prices relative to CWB producer returns made by Schmitz, Carter,

and by the CWB, can be made for oats. In addition, a comparison of oat prices relative to

feed barley prices is made before and after the structural change in the marketing system.

This comparison is guided by Clark's proposition that feedgrain price relationships may be

distorted by a single desk marketing structure.

A number of hypotheses can be formulated using the theoretical framework for evaluating

producer returns in the context of the Western Canadian oat industry. The following

hypotheses are formulated based on the studies of Clark (1995), Carter (1993), CWB

Performance Analysis (1992), and Schmitz (1993);

Hypothesis: The CWB was able to extract higher than normal returns for Western Canadian
oat producers from sales in the Canadian and export markets.

Hypothesis: The change in the marketing structure of the Western Canadian oat industry
from single desk selling towards the open market resulted in an increase in the price ratio
of oats relative to feed barley.

Hypothesis: The change in the marketing structure of the Western Canadian oat industry
from single desk selling towards the open market resulted in a convergence in the price ratio
of Canadian oats relative to the United States.

F) Product Differentiation

One of the main arguments in favour of open market trading for oats has focused upon the growing potential of niche markets. This analysis is compromised by other events. At about the same time that oats was removed from the CWB, a transition in the grading system for oats occurred. "In 1989, the Canadian Grain Commission (CGC) responded to private industry's requests to bring Canada's grading system for oats more in line with our biggest customer, the U.S. market. At that time, the U.S. and Canadian grading standards were incongruous. In order to maximize returns to producers, the Canadian system required changes."[70]

Turvey (1993), identifies product differentiation as an economic element of market conduct that must be examined in the context of market performance evaluations, "The structure of an industry in terms of concentration and integration between markets is influenced not only by the causal factors mentioned previously but also by the conduct of the industry as captured by pricing policies and product differentiation."[71]

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[70] Strychar, Randy, Canadian Oats: A Success Story, p. 2, 1994.

[71] Turvey, C.G., Chen, K., Weersink, A., and Goddard, E., Economics of Structural Change in Agriculture, Canadian Journal of Agricultural Economics. Volume 41, Number 41 (Part 1), 1993.

Jones' (1994), article addresses the inefficiencies of a single desk marketing structure in terms of impeding product growth, "For too long the CWB focus on volume sales has impeded innovation and creativity in the market place for commodities like oats."[72]

Effects of the oats grading system change must be evaluated and the forces behind the change need to be determined in order to adequately assess the market performance of the Western Canadian oat industry. The following hypothesis is formulated based on the statements made by Turvey and by Jones in their analyses of the relationship between product differentiation and market performance;

Hypothesis: *The open market has encouraged product differentiation in the Western Canadian oat industry, and has allowed producers to capture premiums on high quality oats.*

Summary

This Chapter develops a framework of analysis that can be used to evaluate the performance of the Western Canadian oat industry following a structural change in the underlying market organization. Building from a general framework of industrial market structure and for economic performance evaluations outlined by Turvey (1993), the Chapter sets out to identify relevant testable economic criteria that can be used in the performance evaluation of the Western Canadian oat industry. Guided by Turvey's framework of analysis for market performance evaluations, specific economic criteria are extracted from supplementary studies

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[72] Jones, S., Look What We've Done With Our Oats, (1994) p.8.

that evaluate market performance in the context of structural market change. Individual tests of hypotheses for each of the selected economic criteria are then formulated based on theoretical perspectives of moving from a single desk selling market structure to open market trading.

The next two chapters deal exclusively with the examination of those criteria necessary to arrive at a competent judgment regarding the economic performance of the Western Canadian oat industry under two opposing marketing systems.

CHAPTER FIVE
PERFORMANCE ANALYSIS

Introduction

The previous Chapter establishes a model that can be used to analyze the structural changes resulting from the reorganization of the market. Guided by the framework of analysis, the intention of this Chapter is to illustrate and to evaluate the chosen performance criteria.

A) Welfare Loss

Figure 6 *a* and *b* is comprised of four panels, each calculating the welfare losses associated with CWB central desk monopoly control under four demand elasticity scenarios. The calculations[73] made for Equation 5, utilize #1 C.W. data for sales destined to the Canadian human consumption market.[74]

The first Panel of Figure 6 employs an inelastic demand coefficient of -.7 estimated by Schmitz et al. (1993) for domestic feed barley. Under this scenario the welfare losses are rather insignificant, ranging from a low of $57,751 to a high of only $1.4 million dollars. However, most economists would agree that the domestic demand elasticity for oats is unlikely to be inelastic.

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[73] See Appendix 2.

[74] Remember that all sales destined for food and export markets had to be approved by the CWB.

Welfare Loss Associated with Central Desk Monopoly

Millions of Dollars

Year
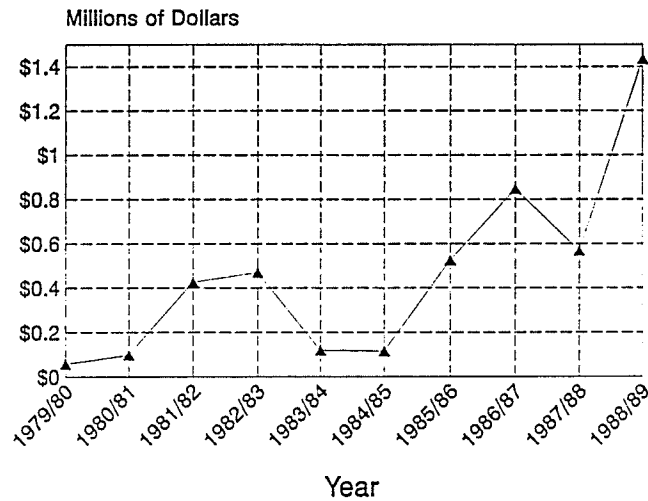
Panel A

#1 C.W. Human Consumption
Inelastic Demand -.7

Millions of Dollars

Year
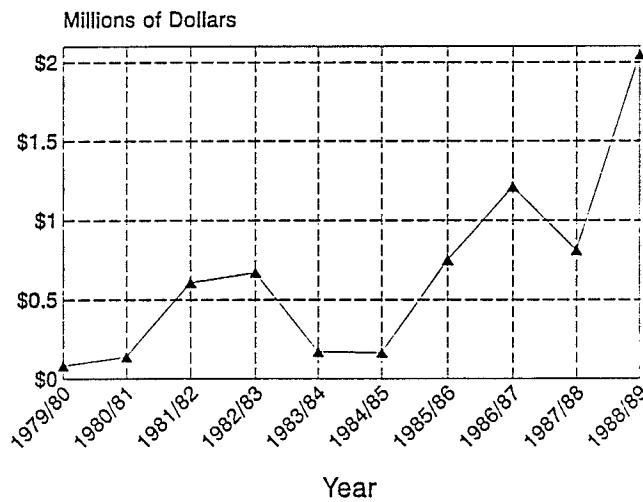
#1 C.W. Human Consumption
Unitary Elastic Demand

Panel B

Figure 6a

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Welfare Loss Associated with Central Desk Monopoly

Millions of Dollars
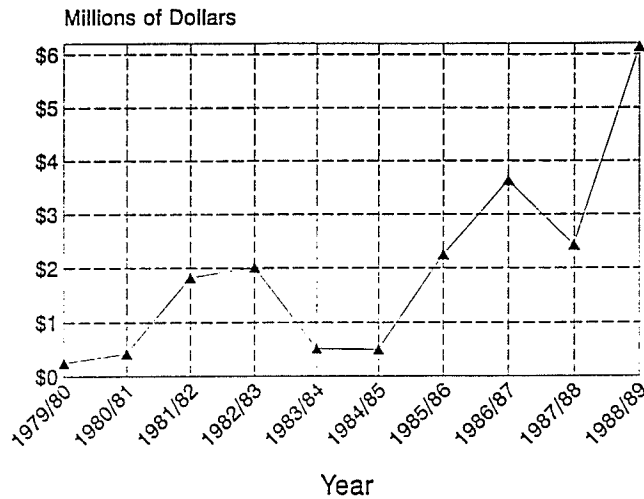
#1 C.W. Human Consumption
Elastic Demand -3.0

Panel C

Millions of Dollars (Millions)
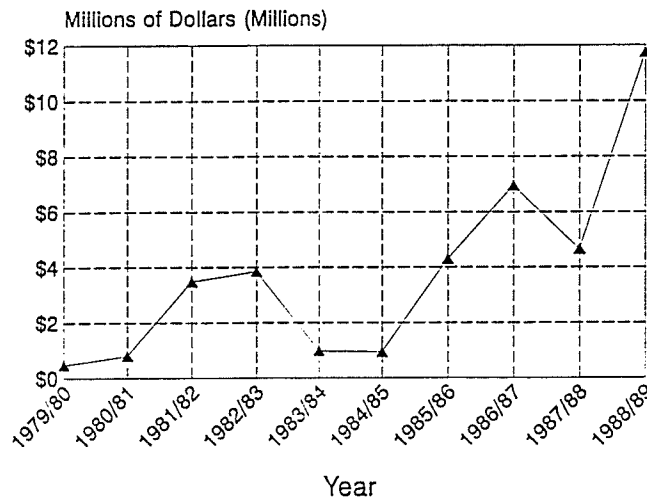
#1 C.W. Human Consumption
Elastic Demand -5.74

Panel D

Figure 6b

Panel B demonstrates the welfare loss under Scherer's (1970) unitary elastic demand reasoning. Although the unitary elastic demand assumption for oats may be considered by some to be low, it does provide an origin for the welfare loss calculations. Although slightly higher than the inelastic case scenario, the welfare losses still remain rather small. In the latter years however, calculated losses reach an estimated $1.2 million in 1986-1987, and $2 million in 1988-1989.

In subsequent panels of Figure 6, elastic demand coefficient estimates that were made for feed barley and wheat, are utilized as proxies for the oat market.[75] In Panel C, a demand elasticity coefficient of -3.0 was utilized.[76] Subsequently welfare losses under this scenario, are calculated at substantially higher levels. For example, welfare losses attributed to central desk monopoly are calculated at $1.8 million in 1981-1982, $2 million in 1982-1983, and increase steadily from $2.2 million in 1985-1986 to a high of $6.1 million in the final crop year.

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[75] See Carter, 1989 and Schmitz 1990. Wheat and barley demand elasticity estimations can be used as proxies because the demand elasticity for oats is considered to be significantly higher than both wheat and barley estimations.

[76] See conclusions of typical elasticity estimates utilized by Alston, Gray, and Sumner., The Wheat War of 1994. Canadian Journal of Agriculture Economics, Volume 42, Number 3, p. 240.

The final panel of Figure 6 (Panel D), is calculated using a slightly higher estimate of the domestic demand elasticity. A coefficient of -5.74[77] generates the highest estimates of welfare loss attributed to central desk monopoly.[78] If this estimate of the demand elasticity is employed, then the welfare losses attributed to the CWB over this period range from $474 thousand in the 1979-1980 crop year, to $11.7 million dollars in 1988-1989. With the exception of the 1983-1984 and 1984-1985 crop years, welfare losses have ranged between $3.4 to $3.8 million over the 1981-1983 period, and $4.2 to $6.9 million over the 1985-1988 period.

The results of Figure 6 demonstrate an overall increase in welfare losses attributed to monopoly desk selling under four demand elasticity scenarios. The 1979-1980 crop year earmarks the lowest estimates of welfare losses attributed to the CWB. Increasing up until 1982-1983, welfare losses were restored to lower levels in 1983-1984 and 1984-1985. However, since the 1985-1986 crop year, welfare losses attributed to monopoly desk selling have escalated to unprecedented levels. The highest of these estimations occurred during the final crop year of centralized marketing for oats in 1988-1989.

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[77] See for example; Carter, C. and W. Gardiner (eds). Elasticities in International Agricultural Trade. Boulder: Westview Press. 1988.

[78] Specific data for domestic oat demand elasticities were unavailable. Therefore, domestic demand estimations for wheat and barley were utilized as proxies. Most economists would agree that the demand elasticity for oats is estimated to be substantially higher than those estimates for wheat and barley. In addition, since the relationship between the welfare loss and the demand elasticity coefficient $\mathscr{E}d$ in Equation 6 of Figure 3 is of a linear nature, a sufficient range of welfare losses have been estimated in Figure 4.

The fluctuation in welfare loss scenarios is attributed to the price differentials and the distortion rate coefficient *(t)* of Equation 6 in Figure 5. Although Q has remained relatively constant over this duration, the same cannot be said with regards to *P and t*. Changes in price levels directly result in welfare loss fluctuations. However, the major factor contributing to the welfare loss increases associated to the CWB is the result of the price distortion *(t)* between monopoly price levels and WCE price levels.

The range of welfare losses calculated in Figure 6 provide a good indication of the rising inefficiencies resulting from a central desk monopoly. Although higher demand elasticity estimates are suggested in the literature,[79] the range of coefficients presented in Figure 6 is sufficient in establishing an upward trend in welfare losses attributed to control over marketing. The results thus support the hypothesis that the single desk marketing responsibilities of the CWB for oats destined to the domestic human consumption market, resulted in Canadian consumer welfare losses.

B) Demand Forces and Changes in Consumption Patterns

The purpose of this section is to determine the trend of oat utilization in Canada. In particular, the analysis attempts to ascertain whether a change has occurred in the

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[79] For examples see Carter (1993), Schmitz et al. (1993), Veeman (1993), Alston, Gray, and Sumner (1994), Blanford (1988), Ahmadi-Esfahani (1989), and results from Alston, Carter, Green and Pick (1990) suggest that domestic demand elasticity for aggregate wheat estimates range from a low of -.7 to a high of -20.7. In fact, estimates between -15 and -19.7 were not uncommon.

composition of total domestic oat usage following the structural change in marketing methods.

Figure 7 provides an account of the total domestic use between 1981 and 1994. In Panel A, the first trend line documents total domestic oat use, while the second documents oats used for feed. The feed market has historically been the predominant user of oats in Canada. The proportion of oats for feed to total domestic use has varied little over this time frame.

Oat usage in Canada has declined rather significantly since 1981 from just over 3 million metric tonnes (1981-1982) to a mere 1.8 million metric tonnes in 1991-1992. More noticeable is the sharp decline in total domestic and feed use since 1990. A drop of approximately 640 thousand tonnes occurred between the 1990 and 1992 crop years. This decrease was alleviated somewhat in 1994 when levels surpassed 2 million metric tonnes.

Human consumption of oats and seed requirements make up the difference between total domestic use and feed oats. Panel B of Figure 7 reveals the human consumption and seed requirement trend over the same time duration. The pattern of usage for human consumption has remained steady between 70 and 90 metric tonnes until the 1992-93 crop year. In 1992-93 and again in 1993-94 human consumption for oats increased by approximately 25 percent.

Seed requirements also remained quite stable until 1988-89, fluctuating between a low of 142 thousand tonnes (1986-1987) to a peak of 179 thousand tonnes in 1988-1989.

Total Domestic Use

Animal Feed & Total Domestic Use

'000 of Metric tonnes

Year

- ▲ Animal Feed ⌧ Total Domestic Use

Human Consumption & Seed Requirements

'000 of Metric tonnes

Year
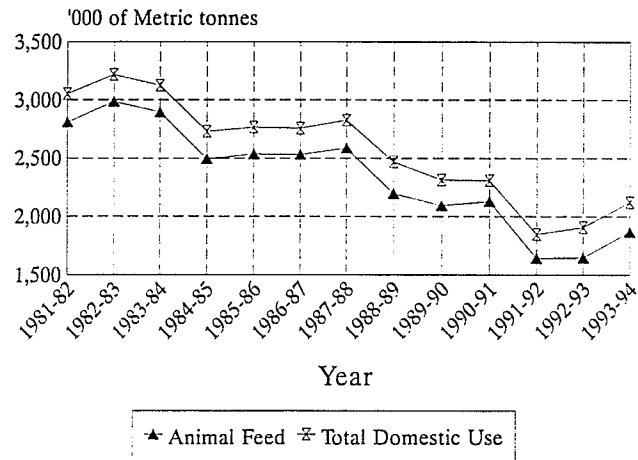
- ▲ Human Consumption ⌧ Seed Requirements
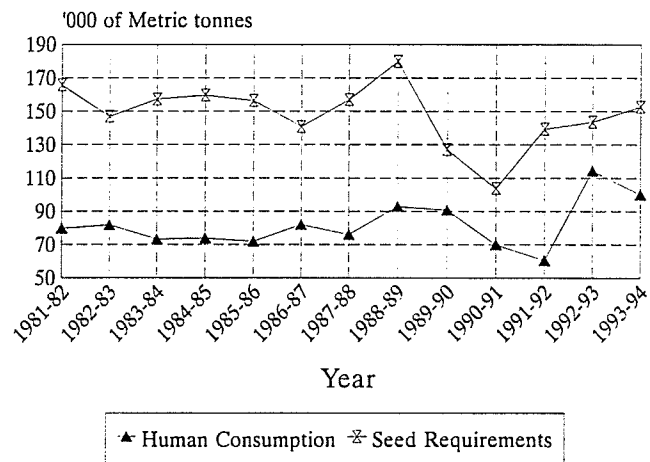
Figure 7
Source: Grain Trade of Canada

Following 1989, a dramatic decrease in seed requirements persisted until a substantial recovery in 1991-1992. However, because of the overwhelming use of oats in the feed industry, fluctuations in human consumption and seed requirements have for the most part gone unnoticed.

Total domestic use has fallen off since the early 1980's. It is therefore difficult to determine the resulting impact on the composition of domestic oat usage. For this reason, the specific ratios to total domestic use are provided on the following page. The average, standard deviation, and variances of these ratios are calculated in addition to the individual ratios by crop year. A closer examination of these ratios and of the underlying statistical measures do not support the hypothesis that the change in the marketing structure of the Western Canadian oat industry resulted in a change in the composition of total domestic oat usage.

Increases in the human consumption of oats, which was forecasted in the late 80's, did not occur until 1992-93. However, it is difficult to speculate whether this trend will continue to rise following the 1993-1994 crop year. Regardless of the underlying market structure, it would appear from the data that the overall demand in Canada for feed oats and for seed has remained unchanged.

Ratios to Total Domestic Use

Year	Animal	Human	Seed	Total
1981-82	.9195	.0261	.0543	.9998
1982-83	.9285	.0255	.0457	.9996
1983-84	.9259	.0234	.0503	.9997
1984-85	.9136	.0271	.0586	.9993
1985-86	.9167	.0260	.0566	.9993
1986-87	.9183	.0298	.0511	.9992
1987-88	.9157	.0269	.0556	.9982
1988-89	.8893	.0376	.0728	.9998
Average	.9159	.0278	.0556	.9994
Standard Deviation	.0119	.0044	.0081	
Variance	.0001	.0000	.0001	
Structural Break	**Animal**	**Human**	**Seed**	**Total**
1989-90	.9055	.0393	.0549	.9997
1990-91	.9230	.0303	.0450	.9983
1991-92	.8887	.0327	.0754	.9968
1992-93	.8629	.0599	.0752	.9981
1993-94	.8803	.0472	.0720	.9994
Average	.8921	.0419	.0645	.9984
Standard Deviation	.0231	.0120	.0138	
Variance	.0005	.0001	.0002	

Figure 7, Table 1. Source: Grain Trade of Canada

C) Exports

The purpose of this section is to examine Canadian oat export volumes over the period of 1981-1994, and to determine whether any significant change in these volumes can be attributed to the change in the marketing structure.

Figure 8 *a* and *b* is comprised of four panels. Total exports and exports to the United States are presented in Panel A. The United States is by far the largest market destination for Canadian oats. Exports to the United States have increased substantially since 1985-1986. Record levels of oat exports were achieved in consecutive crop years during the 1988-1990 period. However, in 1990-1991 and again in 1991-1992, exports to the United States dropped off significantly. In the final two years, exports to the U.S. have surpassed all previous export levels.

Japan is Canada's second largest customer for Canadian oats. Panel B of Figure 8, demonstrates the dramatic increase in exports destined to the Japanese market. Similar to the United States, Canadian exports to Japan increased substantially after 1985. From a mere 2,400 metric tonnes in 1985-1986, Japan has consistently imported more than 20,000 metric tonnes since the 1989-1990 crop year. The bulk of this increase, approximately 15,500 metric tonnes per crop year, has taken place following the 1988-1989 crop year.

Exports of Canadian oatmeal and rolled oats witnessed a more dramatic change. In Panel C of Figure 8, total exports of oatmeal and rolled oats are plotted alongside exports to the United States. Until 1987, Canadian exports of oatmeal and rolled oats were essentially non-

Canadian Oat Exports

Metric Tonnes (Thousands)

Crop Years

Panel A

Metric Tonnes (Thousands)
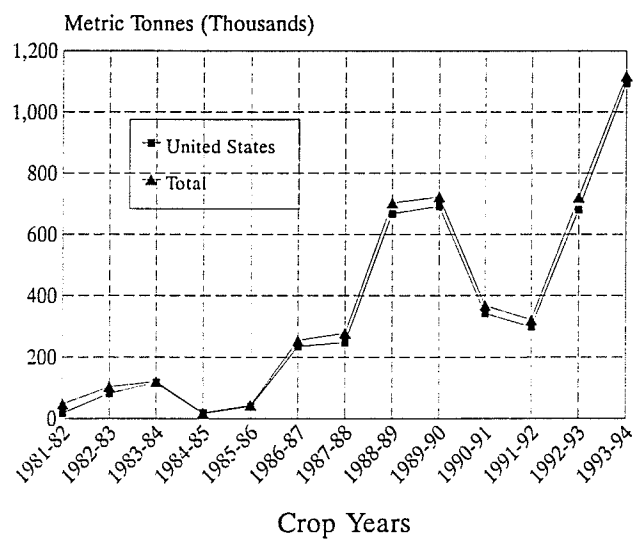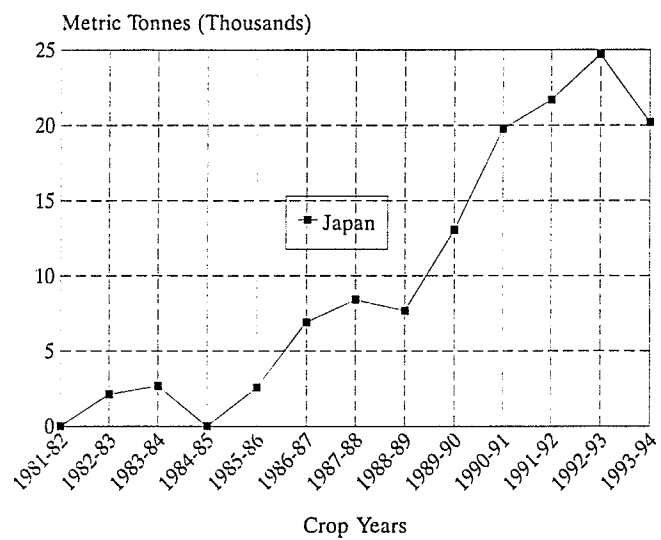
Crop Years

Panel B

Figure 8a

Source: Grain Trade of Canada

Canadian Oat Exports

Metric Tonnes (Thousands)

United States ■ Total

Panel C

Exports*

* Oatmeal & Rolled Oats

Metric Tonnes (Thousands)

South America ■ Central America
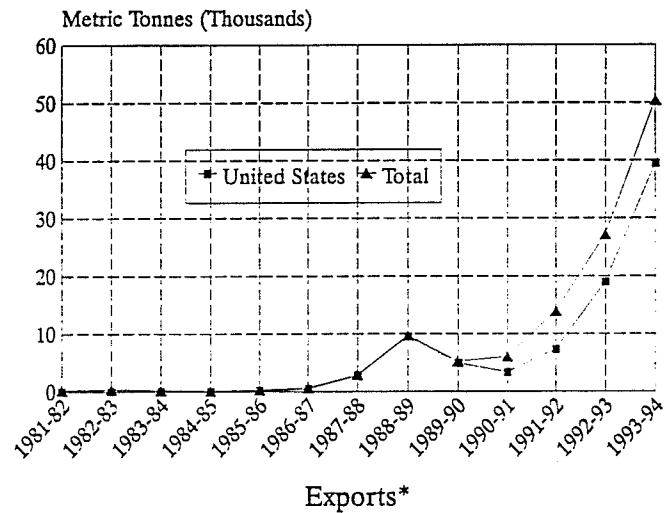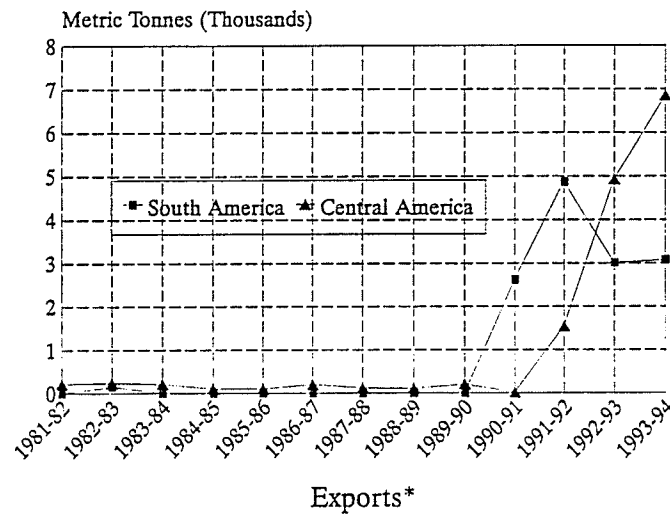
Panel D

Exports*

* Oatmeal & Rolled Oats

Figure 8b

Source: Grain Trade of Canada

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existent. Although exports grew during the 1988-1989 crop year, levels fell off again in 1989-1990. The most dramatic change came between 1990 and 1994, when exports of oatmeal and rolled oats climbed from just over 5,000 metric tonnes in 1989-1990, to over 27,000 and 50,000 metric tonnes in 1992-1993, 1993-94 respectively. The increase is attributed almost entirely to rising United States imports.

Central America, and South America make up the remaining export portion of oatmeal and rolled oats. Since 1991 Central America has imported an increasing amount of Canadian oatmeal and rolled oats. Following a similar pattern of exports, the South American market remained dormant until 1989. Since this time, exports have increased considerably.

Oat exports have grown since 1985.[80] Since the 1987-1988 crop year, the rate of growth has increased substantially. Exports of Canadian oatmeal and rolled oats witnessed an extraordinary surge in sales to the United States and to South America following 1989-90. Although it is difficult to establish a conclusive determinant for the overall increase in oat exports, it would appear that private sector agents were more successful in ferreting out and serving niche markets for value-added products such as oat meal. This would support Veeman's (1993) proposition that by allowing the market structure to permit a number of traders to seek out market opportunities, would likely result in increased sales to these markets. The export volume data presented in this section thus supports the hypothesis that

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[80] Over the same period exports of wheat increased by 14 percent and barley exports fell by 11.6 percent. Canadian Wheat Board Annual Reports.

a change in the marketing structure of the Western Canadian oat industry from single desk

selling to the open market, resulted in increased exports of Canadian oats to the United States

and to the rest of the world.

D) Supply and Disposition

The purpose of this section is to examine the supply and disposition of the Western Canadian

oat industry before and after the structural change in marketing methods. The main objective

is to test Carter's hypothesis that a move from single desk selling towards the open market

would involve an adjustment to comparative advantage and to specialization signals, and that

production would become geographically concentrated.

The analysis begins by providing a brief overview of the Western Canadian oat market yield,

acreage, and production statistics. Shortly thereafter, the focus of the analysis then

concentrates upon the geographical distribution of harvested acreage and production across

the Prairie provinces.

I) Yield

Figure 9 examines the yield statistics for oats across the Western Provinces. The first Panel

of Figure 9 plots Western provincial yield statistics alongside findings for the entire country.

The range of data between 1981 and 1994, detect a low of 1,800 in 1984, to a high of 2,700

Western Canadian Oat Yield Analysis

Pane A
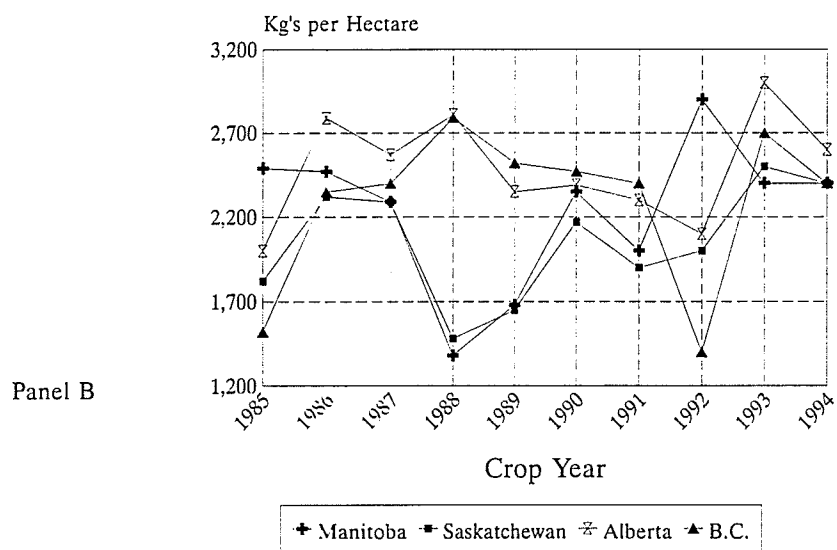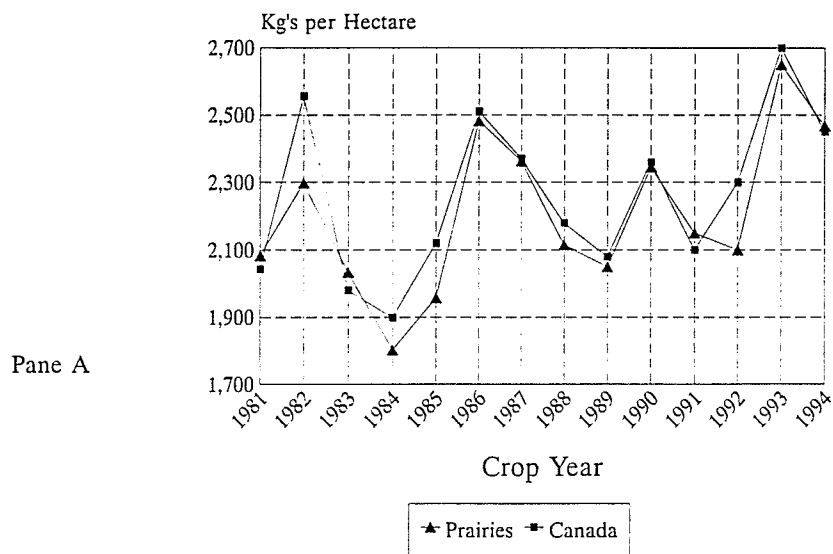
Panel B

Figure 9
Source: Canada Grains Council

kilograms per hectare in 1993. The data also suggest comparable yield measurements across the country. Panel B of Figure 9 provides a Western provincial analysis over a ten year period. Although the pattern of data is difficult to follow, a close inspection uncovers similar yield patterns for Alberta and British Columbia. Comparable yield results between Manitoba and Saskatchewan are also evident. It is fair to say that prior to 1989 Alberta and British Columbia maintained a comparative advantage over Manitoba and Saskatchewan in terms of yield. However, since this time, the Saskatchewan and Manitoba yields have improved dramatically and are now comparable to yield results for Alberta.

ii) Area

Figure 10 provides an examination of the oat acreage in Canada. The total number of oat hectares in Canada and the Prairie provinces are plotted simultaneously in Panel A. The most noticeable element arising from this Figure is the dominance of the Prairie provinces. Over the entire period (1981-1994), the Prairies have accounted for between 77 and 83 percent of the total area in Canada devoted to oat production. As a result of this dominance, the series depicting acreage in Canada parallels the Prairie measurement.

More specifically, the area devoted to oat production in Canada has averaged 1.3 million hectares over the 1981-1994 period. The Prairie average over the same duration has been approximately 1.1 million hectares. Excluding 1991 from the data set, the Canadian and Prairie average climbs to 1.4 and 1.3 million hectares respectively.

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Western Canadian Oat Area Analysis

Panel A
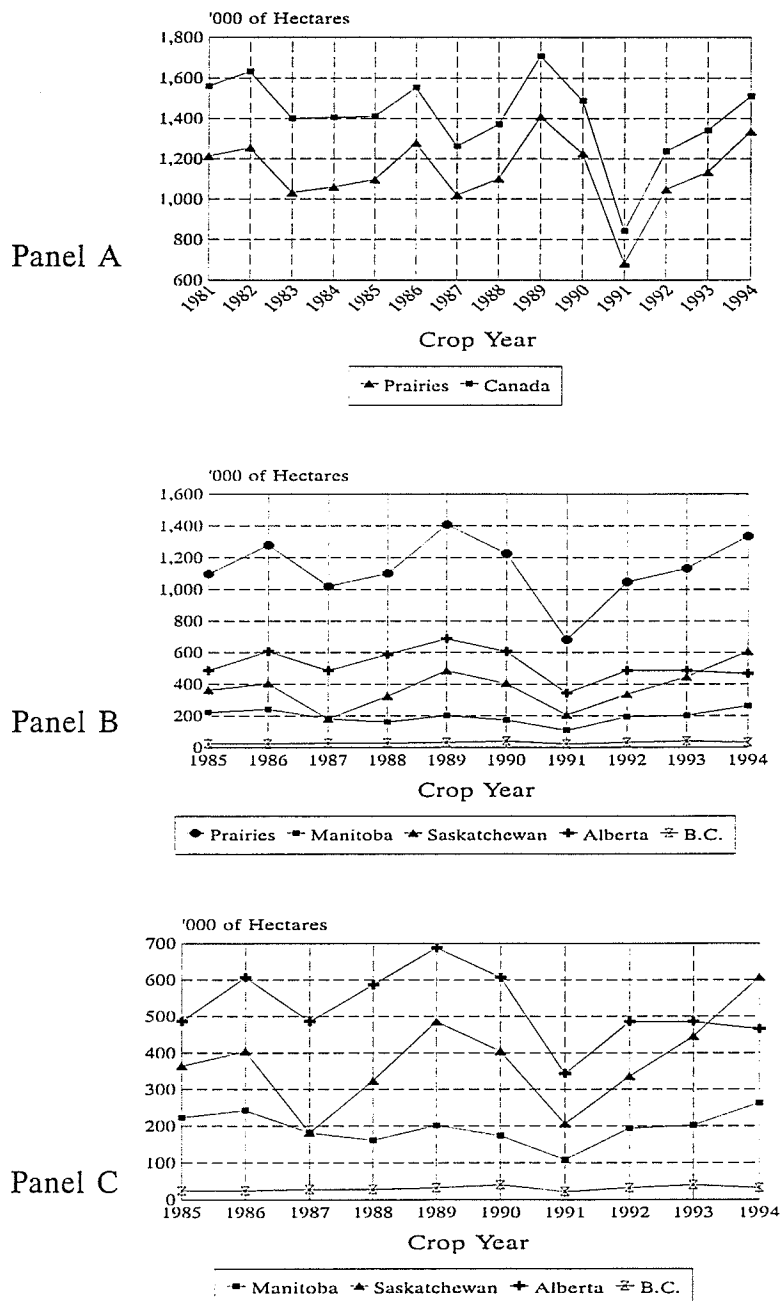
Panel B

Panel C

Figure 10

Source: Canada Grains Council

Panel B of Figure 10 isolates the Western provincial analysis. A total of five series are plotted in this Panel. The uppermost series reports total area in Western Canada, while the remaining four series account for the individual Western provinces. The results of this particular graph are significant because it ranks the provinces in order of total area devoted to oats. For example, Alberta has historically had the largest area devoted to oats, followed by Saskatchewan, Manitoba, and finally British Columbia. In the final year of data, area in Saskatchewan surpassed Alberta for the first time.

Although ranking first in oat yield, the area devoted to oats in British Columbia is insignificant. Alberta, Saskatchewan, and Manitoba account for the preponderance of the area devoted to oat acreage across Canada. Alberta has averaged between 1 and 2 million hectares each year. Saskatchewan has averaged between 500 and 600 thousand hectares. Manitoba, in third place, has averaged around 200 thousand hectares, and finally British Columbia with 30 to 50 thousand hectares per year.

Panel C of Figure 10, explains much of the variation found in Panels A and B. It has been established that Alberta and Saskatchewan account for, on average, between 73 and 78 percent of the total Canadian area devoted to oats. For these reasons, changes in overall Canadian area totals are explained by fluctuations in Alberta and/or Saskatchewan. In 1989, and 1991 for example, large fluctuations in total oat area was clearly a result of the variation found in Alberta and Saskatchewan totals.

Oat acreage in British Columbia and Manitoba has remained quite stable throughout the period. Since 1990, oat acreage in Alberta has remained lower than historical levels for that province. The area in Saskatchewan on the other hand, has continued to increase particularly since 1991. In 1994, Saskatchewan became the leading province in the amount of area devoted to oat production.

iii) Production

A broad illustration of Canadian oat production is displayed in three panels of Figure 11. Oat production between 1981 and 1994 for Canada and the Prairies is plotted in Panel A. Panel B compares Western provincial totals with overall Prairie oat production. The series depicting Prairie production is removed in the final panel in order to examine each of the Western provinces separately.

The Prairie provinces account for approximately 85 percent of the oat production in Canada. In 1991, oat production fell off dramatically due to extremely low price levels during the seeding period. Since this time however, production has continued to grow through to 1994.

Oat production has increased in Saskatchewan and Manitoba. This can be seen in Panel C of Figure 11. Production in Alberta has remained consistently lower than levels established in 1988 and 1989.

Western Canadian Oat Production Analysis

Panel A

'000 of metric tonnes

Crop Year

⁎ Canada ▪ Prairies

Panel B

'000 of Metric Tonnes

Crop Year

● Prairies ▪ Manitoba ✚ Saskatchewan ✦ Alberta ▲ B.C.

Panel C

'000 of Metric Tonnes

Crop Year
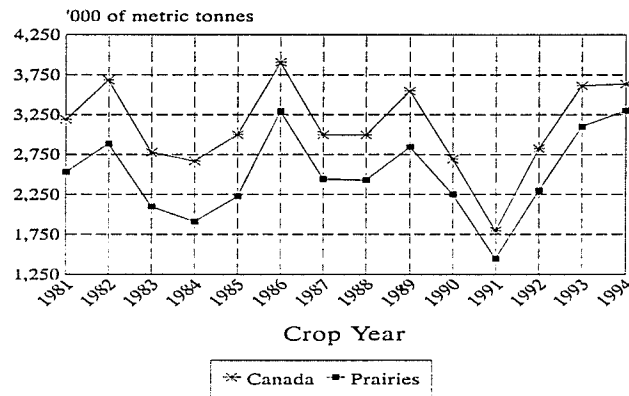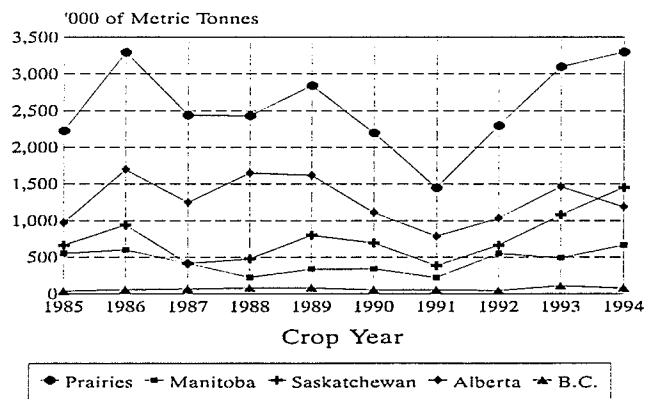
▪ Manitoba ✚ Saskatchewan ✦ Alberta ▲ B.C.
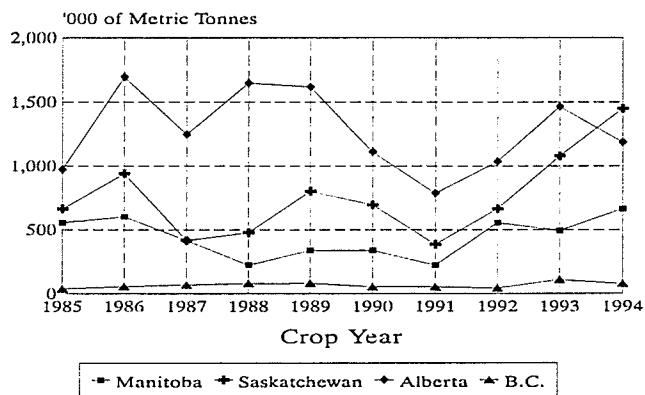
Figure 11

Source: Canada Grains Council

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Prairie crop district data can provide a closer and more accurate examination of the production patterns. For this reason, an inspection of the available data is in order. In order to aid in the ensuing analysis, a crop district map is provided in Appendix 3.

iv) Prairie Crop District Analysis

a) Harvested Area

The intention of this section is to examine the Prairie provincial patterns of harvested acreage and production among crop districts between 1983 and 1994 and to determine whether the move from single desk selling towards the open market resulted in an adjustment to comparative advantage and to specialization signals, and to determine whether or not production has become geographically concentrated. The data examines the single desk selling period of 1983-1988 against the 1989-1994 period of open marketing.

Table 1 is divided into Tables 1 and 1A. Table 1 provides the total number of harvested oat acreage devoted to each crop district in Manitoba, Saskatchewan, and Alberta. The crop district data of Table 1 are then converted into percent and presented in Table 1A. In doing so, it is much easier to visualize those crop districts constituting the largest area devoted to oat acreage among the provinces. Table 1A, for example, demonstrates that the Northwest, Central, and Southwest crop districts constitute approximately 80 percent of the area harvested for oats, and thus form the main oat harvesting regions of Manitoba. In Manitoba and of particular significance, is a large percentage increase in the harvested oat acreage in the Central district. The data demonstrates that the 1989-1994 percentage share in the

Table 1
Harvested Oat Acreage Among the Prairie Provinces
By Crop District ('000 of Acres)

MANITOBA

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1989-1994 Average
SOUTHWEST	192.0	168.0	181.0	152.0	140.0	116.0	156.5	141.0	139.0	93.6	150.0	149.0	190.0	143.6
NORTHWEST	126.0	140.0	146.0	99.0	86.0	92.0	115.2	103.0	98.0	53.7	70.0	102.0	115.0	90.3
CENTRAL	109.0	134.0	122.0	107.0	118.0	114.0	117.3	145.0	109.0	66.3	179.0	169.0	240.0	151.4
EASTERN	53.0	52.0	50.0	49.0	53.0	41.0	49.7	52.0	27.0	25.1	41.0	43.0	65.0	42.2
INTERLAKE	70.0	76.0	51.0	43.0	51.0	51.0	57.0	59.0	57.0	31.2	40.0	39.0	40.0	44.4
TOTAL	550.0	570.0	550.0	450.0	450.0	416.0	497.7	500.0	430.0	269.9	460.0	502.0	650.0	472.0

SASKATCHEWAN

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1989-1994 Average
#1	115.0	101.0	113.0	124.0	119.1	118.4	115.1	163.7	104.2	63.3	143.2	160.3	187.6	137.1
#2	45.0	44.0	38.0	47.0	45.6	45.9	44.3	64.4	41.5	25.6	46.0	75.3	66.8	53.6
#3	93.0	52.0	41.0	86.0	87.9	93.2	75.5	137.7	93.8	61.0	90.1	90.8	118.1	98.6
#4	36.0	9.0	18.0	31.0	34.1	38.5	27.8	60.2	43.2	29.5	15.0	33.8	22.8	34.1
#5	173.0	190.0	189.0	143.0	140.9	143.9	163.3	204.9	134.5	84.4	186.9	252.7	434.9	216.4
#6	65.0	74.0	97.0	89.0	87.8	89.8	83.8	128.0	84.1	52.8	103.8	130.0	169.8	111.4
#7	65.0	51.0	52.0	61.0	61.6	64.7	59.2	94.2	63.4	40.8	40.4	61.9	51.4	58.7
#8	48.0	64.0	56.0	36.0	37.2	39.7	46.8	59.2	40.8	26.6	56.9	94.1	154.4	72.0
#9	210.0	165.0	146.0	183.0	185.8	195.9	181.0	287.7	194.7	126.0	147.9	201.1	242.0	199.9
TOTAL	850.0	750.0	750.0	800.0	800.0	830.0	796.7	1,200.0	800.0	510.0	830.0	1,100.0	1,450.0	981.7

ALBERTA

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1989-1994 Average
1	113.0	44.0	70.0	80.0	31.0	64.0	67.0	71.0	42.0	60.0	48.1	73.5	90.0	64.1
2	49.0	46.0	59.0	71.0	51.0	53.0	54.8	67.0	66.0	40.0	46.9	36.0	30.0	47.7
3	139.0	86.0	51.0	113.0	81.0	97.0	94.5	141.0	87.0	50.0	71.1	68.2	65.0	80.4
4A	147.0	154.0	153.0	151.0	147.0	175.0	154.5	191.0	157.0	127.0	120.7	135.6	115.0	141.1
4B	183.0	219.0	181.0	219.0	204.0	238.0	207.3	242.0	189.0	153.0	213.0	223.5	186.0	201.1
5	205.0	247.0	226.0	227.0	240.0	264.0	234.8	263.0	176.0	125.0	207.3	206.2	186.0	194.6
6	228.0	251.0	268.0	281.0	260.0	311.0	266.5	297.0	202.0	185.0	231.2	233.1	261.0	234.9
7	86.0	103.0	92.0	158.0	186.0	248.0	145.5	277.0	229.0	110.6	261.7	223.9	215.0	219.5
TOTAL	1,150.0	1,150.0	1,100.0	1,300.0	1,200.0	1,450.0	1,225.0	1,549.0	1,150.0	850.6	1,200.0	1,200.0	1,150.0	1,183.3

Source: Provincial Agricultural Offices

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Table 1A
Harvested Oat Acreage Among the Prairie Provinces
By Crop District (Percentage '000 of Acres)

MANITOBA

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1988-1994 Average
SOUTHWEST	34.9%	29.5%	32.9%	33.8%	31.1%	28.4%	31.8%	28.2%	32.3%	34.7%	31.3%	29.7%	29.2%	30.9%
NORTHWEST	22.9%	24.6%	26.5%	22.0%	19.6%	22.1%	22.9%	20.6%	22.8%	19.9%	14.6%	20.3%	17.7%	19.3%
CENTRAL	19.8%	23.5%	22.2%	23.8%	26.2%	27.4%	23.8%	29.0%	25.3%	24.6%	37.3%	33.7%	36.9%	31.1%
EASTERN	9.6%	9.1%	9.1%	10.9%	11.8%	9.9%	10.1%	10.4%	6.3%	9.3%	8.5%	8.6%	10.0%	8.8%
INTERLAKE	12.7%	13.3%	9.3%	9.6%	11.3%	12.3%	11.4%	11.6%	13.3%	11.6%	8.3%	7.8%	6.2%	9.8%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

SASKATCHEWAN

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1988-1994 Average
#1	13.5%	13.5%	15.1%	15.5%	14.9%	14.3%	14.5%	13.6%	13.0%	12.4%	17.3%	14.6%	13.0%	14.0%
#2	5.3%	5.9%	5.1%	5.9%	5.7%	5.5%	5.6%	5.4%	5.2%	5.0%	5.5%	6.8%	4.7%	5.5%
#3	10.9%	6.9%	5.5%	10.8%	11.0%	11.2%	9.4%	11.5%	11.7%	12.0%	10.9%	8.3%	8.1%	10.4%
#4	4.2%	1.2%	2.4%	3.9%	4.3%	4.6%	3.4%	5.0%	5.4%	5.8%	1.8%	3.1%	1.6%	3.8%
#5	20.4%	25.3%	25.2%	17.9%	17.6%	17.3%	20.6%	17.1%	16.8%	16.5%	22.5%	23.0%	30.0%	21.0%
#6	7.6%	9.9%	12.9%	11.1%	11.0%	10.8%	10.6%	10.7%	10.5%	10.4%	12.5%	11.8%	11.7%	11.3%
#7	7.6%	6.6%	6.9%	7.6%	7.7%	7.8%	7.4%	7.9%	7.9%	8.0%	4.9%	5.6%	3.5%	6.3%
#8	5.6%	8.5%	7.5%	4.5%	4.7%	4.8%	5.9%	4.9%	5.1%	5.2%	6.9%	8.6%	10.6%	6.9%
#9	24.7%	22.0%	19.5%	22.9%	23.2%	23.6%	22.6%	24.0%	24.3%	24.7%	17.8%	18.3%	16.7%	21.0%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

ALBERTA

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1988-1994 Average
1	9.8%	3.6%	6.4%	6.2%	2.6%	4.4%	5.5%	4.6%	3.7%	7.1%	4.0%	6.1%	7.6%	5.5%
2	4.3%	4.0%	5.4%	5.5%	4.3%	3.7%	4.5%	4.3%	5.7%	4.7%	3.9%	3.0%	2.6%	4.0%
3	12.1%	7.5%	4.6%	8.7%	6.8%	6.7%	7.7%	9.1%	7.6%	5.9%	5.9%	5.7%	6.7%	6.6%
4A	12.6%	13.4%	13.9%	11.6%	12.3%	12.1%	12.7%	12.3%	13.7%	14.9%	10.1%	11.3%	10.0%	12.0%
4B	15.9%	19.0%	16.5%	16.6%	17.0%	16.4%	16.9%	15.6%	16.4%	18.0%	17.6%	18.6%	16.2%	17.1%
5	17.6%	21.5%	20.5%	17.5%	20.0%	18.2%	19.3%	17.0%	15.5%	14.7%	17.3%	17.2%	16.3%	16.3%
6	19.8%	21.8%	24.4%	21.6%	21.7%	21.4%	21.8%	19.2%	17.6%	21.7%	19.3%	19.4%	22.7%	20.0%
7	7.5%	9.0%	8.4%	12.2%	15.5%	17.1%	11.6%	17.9%	19.9%	13.0%	21.8%	18.7%	18.7%	18.3%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Provincial Agricultural Offices

Central region climbed by 7.3 percent over the 1983-1988 average. The data shows little change in the Northwest and Southwest districts, but small declines are noticeable in the Eastern and Interlake regions.

Harvested oat acreage in Saskatchewan increased dramatically in the period of open marketing. The data in Table 1 demonstrates an overall average increase in harvested oat acreage between the 1983-1988 and 1989-1994 period. It is interesting to note that harvested oat acreage increased in all districts except for in the 7th District, where a small average decline has been evident.

Northern Alberta is the largest oat harvesting region in the province. Districts 4A, 4B, 5, 6, and 7 account for approximately 82 percent of the total Alberta acreage. An examination of the data shows little change in dominance among these crop districts over both time frames. The only noticeable change in Alberta is evident in the Northwestern District 7. Since the 1983-1988 period, the percentage share of harvested acreage in District 7 increased by 6.7 percent. This increase has come about at the expense of slight decreases in six of the seven remaining districts.

b) Production

Table 2 is divided into Tables 2 and 2A. Overall production by crop district is tabulated in Table 2. The totals are then used to calculate the percentage values by district in Table 2A.

Table 2
Oat Production Among the Prairie Provinces
By Crop District ('000 of Tonnes)

MANITOBA

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1989-1994 Average
SOUTHWEST	143.4	107.3	172.7	161.1	121.9	58.5	127.5	69.3	135.1	79.3	187.3	157.9	166.6	129.2
NORTHWEST	89.8	106.7	142.8	92.9	77.7	60.5	95.1	68.4	83.7	45.5	60.1	93.4	106.4	78.3
CENTRAL	84.3	117.8	140.2	120.9	119.9	56.4	106.6	100.6	104.5	55.5	237.5	172.7	280.7	160.1
EASTERN	38.8	46.9	62.8	45.8	51.0	24.2	43.3	44.7	27.5	15.1	49.4	36.8	66.3	40.0
INTERLAKE	44.6	68.6	46.6	41.9	45.8	31.6	46.6	47.2	57.8	26.7	40.9	32.7	43.2	41.4
TOTAL	401.0	447.2	555.2	462.7	416.4	231.3	419.0	330.3	408.7	222.1	555.2	493.6	663.2	447.0

SASKATCHEWAN

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1989-1994 Average
#1	66.0	36.0	71.0	125.0	99.1	64.0	76.5	65.3	99.2	46.6	120.6	152.6	163.9	106.4
#2	30.0	17.0	20.0	49.0	39.9	20.5	29.4	37.0	35.3	19.3	39.5	72.6	51.2	42.5
#3	65.0	19.0	11.0	65.0	71.8	35.6	44.6	84.4	70.6	45.6	71.3	87.1	83.7	73.8
#4	35.0	4.0	4.0	26.0	26.2	14.5	18.3	42.6	31.5	26.5	12.4	34.3	15.8	27.2
#5	130.0	124.0	169.0	133.0	132.4	94.8	130.5	154.3	122.0	63.6	151.8	233.8	435.7	193.5
#6	53.0	32.0	68.0	76.0	74.0	33.3	56.4	73.9	61.6	37.7	85.2	139.4	160.9	93.1
#7	56.0	27.0	32.0	64.0	51.6	34.8	44.3	52.6	46.9	27.4	30.3	61.7	43.7	43.8
#8	42.0	51.0	58.0	32.0	34.5	25.2	40.5	40.0	40.4	22.2	40.7	98.6	191.4	73.7
#9	173.0	122.0	122.0	183.7	179.7	180.8	160.2	242.9	188.5	94.7	111.2	199.2	241.7	179.4
TOTAL	652.0	432.0	555.0	755.7	709.4	493.5	599.6	802.0	604.0	385.6	663.2	1,079.5	1,388.0	835.4

ALBERTA

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1989-1994 Average
1	84.3	18.8	28.7	65.3	19.1	29.0	40.9	32.0	20.2	49.0	41.4	74.9	71.0	48.1
2	47.0	30.0	42.8	82.5	54.7	53.0	51.7	54.9	56.8	40.0	45.9	44.5	29.5	45.3
3	121.7	43.7	28.7	123.6	94.1	93.0	84.1	130.7	91.3	47.3	67.9	84.8	60.3	80.4
4A	128.1	104.7	122.0	174.2	130.4	149.0	134.7	130.0	138.6	112.5	99.5	149.7	97.6	122.6
4B	155.2	190.1	144.3	256.8	201.9	250.0	199.7	245.2	176.5	115.8	160.5	258.6	191.6	191.4
5	208.3	251.5	230.4	285.0	286.0	387.0	271.0	291.7	201.0	140.6	200.3	276.6	236.4	224.4
6	218.8	232.9	262.5	316.1	269.3	402.0	283.6	297.1	206.5	163.4	174.6	302.3	281.0	237.5
7	87.5	84.8	61.6	145.4	193.9	309.0	147.0	290.2	219.5	117.9	248.2	273.7	220.0	227.9
TOTAL	1,048.9	956.5	921.0	1,448.9	1,249.4	1,652.0	1,212.8	1,480.8	1,110.4	786.5	1,038.3	1,465.1	1,187.4	1,177.8

Source: Provincial Agricultural Offices

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Table 2A

Oat Production Among the Prairie Provinces

By Crop District (Percentage '000 of Tonnes)

MANITOBA

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1988-1994 Average
SOUTHWEST	35.8%	24.0%	31.1%	34.8%	29.3%	25.3%	30.0%	20.4%	33.1%	35.7%	30.1%	32.0%	25.1%	29.4%
NORTHWEST	22.4%	23.9%	25.7%	20.1%	18.7%	26.1%	22.8%	20.2%	20.5%	20.5%	10.8%	18.9%	16.0%	17.8%
CENTRAL	21.0%	26.3%	25.3%	26.1%	28.8%	24.4%	25.3%	32.3%	25.6%	25.0%	42.8%	35.0%	42.3%	33.8%
EASTERN	9.7%	10.5%	9.5%	9.9%	12.3%	10.5%	10.4%	13.2%	6.7%	6.8%	8.9%	7.4%	10.0%	8.8%
INTERLAKE	11.1%	15.3%	8.4%	9.1%	11.0%	13.7%	11.4%	13.0%	14.2%	12.0%	7.4%	6.6%	6.5%	10.1%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

SASKATCHEWAN

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1988-1994 Average
#1	10.4%	8.3%	12.8%	16.5%	14.0%	10.9%	12.2%	8.1%	14.3%	12.6%	18.2%	14.2%	11.8%	13.2%
#2	4.6%	3.9%	3.6%	6.5%	5.6%	4.2%	4.7%	4.6%	5.1%	5.0%	6.0%	6.7%	3.7%	5.2%
#3	10.0%	4.4%	2.0%	8.6%	10.1%	7.2%	7.0%	10.5%	10.2%	11.8%	10.8%	8.1%	6.0%	9.6%
#4	5.4%	0.9%	0.7%	3.4%	3.7%	2.9%	2.8%	5.3%	4.5%	6.9%	1.9%	3.2%	1.1%	3.8%
#5	19.9%	28.7%	30.5%	17.6%	18.7%	19.2%	22.4%	19.2%	17.6%	16.5%	22.9%	21.7%	31.4%	21.5%
#6	8.1%	7.4%	12.3%	10.3%	10.4%	6.7%	9.2%	9.2%	8.9%	9.8%	12.8%	12.9%	11.6%	10.9%
#7	8.6%	6.3%	5.8%	8.5%	7.3%	7.1%	7.2%	6.0%	6.8%	7.1%	4.6%	5.7%	3.1%	5.6%
#8	6.4%	11.8%	10.5%	4.2%	4.9%	5.1%	7.2%	6.1%	5.8%	5.8%	6.1%	9.1%	13.8%	7.8%
#9	26.5%	28.2%	22.0%	24.3%	25.3%	36.6%	27.2%	30.3%	26.9%	24.6%	16.8%	18.5%	17.4%	22.4%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

ALBERTA

Crop District	1983	1984	1985	1986	1987	1988	1983-1988 Average	1989	1990	1991	1992	1993	1994	1988-1994 Average
1	8.0%	2.0%	3.1%	4.5%	1.6%	1.8%	3.5%	2.2%	1.8%	6.2%	4.0%	5.1%	6.0%	4.2%
2	4.5%	3.1%	4.6%	5.7%	4.4%	3.2%	4.3%	3.7%	5.1%	5.1%	4.4%	3.0%	2.5%	4.0%
3	11.6%	4.6%	3.1%	8.5%	7.5%	5.6%	6.8%	8.8%	8.2%	6.0%	6.6%	5.8%	5.1%	6.7%
4A	12.2%	10.9%	13.2%	12.0%	10.4%	9.0%	11.3%	9.4%	12.5%	14.3%	9.6%	10.2%	8.2%	10.7%
4B	14.6%	19.9%	15.7%	17.7%	16.2%	15.1%	16.6%	16.6%	15.9%	14.7%	15.5%	17.7%	16.1%	16.1%
5	19.7%	26.3%	25.0%	19.7%	22.9%	22.2%	22.6%	19.7%	18.1%	17.9%	19.3%	18.9%	19.9%	19.0%
6	20.9%	24.3%	28.5%	21.6%	21.6%	24.3%	23.6%	20.1%	18.6%	20.8%	16.8%	20.6%	23.7%	20.1%
7	8.3%	8.9%	6.7%	10.0%	15.5%	18.7%	11.4%	19.6%	19.8%	15.0%	23.8%	18.7%	18.5%	19.2%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

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Source: Provincial Agricultural Offices

It has already been established that Manitoba ranks third among the Prairie provinces in oat production. Over the entire 1983 through 1994 period, approximately 80 percent of the production in Manitoba has been derived in the Southwest, Central, and Northwest crop districts.

The oat production pattern in Manitoba has changed since 1988. Production of oats in the Northwest, Interlake, and Eastern regions has fallen off. After 1991, large production increases in the magnitude of 180 thousand tonnes resulted in the Central district. Over the two marketing stratagems, production in the Central district grew by thirty three percent over long term average production totals.

Oat production in Saskatchewan is dominated by Districts 9, 5, and 1. Collectively these three districts account for approximately 60 percent of the oat production in the province. Historically, District 9 has had the largest production, followed by District 5 and then District 1. However, since 1988 District 5 has become the largest oat producing region in the province.

Saskatchewan production has dramatically increased. Since the 1983-1988 period, oat production has increased by an average of 235.8 thousand tonnes, or by 28 percent. An even higher increase of 35 percent is revealed when the 1991 data is excluded.[81]

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[81] Oat prices during February and March of 1991 fell to historical lows. This resulted in a shift away from oats across the Prairie provinces towards other

The increase in Saskatchewan's production has been the result of large production increases in Districts 1 through 6, and in District 8. These increases are evident in Table 2. In terms of the percentage share of production among crop districts, very little has transpired. Although large production increases have resulted in Saskatchewan, it is difficult to attribute the changes to selective districts in terms of percentage shares.

The pattern of oat production has not changed quite so dramatically in Alberta. Districts 4B, 5, 6, and 7 constitute 75 percent of the total provincial production and thus dominate the oat production in Alberta. Overall oat production in Alberta has remained consistent, fluctuating by only 35 thousand tonnes over the 1983-88 and 1989-1994 averages. A visual inspection of Table 2A, demonstrates that the only significant change in Alberta has been a 7.8 percent production percentage share increase in District 7. This translates into a 35 percent overall increase since 1989. For the most part however, District 6 remains to be the dominate oat producing region in terms of both harvested acreage and production.

v) Crop District Data Synopsis

In Manitoba, harvested area and production increased substantially in the Central district, while decreased activity was reported in the Interlake, Northwest, and Eastern districts. Harvested acreage and production increased dramatically in most parts of Saskatchewan.

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grains. For this reason harvested acreage and production levels in 1991 were significantly lower than previous levels. In most cases harvested acreage and production across the Prairie crop districts fell by between 30 to 52 percent.

Only District 7 of Saskatchewan reported slight decreases in both harvested acreage and production. In Alberta, harvested area and production were noticed to have increased in only one of the seven districts. This occurred in the Northwestern District 7. In the remaining districts, very little change can be reported.

In order to adequately test whether a significant change in harvested acreage and production occurred, statistical hypothesis testing of the individual crop districts is employed. The data used for the T-statistic tests of hypothesis is found in Appendix 4. This particular test can be used to determine whether statistically significant differences in harvested acreage and production have resulted over two time frames. The time frames that are of concern is the 1983-1988 period of single desk selling versus the 1989-1994 period of open market trading.

The testing procedure assumes that the data is normally distributed, and therefore is unaffected by the underlying market structure in either period. Each crop district is tested before and after the structural change in the market. In the case of Manitoba, the crop districts reported earlier in Tables 1 and 2, are divided into 12 separate districts in order to provide for more accurate results. These sub-divided districts can be referred to in Appendix 3.

In order to detect for statistically significant changes in harvested area and in production patterns as a result of the change in the market structure, the null hypothesis is formulated in the following manner:

$$Ho:(U_1 - U_2) = 0 \qquad (6)$$

Specified in this way, the change in the market structure in August of 1989 should not result in significant differences in harvested acreage or production. The null hypothesis is thus tested against the alternative hypothesis:

$$Ha:(U_1 - U_2) \neq 0 \qquad (7)$$

In this particular case the crop district data renders the use of the T-test statistic. The test statistic is formulated by:

$$Test\ statistic:\ t = \frac{(\overline{x_1} - \overline{x_2}) - Do}{\sqrt{S^2p\ (\frac{1}{n_1} + \frac{1}{n_2})}} \qquad (8)$$

where

$$S^2p = \frac{(n_1 - 1)s^2_1 + (n_2 - 1)s^2_2}{n_1 + n_2 - 2} \qquad (9)$$

and

$$t\frac{\alpha}{2}\ is\ based\ on\ (n_1 + n_2 - 2)\ degrees\ of\ freedom. \qquad (10)$$

The results of these tests are presented in Table 3.

In the case of Manitoba, statistically significant changes in harvested acreage and production have occurred in Districts 7, 8, 10, 11, and 12. Significant increases in harvested acreage have resulted in the Central district which is comprised of Districts 7 and 8. Although production increases in district 8 fall outside of the rejection region, the data reveal statistically significant increases in total production for the Central district since 1988. The T-values for District 10 show a significant decrease in both harvested acreage and production, while results for Districts 11 and 12 are mixed. In district 11 for example, production has increased dramatically whereas in District 12 harvested acreage has fallen off rather significantly since 1988.

The results for Saskatchewan are even more dramatic and represent the greatest change that has occurred in terms of the geographical redistribution of the Western Canadian oat industry. Although the data of Appendix 4 demonstrates an increase in harvested acreage and production in each of the crop districts, oat production since the change in the market structure has been focussed in the south-east/central region of the province. Districts 1, 2, 3, and 6 have all undergone significant increases in both harvested acreage and production since the 1983-1988 period. Although enormous increases in harvested acreage and production are evident in District 5, the statistical test fails to conclude that these changes have been statistically significant. This is because the largest of the increases have occurred in the last two years resulting in a large standard deviation in both harvested acreage and

Table 3

Test Statistic Results for Prairie Crop District Harvested Acreage and Production

Manitoba Crop District	Reported T Values Harvested Acreage	Reported T Values Production
1	-0.31	-0.58
2	0.69	-0.17
3	0.00	-0.78
4	0.91	0.33
5	0.44	1.68
6	0.88	0.24
7	-2.94	-2.33
8	-1.86	-1.74
9	0.00	-0.66
10	2.54	2.11
11	-1.30	-2.15
12	1.95	0.48

Saskatchewan Crop District	Reported T Values Harvested Acreage	Reported T Values Production
1	-2.82	-2.07
2	-2.44	-2.08
3	-2.91	-2.84*
4	-0.81	-1.02
5	-1.67	-1.69
6	-2.79	-2.42
7	-0.36	-0.33
8	-1.80	-1.63
9	-1.43	-1.41

Alberta Crop District	Reported T Values Harvested Acreage	Reported T Values Production
1	0.14	-0.04
2	0.71	0.60
3	0.43	0.14
4A	0.79	0.67
4B	-0.19	-0.25
5	1.63	0.97
6	1.12	0.82
7	-3.11	-2.35

Where the Rejection Region is Defined by:

$$t_{.025} = \pm 2.262 \text{ at } 95\% \text{ Confidence}$$

$$t_{.05} = \pm 1.833 \text{ at } 90\% \text{ Confidence}$$

production. Because the test statistic of Equation 8 must consider the pooled variance for both marketing periods, the enormous increases that have occurred in District 5 particularly in 1993 and again in 1994, have the effect of deflating the overall T-value reported in Table 3. As a result, the changes in District 5 fall outside of the rejection region and no significant changes in harvested acreage nor production is reported.

The structural change in the market has not resulted in a significant change in Alberta's overall harvested acreage and production. The T-values of Table 3, demonstrate that the only significant change that has occurred since the 1983-1988 period has been in the Northwestern District 7. With T-values calculated at -3.11 and -2.35 for harvested acreage and production respectively, the increase in both harvested acreage and production can be deemed statistically significant at the 95 percent level of confidence. The remaining T-values demonstrate that very little change in either direction has resulted in the remainder of the province.

Another interesting way to examine the crop district data is to look at the production ranking among the Prairie provinces and to compare the data across the two marketing periods. Table 4 ranks the crop districts intraprovincially in order to demonstrate how production has changed within the individual provinces. Table 4 also examines the interprovincial Prairie production ranking among crop districts in order to see whether any meaningful changes have transpired.

Table 4
Production Ranking within the Provinces

Alberta Districts

Rank	1983-88	1989-1994
First	6	6
Second	5	7
Third	4B	5
Fourth	7	4B

Saskatchewan Districts

Rank	1983-88	1989-1994
First	9	5
Second	5	9
Third	1	1

Manitoba Districts

Rank	1983-88	1989-1994
First	Southwest	Central
Second	Central	Southwest
Third	Northwest	Northwest

Production Ranking Among the Prairies

Rank	1983-1988	1989-1994
First	Alberta 6	Alberta 6
Second	Alberta 5	Alberta 7
Third	Alberta 4B	Alberta 5
Fourth	Saskatchewan 9	Saskatchewan 5
Fifth	Alberta 7	Alberta 4B
Sixth	Alberta 4A	Saskatchewan 9
Seventh	Saskatchewan 5	Manitoba Central
Eighth	Manitoba Southwest	Manitoba Southwest
Ninth	Manitoba Central	Alberta 4A
Tenth	Manitoba Northwest	Saskatchewan 1

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In Alberta, District 6 has maintained its rank in terms of Alberta's overall oat production across both marketing periods. District 7 however, has vaulted from number fourth position to the second position in terms of regional oat production. The only significant change in Saskatchewan has been a reversal between Districts 9 and 5, while District 1 maintains its third position. As the T-Stat test of Table 3 would indicate, there has been a significant restructuring in Manitoba's oat industry. Under the period of single desk selling, the Southwest district was by far Manitoba's leading oat producer. However, since 1988 the Central district has taken over this ranking.

The interprovincial production ranking across Prairie crop districts provides an overall picture of what has transpired under the open market. Table 4 ranks the top ten Prairie crop districts in terms of production over the 1983-1988 and 1988-1994 period. Of particular significance is a movement of Alberta's crop District 7 from fifth position under single desk selling to second position under the open market. The increase in production that has been seen in Saskatchewan District 5, moves it from a distant seventh position during the first term, to third position in the latter term. In Manitoba, the Central district moves up two positions overtaking the Southwest Manitoba district and District 4A of Alberta.

The location of Prairie oat processors can help explain much of the crop district variation that has occurred since the structural change in the market. There are five oat processors in the Prairie provinces. Can-Oat Milling is located in the Central district of Manitoba in the town of Portage La Prairie. Two mills are located in Saskatchewan, Popowich Milling located

outside of Yorkton, and Robin Hood Mills in Saskatoon. Alberta has two oat mills that specialize in oats for human consumption, the first, Alberta Mills, located north of Edmonton, and the second West Glen Mills, in Barhead. United Grain Growers own and operate a "clipping" mill in Edmonton specializing in the pony oats market, while the Alberta Wheat Pool own similar operations in Grand Prairie and Camrose. Champion Oats, the most recent addition to the Alberta oat feed industry is also located in Grand Prairie.

Figure 12 graphs the processor locales in relation to the Prairie crop districts. Mills actively contract farmers for delivery of high grade human consumption oats. Producers located near processors obviously face lower transportation costs than those located further away. In addition, protein content and grout size vary significantly from region to region, and as a result, processors make every attempt to secure supply from nearby districts. Likewise, preference is given to neighbouring crop districts where on-farm crop testing, research, producer-processor interactions, and on-farm purchasing and product pick-up are easily accomplished.

Contracting supply at farm gate has had a great impact on oat production patterns. Producers in the Southwest and Central districts of Manitoba for example, enjoy an easy outlet for their high quality product. The Central and Southwest districts have a comparative advantage in growing a well developed oat groat with low moisture content and a substantially higher protein content than can be achieved in the northern region. In the summer of 1991 Can Oat began its milling operations and chose Portage La Prairie primarily for its location in terms

Location of Prairie Oat Processors
# In Relation to Crop Districts

Figure 12

of centralized location with respect to end markets, transportation costs, and the availability of high quality oats in the Central and Southwest region of Manitoba. Can Oat executives have indicated that they concentrate their contracting of supply along a north-westerly belt that stretches from Central Manitoba up and into Districts 1, 2, 3, 5, and 6 of Saskatchewan. Their reasoning for doing so, focuses upon the availability of a consistent high quality product, a uniform-sized oat groat, guaranteed high protein, and a low moisture content.

Saskatchewan oat producers in Districts 1, 2, 3, 5, and 6, can choose to deliver to Popowich Milling, Robin Hood, or to Can-Oat, all of which specialize in the human consumption market. Producers in District 9, particularly in the southern portion of the region, can easily deliver to Robin Hood in Saskatoon, or serve the feed industry in neighbouring Alberta.

Of the six oat milling operations in Alberta, only two are designated processors of oats destined for the human consumption market, while the remaining four specialize in the feed industry. West Glen Mills in Barhead, and Alberta Mills just north of Edmonton, specialize in the processing of oats for human consumption. UGG, Alberta Wheat Pool in Grand Prairie and Camrose, and Champion oats also of Grand Prairie, each specialize in oats destined for the feed market. The various locations of oat processors in Central and Northern Alberta make it extremely easy for Alberta farmers to market their crop. The largest producing region is comprised of District 4B, 5, 6, and 7. Farmers in Districts 4B, 5, and parts of southern District 6, can choose to deliver their product to Alberta Oats, West Glen Mills in Barhead, United Grain Growers in Edmonton, or to the Alberta Wheat Pool

in Camrose. It should be noted that although Alberta Oats specializes in oat processing for human consumption purposes, it also serves as a substantial buyer/seller in the market for pony oats.

The producers in more northern locales such as Northern District 6, and particularly producers in District 7, have witnessed a dramatic change in end market outlets for their oats. At the present time, United Grain Growers contracts 38 percent of the total supply in District 7 for sales destined to the pony market. United Grains Growers operate an extensive "on-farm program" that contracts supply, in addition to on-farm pick-up and transportation of the oats to their clipping mill in Edmonton. In addition, Champion Oats, and the Alberta Wheat Pool in Grand Prairie, are both substantial purchasers of oats in the region, and are also involved in on-farm contracting.

More recent events have intensified competition among supply hungry processors as mills from the United States are now actively contracting farmers for Canadian oats. Canadian producers located in Saskatchewan crop Districts 1, 2, 3, 5, and 6, and in the Southwest and Central districts of Manitoba, will surely benefit as the bulk of the U.S. oat mills are located in Iowa and Wisconsin. Competing forces have, and will continue to shift more oat production into the south-central Manitoba districts and into the south-central/south-eastern districts of Saskatchewan. These regions maintain a comparative advantage in terms of proximity to processors and to end markets. In addition, in terms of protein and moisture

content, these regions are best suited to fulfilling the grade specification required of the human consumption market in the United States and in Canada.

The northern region of Alberta has always experienced weather conditions favourable for high oat yield. Using the words of Vince Bokenforh of United Grain Growers, "come monsoon or drought, producers in Northern Alberta (District 7) do very well in terms of yield, 100 to 120 bushels per acre is pretty well guaranteed, whereas crops such as barley require almost ideal conditions (in this area)". High yield capabilities alongside an increased number of end market outlets and an ever increasing export feed industry that is seeking new varieties of oats, Alberta oat growers in Districts 6 and 7 have witnessed very favourable market conditions on the open market.

Since 1988 oat yield in Manitoba and Saskatchewan has steadily increased. Under the open market, greater emphasis has been placed on the market opportunities for oats in the human consumption market. Higher yield patterns in Manitoba and Saskatchewan reflect upon farmers' efforts to consistently produce a high quality product that is suitable for human consumption. On-farm contracting that pays premiums for high quality oats have caused producers to look again at the market potential of this crop as a viable contribution to their domestic income. New incentives under the open market have resulted in a greater number of oat varieties growing in regions where traditionally the crop was planted only as a utility crop.

There has been a significant geographical redistribution in harvested acreage and oat production in the Prairie provinces. The crop district data analysis of this section, demonstrates how these patterns have changed under the open market. Northern Alberta specializes almost entirely in the pony oats market, whereas southern areas of Saskatchewan and Manitoba have since 1988, begun to specialize in high quality oat production destined for the human consumption market. Prairie oat mills, clipping mills, and processors have invested heavily in the oat industry. They have chosen their locations based on the proximity of end markets and upon the availability of a high quality product that can fulfil the needs and specifications of end users.

The crop district analysis of this section supports the hypothesis that the change in the marketing structure of the Western Canadian oat industry from single desk selling to the open market, would result in a reduction of oat production in some areas and greater specialization by some producers in good oat growing regions. High quality oat production destined for the human consumption market has increased in areas that have comparative advantages in terms of location to end-user markets, proximity to processors, the ability to produce an oat groat with high protein content along with a low moisture content, in addition to high yield capabilities. The increased marketing opportunities for the export feed market has resulted in a greater concentration of oat production in northern Alberta in addition to a number of new oat processing facilities. By adjusting to comparative advantage and to specialization signals in both the feed industry and human consumption markets, oat

production has become geographically concentrated in favour of good oat growing regions that are capable of meeting the specific needs of the end-user.

E) Producer Returns

The purpose of this section is twofold. The first is to determine whether the CWB was able to extract higher than normal returns for Western Canadian oat producers. Similar comparisons by Carter, the CWB, and by Schmitz, of cash grain prices relative to CWB producer returns are made for Western Canadian oats. Secondly, Clark's (1995), proposition that feedgrain price relationships may be distorted by a single desk marketing structure, is examined in the context of the Western Canadian oat market. Specifically, the analysis tests the hypothesis that a change in the marketing structure of the Western Canadian oat industry from single desk selling towards the open market resulted in a convergence in the price ratio of oats relative to feed barley. The intent is to determine whether oat prices have increased relative to barley as a result of the market restructuring. The analysis is then extended to determine whether the structural change in the market had any significant impacts on the relative price relationships between the prices of oats at the Winnipeg Commodity Exchange (WCE), and the Chicago Board of Exchange (CBE).

I) Cash Grain Prices vs. CWB Producer Payments

CWB producer payments are compared against WCE and CBE cash grain prices, in order to assess whether the CWB was able to extract higher than normal returns for Western Canadian oat producers. Figure 13 examines CWB producer payments against cash grain

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prices established at the WCE and at the CBE.[82] Average cash grain prices derived from the

WCE and CBE are plotted against CWB producer payments. In order to account for the time

value of money, the CWB final payment is discounted at 5 percent per annum over an

average of six months.

Figure 13 demonstrates that the CWB producer payments did not out perform the CBE nor

the WCE. In fact, CWB producer payments were well below the established CBE prices in

all but the 1988/89 crop year. During the first few years examined in Figure 13, WCE

average cash prices were considerably higher than CWB producer payments. This trend was

reversed during the 1985-86 crop year, and CWB producer payments remained considerably

higher than WCE prices until oats were removed from the Board. It should be noted

however, that in two of the four years that CWB producer payments exceeded the WCE

established prices (and the CBE in the final year), the CWB ran deficits of $6.9 in 1985/86,

and a record $32.4 million dollar deficit in 1988/89.[83] These losses were absorbed by the

Canadian Government.

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[82] CBE prices are presented in Canadian dollars.

[83] The Western Canadian Wheat Growers Association reacted to the CWB oats
pool deficit in 1988/89 in an April 17, 1990 news release. The final statement for
the 1988/89 oats pool showed a $32.4 million account deficit on 811,695 tonnes
of oats. This translated into a loss of $39.77 per tonne. The $24.19 per tonne
sales deficit, along with the $15.68 per tonne in administrative and operating
costs, will be picked up by the Federal government. It should also be noted that
Carter (1993), excludes CWB deficit years from his analysis of CWB producer
returns and prices.

WCE, CBE Cash Grain Prices vs CWB Producer Payments

Price per Tonne

Crop Year

★ WCE Average ■ CBE Average ✧ *CWB Payment
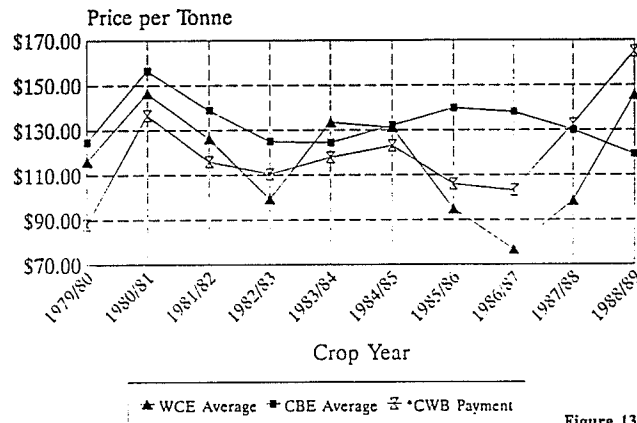
Figure 13

#1 C.W.

Source: Canada Grains Council

WCE, CBE Cash Grain Prices vs CWB Producer Payments on the Designated Pool Account

Price per Tonne

Crop Year

★ WCE Average ■ CBE Average ✧ *CWB Payment
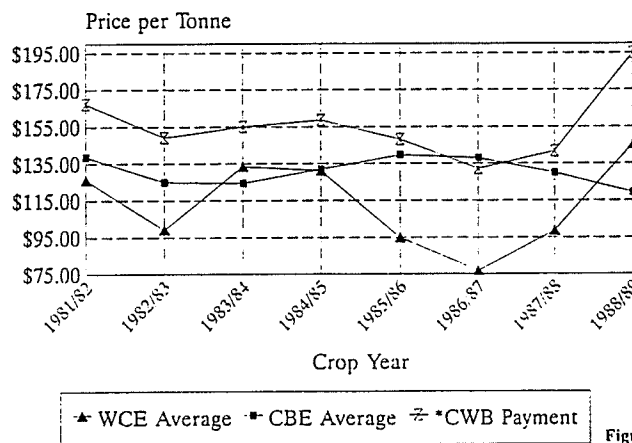
Figure 14

#1 C.W.

Source: Canada Grains Council

A designated oats account was authorized by Order-in-Council on August 1, 1981.[84] Oats

selected and accepted from producers for use in processing and milling for human

consumption could be delivered as "Designated Oats". CWB producer payments in this

account were significantly higher than other categories of oats. CWB producer payments for

designated oats were considerably higher than oats outside of the Designated Pool Account.

Figure 14 examines CWB producer payments from the Designated Pool against WCE and

CBE cash grain prices. CWB producer payments improved considerably over producer

payments received outside of the Designated Account. In all but two crop years (1986/87

and 1987/88), CWB producer payments exceeded average CBE and WCE established cash

prices. The WCE average cash price was significantly out performed by the Designated

Pool.

Receipts of #1 and #2 C.W. oats accounted for 52 percent of total deliveries to the Board in

the 1987/88 crop year.[85] The Designated Oat Pool that operated between 1981 and 1989 was

a good attempt by the CWB to reward producers for a high quality product. The CWB also

made an effort in dealing with processor concerns of supplying them with a consistent high

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[84] Canadian Wheat Board Annual Report, 1987-88 Crop Year. At the
beginning of the crop year the Board was authorized to purchase designated oats
from producers at fixed initial prices of $100.00 and $98.00 per tonne for Nos. 1
and 2 Canada Western Oats respectively and $94.00 per tonne for No. 1 Feed
Oats. Initial prices were increased on October 26, 1987, to $125.00 and $123.00
per tonne for Nos. 1 and 2 Canada Western Oats respectively and $119.00 per
tonne for No. 1 Feed Oats.

[85] Canadian Wheat Board Annual Report, 1987-88 Crop Year

quality product that could be used in processing and milling for human consumption. "As to operating costs, it should be noted that the Designated Oats Pool, by its very nature did not incur the handling expenses normally related to feeding grades of oats. It is not stored by Board, being selected by the purchaser and shipped at his request from farm to processing plant via the country elevator. As a result, the only expense attributable to such oats were costs related to hopper cars owned by the Wheat Board and administrative charges."[86]


ii) Oat Price Ratios

Figure 15 examines the ratio of the six month futures settlement of oat prices on the WCE relative to the CBE over the 1983 to 1995 period. Panel B also examines the six month futures settlement of the ratio of oats to feed barley over the same period. A vertical line is added to each panel in order to mark the announcement of the structural break in marketing methods. Cash grain prices are examined in Figure 16. Panel A considers the ratio of WCE prices relative to the U.S. cash price. WCE prices relative to the U.S. price are plotted in Panel B. Panel A of Figure 15 demonstrates not only an overall increase in the ratio but also a convergence of the six month futures settlement ratio of WCE to CBE. This implies that following the structural break in marketing methods, producers and oat market participants have benefitted by arbitrating between the WCE and the CBE.

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[86] Canadian Wheat Board Annual Report, 1987-88 Crop Year.

Six Month Futures Settlement
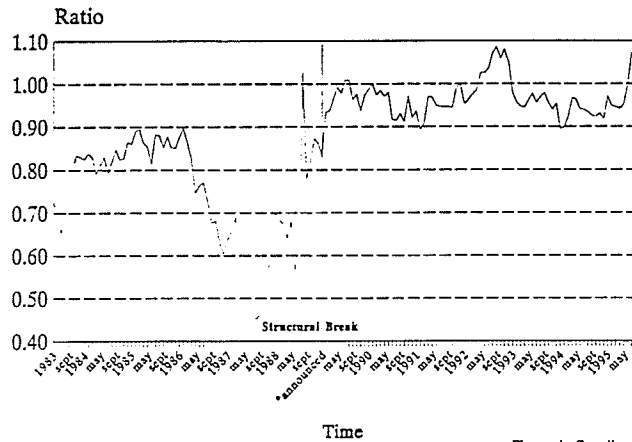
Ratio of WCE to CBE

Panel A

Ratio of #1 C.W. Oats to #1 Feed Barley

Panel B

Figure 15

Prior to 1989, the CBE paid a substantial premium against what could have been attained on the WCE. The ratio depicting the six month futures settlement prices of oats relative to feed barley has also increased on the open market. On the open market, and in terms of the feed grain price relationship, a premium for oats has been established relative to feed barley. Under central desk selling, feed barley traded at a premium relative to oats until 1988. This trend was reversed following the change in marketing methods for oats, and on average, the six month futures settlement price for oats has done considerably better relative to feed barley.

Similar results are attained when examining the cash grain price experience. In Panel A of Figure 16, the ratio of WCE to U.S. prices has increased and has become much more stable than its experience under central desk selling. The results of Panel B are not as obvious. Although it appears that the ratio of oats relative to feed barley has increased, an analytical test is needed in order to determine the extent of the increase.

The ratio of farmgate prices for #1 C.W. oats relative to feed barley are depicted in Figure 17. Again, it is unclear whether the change in marketing structure has affected the oats to feed barley relationship. The use of a time series modelling technique will aid in determining whether a significant change in the ratios have resulted.

Following Carter (1993), and Clark (1995), the impact of discontinuing centralized selling should be visible in feedgrain market price relationships. A time series intervention

Cash Grain Prices

Ratio of WCE to U.S. Prices

Panel A

Time

Figures in Canadian Dollars
Source: Cereals & Oilseeds Review

Ratio of #1 C.W. Oats to #1 Feed Barley

Panel B

Time

Source: Winnipeg Commodity Exchange
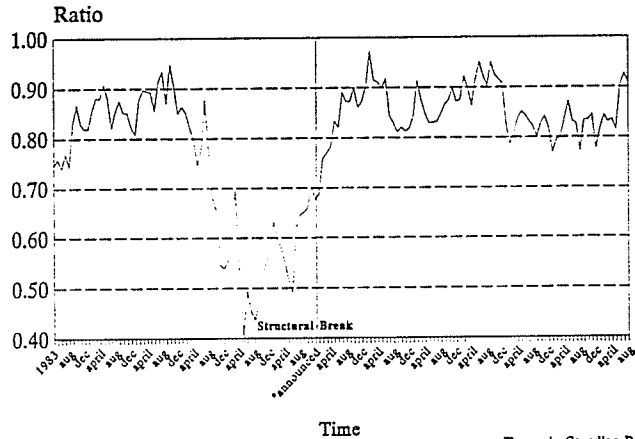
Figure 16

Farm Gate Prices

### Ratio of #1 C.W. Oats to Feed Barley

Time
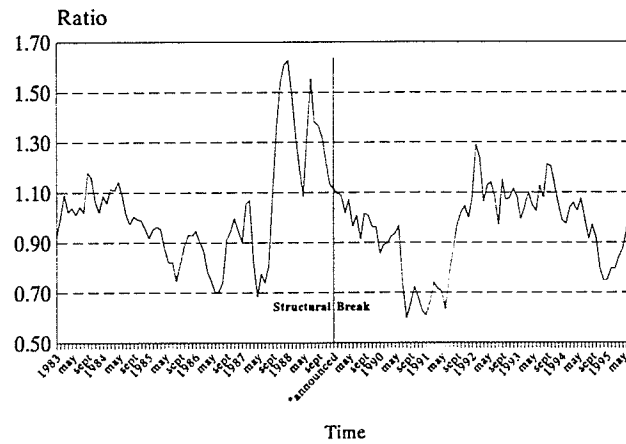
Figure 17
Source: Canada Grains Council

model[87] is capable of estimating the magnitude of change on the individual price ratios as a result of the structural break in marketing methods.

Attention now focuses on answering the following question, given the time series history of Figures 15 through 17 and the known intervention, is there evidence that the above ratios have significantly increased following the change in marketing methods, and, if so, by how much? Box and Tiao (1975), explain that generally, the t-test is applicable only if the observations are approximately normally and independently distributed with constant variances. These assumptions will not be met by the majority of time series data. To develop the intervention model, it is necessary to hypothesize the effect that the change in marketing methods may have had on the price ratios. The simplest scenario is one in which the level of the price ratio is permanently changed by a constant amount. It is also possible to investigate alternative hypotheses regarding the impact of the change from central desk selling to open marketing by hypothesizing that the effect of the policy change is not to immediately cause an immediate change in the price ratio, but to cause a more gradual change.

According to Box and Tiao (1985), the nature of the intervention effect can be estimated by using the analyst's knowledge of the expected behaviour that the identifiable event should produce and by a consideration of the patterns in the output obtained. The modelling process

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[87] See Box, G.E.P., and Tiao, G.C., Intervention Analysis with Applications to Economic and Environmental Problems March 1975.

proceeds by identifying the model form, fitting, and diagnostic checking. Using this process, a model can be framed that describes what is expected to occur given knowledge regarding the known intervention. The following model illustrates the type of intervention effects that can be represented within the transfer function model framework of time series analysis. Consider the situation where the input Z_t is a step function

$$Z_t = S_t^T = \{_1^0 \quad \begin{matrix} t > T \\ \geq T \end{matrix} \tag{11}$$

Equation 11 represents a change or intervention occurring at time T and remaining in effect.[88] The transfer function of the time series data is

$$X_t = \frac{w(B)}{\delta(B)} S_t^T \tag{12}$$

If it is believed that the change on the price ratio is to be gradual and since $X_t = 0$ for $t < T$ and $Xt = w_o$ for $t \geq T$, the level of the output series is permanently changed by w_o for all future time periods starting with period T. This can then be written as

$$X_t = \frac{w_o}{1 - \delta_1 B} S_t^T \tag{13}$$

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[88] For the Western Canadian oat industry the intervention is the January, 1989 announcement that removed the marketing of oats from under the jurisdiction of the CWB.

If the estimate for δ_1 is found to be insignificant, then this parameter may be removed from the model, implying that the change in marketing methods impacted immediately on the price ratio. Under this scenario, Equation 13 becomes

$$X_t = w_o S_t^T \qquad (14)$$

The policy announcement took place January 18, 1989. Therefore the model assumes that the first influence on the six month futures price was not sensed until the following month. Therefore, the period of January 1983 to January 1989 is regarded as containing no intervention effect. These months of data are analyzed to produce a univariate model for the noise series. The data are adjusted to account for seasonality, and the autocorrelation function indicates that the noise series is modelled by an AR(1) for four of the price series and by an ARMA(1,1) modelling procedure for the six month futures of oats relative to feed barley. Inspection of the residuals and the autocorrelation functions of the time series pricing ratios up to and excluding intervention reveal no obvious inadequacies of the model, so a seasonally adjusted stationary model is adopted[89].

For the cash grain and farmgate price series, the period of January 1989 to August of 1989 was modelled as containing no intervention effect. This provides cash grain markets the flexibility of functioning independently outside of potential single desk monopoly marketing

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[89] The sample autocorrelation functions prior to intervention suggest stationarity. Partial autocorrelations and autocorrelation check of residuals are contained in Appendix 5.

influence. The final model used to approximate the intervention effect of removing oats from CWB central desk authority is

$$(Z_t) = w_o(B)S_t \qquad (15)$$

Where:

B is considered as a backshift operator such that

$$By_t = y_{t-1} \qquad (16)$$

The final estimates and T ratios for the parameters are shown in Table 5[90].

Table 5: Intervention Model Results

Price Series	W_o Estimate	T Ratio
Fit 1 Six Month Futures Settlement: Ratio of WCE to CBE Oats	.1839600	4.9283621
Fit 2 Six Month Futures Settlement: Ratio of #1 C.W. Oats to #1 Feed Barley	.11580684	2.3282121
Fit 3 Cash Grain Prices: Ratio of WCE to U.S. Oats	.09256301	2.622631
Fit 4 Cash Grain Prices: Ratio of #1 C.W. Oats to #1 Feed Barley	.0506916	.770232
Fit 5 Farm Gate Prices: Ratio of #1 C.W. Oats to Feed Barley	.05427348	.716850

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[90] Model identification of AR(1) and ARMA(1,1) models leading up to the intervention point are presented in Appendix 5.

The T ratios of Table 5 demonstrate that only three of the price series have been significantly affected by the market restructuring. The W_o parameter and the corresponding T ratio of the first three models (Fit 1 through Fit 3) suggest that a significant increase in the price ratios is associated with the intervention in the market structure. The results for the six month futures settlement of Fit 1 can be interpreted by concluding that the policy decision to restructure the Western Canadian oat market from single desk monopoly selling to the open market induced a permanent increase of .18396 units of the WCE to CBE oat price ratio. Results of Fit 4 and Fit 5 are not statistically significant, and therefore the model concludes that the intervention had no impact on the ratio of oats relative to feed barley.

The intervention model results of Fit 1, Fit 2, and Fit 3, demonstrate that oat producers have benefitted from the structural change in the market. Although W_o parameter estimates are positive for Fit 4 and Fit 5, the results do not demonstrate a significant change resulting from the market restructure.

F. Product Differentiation

The CWB marketed #1, #2, Extra #1 feed (#3), and #1 Feed oats. Recommended by the CWB, the Federal Government established a separate Designated Oats Pool Account for high-quality oats. The new pool became effective for the 1981-82 crop year. Until the formation of the Designated Oat Pool, producers ran the risk that returns on high quality oats would be diluted by a deficit in sales of feed oats.

Designated oats were delivered to country elevators and shipped in carlots direct to the United States. In other cases, designated oats were shipped to the U.S. via Thunder Bay terminals. Under the CWB, exports of designated oats to the United States primarily came from the province of Alberta. Cool, moist weather conditions,[91] compounded with cheap freight rates under the Crow Rate, helped to encourage oat production in northern Alberta.

The Designated Pool Account, for a time, curtailed the shortage of high-grade oats required by the food processing industry. However, U.S. processors remained unsatisfied with the quality of the final product arriving through Thunder Bay and buyers priced their bids to the bottom of the Canadian grade scale.[92]

To illustrate, a typical sale to a U.S. processor can have the following specifications:

Canadian Oats, 45 lbs, 97/1/1/1, 13% moisture

The first part of these specifications, 45 lbs, relates to the test weight. American buyers "rate the test weight of Canadian oats as one of their best characteristics for milling purposes. Naturally, the higher the weight the better, as it will improve the yield in their milling plants

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[91] Cool, moist conditions in northern Alberta allow for a larger more plump kernel than is grown in the more southern Prairie regions of Canada.

[92] See James, Terry, and Cretney, Jim, Marketing Requirements: Domestic and Export, Oat Symposium Proceedings, September 6 and 7, 1989, Ottawa. Strychar, Randy, Canadian Oats: A Success Story, 1994.

with less clean out."[93] The second part, 97%, refers to the sound count, and is the percentage

of undamaged oats in a sample, minus the percentage volume of foreign matter. The sound

count is then calculated by 100% less foreign material.

Foreign matter such as barley, wheat, and wild oats is represented by the 1/1/1 measure. By

placing a tolerance on the level of each grain other than oats, millers are ensured they will

not get a blended product from Prairie elevators. Each processor has a distinct milling

technique and the percentage tolerance of foreign material is often more strict than the

example above. Finally, the Canadian export standard allows for moisture up to 14 percent

before discounts apply. An increase in the water content results in more difficulty during the

hulling process. As a result, millers will pay premiums for extra dry oats.

I) Exports Under the CWB

Designated oats destined for the human food market were exported in two fashions. Oats

could be selected and accepted from producers, loaded into hopper cars and delivered

directly to processors in the United States. In other cases, oats exported to the United States

arrived via Thunder Bay terminals. Thunder Bay terminals were unable to maintain grade

standards, resulting in excessive export quality deterioration.

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[93] James, Terry, Marketing Requirements: Domestic and Export, Oat
Symposium Proceedings, September 6 and 7, 1989, Ottawa, p. 123.

High sound count was achieved from carlot shipments direct to the United States. On average, designated oats exported in this fashion achieved a sound count between 97 to 99 percent. Oats exported via Thunder Bay terminals on the other hand, did not have the sound count U.S. processors required. Averages on these shipments were only 90 percent.[94] As a result, misconceptions regarding the quality of Canadian oats emerged.

ii) U.S. Processor Misconceptions

Strict foreign matter tolerances on Canadian oats exported from Thunder Bay terminals were impossible to achieve. Serious problems were associated with the high barley content. Barley is similar in size to oats and therefore slips through the pre-milling cleaning process. After processing, the flakes of the barley hull were very evident in the final product.

The foreign content problem persisted, and buyers from the United States began bidding on all Canadian oats, including designated oats, at the lower sound count prices. "Prior to 1989, the percentage of sound measure in #3 C.W. oats by the Canadian Grain Commission (CGC) ranged from 88 to 94 percent. Because the spread was so wide, U.S. buyers simply bid to the 88 percent level, or at best, to the anticipated low end average."[95] Instead of being rewarded for a high quality product, Prairie oat growers in Manitoba and Saskatchewan were paid based on a lower grade of oats.

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[94] See James, Terry, Marketing Requirements: Domestic and Export, Oat Symposium Proceedings, September 6 and 7, 1989, Ottawa.

[95] Strychar, Randy, Canadian Oats: A Success Story, p. 2, 1994.

The most serious allegation against the quality of Canadian oats surrounded an inferior protein content. "During the tight oat situation in the summer of 1988 some mills had to implement protein minimums in order to shut out Canadian oats because our protein levels were lower that their traditional U.S. oats supply. By allowing lower protein Canadian oats into their plants, the millers were experiencing difficulty meeting their finished product protein guarantees."[96]

The cause of this problem was rooted in the selection procedures of the Designated Oat Pool Account. Northern Alberta has always been known for their prominence in oat production. Large, plump oat kernels are easily achieved due to cool, moist weather conditions in the region, however, the larger more plump kernel has significantly lower protein content. Ample supply, and lower freight rates under the Crow Rate, encouraged the CWB to select and export a large quantity of oats from Northern Alberta.

Soon afterwards, buyers in the United States characterized all Canadian oats as having insufficient protein content. These allegations, although rightfully justified, harmed the credibility of oat producers in Saskatchewan and Manitoba. Can-Oat Milling executives in Portage La Prairie, Manitoba, affirm that they have never had a problem in consistently maintaining 16 percent protein content from Manitoba and Saskatchewan producers.

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[96] James, Terry, Marketing Requirements: Domestic and Export, Oat Symposium Proceedings, September 6 and 7, 1989, Ottawa, p. 125.

iii) Logistical Problems

The problem was twofold, U.S. end users were concerned with the high foreign content from Thunder Bay shipments. They were also concerned with the below average protein content associated with the CWB Western Canadian oat supply.

Logistical problems were at the root of the grading dispute between U.S. purchasers and Canadian oat producers. Alberta exports to the United States were encouraged by Crow Rate benefits. Blending problems at Thunder Bay were never rectified. At the same time, producers wanted to get paid for their production of a high-quality product. The solution to the problem lay within the realm of tighter grade specifications. The massive logistics system inherent within the central desk marketing system was unable to solve these problems to the best advantage of oat producers. At the peak of the dispute, Hon. Charlie Mayer announced the removal of oats from under the jurisdiction of the Canadian Wheat Board.

iv) Grade Change

The grading standards between the United States and Canada were far from being uniform. The United States system was geared to meet the specific needs of a competitive end-user marketplace, while the Canadian system was serving the needs of markets past. In order to maximize returns to oat producers, the Canadian system required changes. The removal of oats from CWB jurisdiction paved the way for the Canadian Grain Commission to respond.

In 1989, the Canadian Grain Commission responded to private industry's request to bring Canada's grading system for oats more in line with our biggest customer, the United States market. Sound count minimums were raised in line with United States standards. This has allowed Canadian producers to capture premiums the market is willing to pay for specific qualities, while still providing a market for lower grades. "Today the private trade has gone beyond the CGC grade standards in some cases by responding to end-user needs for specific qualities. These qualities are paying premiums to Canadian oat producers."[97]

Summary

Chapter Five provides an economic performance analysis of the Western Canadian oat industry following the reorganization in the underlying market structure. The performance criteria selected in the analysis follows a general framework for industrial market structure and economic performance evaluations.

A number of conclusions regarding the performance of oats under the CWB and its performance on the open market were drawn from the available data.

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[97] Strychar, Randy, Canadian Oats: A Success Story, p. 3, 1994.

CHAPTER SIX
PERFORMANCE ANALYSIS REVISITED

Introduction

This report examines the performance of the Western Canadian oat market on the open market, with its performance under the Canadian Wheat Board during the 1980-1989 period. The intent of this study is to identify and measure some of the economic impacts resulting from the market restructuring, and to provide an assessment on how market performance has been affected.

Chapter One begins with the background of the Western Canadian oat industry and outlines the intended research objectives for this report. Historical perspectives and an examination of the underlying market structures of the Western Canadian oat industry is discussed in Chapter Two. The first section examines the market structure of the industry when oat marketing was under the central desk authority of the Canadian Wheat Board. The second section examines the post-August 1989 open-market structure of the Western Canadian oat industry. The Second Chapter concludes with an examination of the factors that motivated oat market structural reform.

Chapter Three contains a literature review. Relevant literature is examined in the context of its applicability to the market structure change of the Western Canadian oat industry. Perspectives regarding market structure and the rationale for single desk selling versus the

open market are then discussed. A framework of analysis begins to unfold based on Turvey's 1993 analytic model of the relationship between market structure, conduct and performance. The Chapter concludes by consolidating a number of additional studies into Turvey's framework. These studies evaluate the economic merits and weaknesses of single desk marketing versus the open market, and provide a set of performance evaluation measures that can be used to evaluate the market performance of the Western Canadian oat industry.

Chapter Four develops a framework of analysis that can be used to evaluate the performance of the Western Canadian oat industry following a structural change in the underlying market organization. A model is developed based on Turvey's (1993) framework of analysis for industrial market structure and for economic performance evaluations. The analytic model considers testable criteria based on observable data. Testable criteria that can be used to evaluate the market performance of the Western Canadian oat industry are selected from studies that evaluate market performance in the context of structural market change. Economic hypotheses are then formulated based on the expected result of moving from single desk marketing to the open market.

The Fifth Chapter conducts an economic performance analysis of the Western Canadian oat industry. The analysis is guided by the theoretical framework of analysis developed by Turvey (1993).

Major Findings

Welfare losses attributed to central desk selling are calculated utilizing four different estimations of demand elasticity. The results demonstrate an upward trend in welfare losses between 1979-1989.

The size of the welfare loss depends in part on the elasticity estimate. For this reason, caution must be exerted when interpreting the welfare loss results of Chapter 5. When higher coefficients are used in the calculations, welfare losses increase dramatically. In addition, the distortion rate t, which is calculated by the price differentials between monopoly price levels and cash grain prices, must also be approached with caution. During the last three crop years under the CWB jurisdiction, CWB price quotations were considerably higher than cash grain prices especially for designated oats. Although this translated into higher prices for end users, it also meant more money to producers.

It is also imperative that the welfare loss be interpreted within the proper context. Calculations are made based on Scherer's 1970 model of dead weight loss. The dead weight loss should not be interpreted as a financial loss to all oat industry participants. Increases in welfare losses could mean higher returns to producers because Western oat producers benefitted from price differentials extracted by the CWB. Questions are raised regarding precise elasticity of demand estimations, and if the domestic human consumption oat demand is fairly inelastic, then the welfare losses attributed to the CWB are quite small. It can also

be argued that the deadweight loss is a necessary price to be paid in order to extract price premiums for Western Canadian oat producers.

Total domestic oat use in Canada has steadily declined since 1981. The impact on the composition of domestic oat usage is examined utilizing ratios of animal, human, and oats for seed, to the total domestic usage. The results demonstrate that the change in the market structure did not affect the composition of total domestic usage. The increase in human consumption of oats that was forecasted in the late 1980's did not occur until 1992-93. It would appear from the data that the overall demand in Canada for feed oats and for seed, has remained unchanged regardless of the underlying market structure.

Oat exports have increased since 1985. Since the 1988-1989 crop year, the rate of growth has increased substantially. Without a doubt, exports of value-added oats such as oatmeal and rolled oats have improved under the open market system. Although it is difficult to establish a conclusive determinant for the overall increase in oat exports, it would appear that private sector agents have been more successful in ferreting out and serving niche markets for value-added products such as oatmeal and rolled oats.

The Prairie provinces account for approximately 85 percent of the Canadian oat production. Oat production has increased dramatically in Saskatchewan and in Manitoba. Despite a dramatic increase in oat production in northern Alberta, production has remained consistently lower than levels established during the latter part of the 1980's.

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There has been a significant geographical redistribution in harvested acreage and oat production in the Prairie provinces. By adjusting to comparative advantage and to specialization signals in both the feed industry and human consumption markets, oat production has become geographically concentrated in favour of good oat growing regions that are capable of meeting the specific needs of the end-user. High quality oat production destined for the human consumption market has increased in areas of Manitoba and Saskatchewan that have comparative advantages in terms of location to end-user markets, proximity to processors, the ability to produce an oat groat with high protein content along with a low moisture content, in addition to high yield capabilities. Increased market opportunities for the export feed market has resulted in a greater concentration of oat production in north-west Alberta.

Prairie oat mills, clipping mills, and processors have invested heavily in the Western Canadian oat industry. Since August of 1989, five new oat processors have emerged. Locations have been chosen based on the proximity of end markets and upon the availability of a high quality product that can fulfil the needs and specifications of the end-user. Oat production has increased dramatically in parts of northern Alberta. A comparative advantage in growing a specialty oat that is required by the pony oat market has impacted on oat production in that region.

CWB producer payments did not out perform the CBE nor the WCE. CWB producer payments were well below the established CBE prices in all but one crop year. During the

1988/89 crop year CWB producer payments exceeded CBE and WCE prices, however during this year the CWB incurred a $32.4 million dollar deficit. On average, WCE cash prices were higher than CWB producer payments until 1985. Between 1986 and 1989, CWB producer payments were higher than average cash prices established at the WCE. In two of final four years that CWB producer payments exceeded WCE prices, large deficits were recovered at the expense of Canadian tax payers.

CWB producer payments for designated oats were substantially higher than oats outside of the Designated Pool Account. In almost every year, CWB producer payments from the Designated Pool Account exceeded average CBE and WCE established cash prices. The WCE average cash price was significantly out performed by the Designated Pool.

Intervention analysis was used to determine whether the structural break in marketing methods resulted in any significant changes in oat price relationships and in relative feedgrain prices. The model demonstrates that a significant increase in the relative price relationship between the six month futures price and the ratio of WCE to U.S. prices for oats and feedgrains results following the policy change. Cashgrain and farmgate prices for oats relative to feed barley were found not to be significant. Therefore no change in these price relationships are reported.

The massive logistics system under the central desk marketing system was unable to adequately meet the specific needs of end-users. High sound count was achieved from carlot

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shipments direct to the United States. Oats exported via Thunder Bay terminals on the other hand did not have the sound count U.S. processors required. This led to U.S. processor misconceptions regarding the overall quality of the Western Canadian oat supply. Acceptable levels of foreign matter, protein, and moisture content, could not be achieved via Thunder Bay. The Crow Rate benefit that lowered transportation costs for oats, discouraged direct shipments of oats from country elevators to the United States. The location of United States processors of oats for food, forced oats selected in Alberta on the Designated Account to be routed through Thunder Bay. Thunder Bay terminals were unable to maintain grade standards, resulting in excessive export quality deterioration.

The removal of oats from the CWB jurisdiction paved the way for the Canadian Grain Commission to respond to the requests of the private industry to bring Canada's grading system for oats more in line with the quality standards of the United States market. Sound count minimums were raised in line with United States standards. This allowed Canadian producers to capture premiums that the market is willing to pay for specific qualities, while still providing a market for lower grades.

Conclusions

The policy change that transferred the marketing responsibilities for Western Canadian oats from central desk authority to private marketing, resulted in greater market efficiency and the opportunity of greater economic benefits to many producers.

Producers who have responded to meet the needs of end-users demand for a high quality value-added product have clearly benefitted from the market restructuring. Other producers who have not met these demands, may have benefitted more from CWB centralized marketing. Nevertheless, the open market has provided Western Canadian oat producers with the opportunity to increase revenues by forward contracting directly with end-users. Oat growers across the Prairies have benefitted from on-farm contracting. Production in Northern Alberta is geared towards meeting the specific needs of the feed industry, whereas production in southern Saskatchewan and Manitoba is geared towards servicing the human consumption market.

The main factors contributing to increased market efficiency was the removal of oats from under the CWB in 1989. The market restructuring has provided producers with greater market access. Increased market efficiency has resulted in producers striving to meet the specific needs of end-users. The change in the marketing structure of the Western Canadian oat industry from single desk selling to the open market, resulted in an adjustment to comparative advantage and to specialization signals. By adjusting to comparative advantage and to specialization signals in both the feed industry and human consumption markets, oat production has become geographically concentrated in favour of good oat growing regions that are capable of meeting the specific needs of the end-user. Higher quality oat production destined for the human consumption market and to specialty feed markets has increased in those areas of the Prairies maintaining a comparative advantage. The CWB was unable to effectively respond to end-user needs for specific qualities.

Limitations of the Study

Elasticity of demand estimates for oats utilized in welfare loss calculations were unavailable. For this reason, domestic barley and wheat approximations had to be employed. These are totally different markets and could be quite unreliable. Specific CWB pricing data was unavailable, therefore CWB quotation prices were utilized in order to calculate the pricing distortion between monopoly and cash grain prices.

It is difficult to quantify and to compare CWB producer payments to open market returns. In order to make an accurate assessment, specific CWB quota data must be obtained. Although CWB producer payments on the Designated Pool Account were significantly higher than CBE and WCE cash grain prices, quota restrictions may have impeded producers from increasing revenue by not allowing them to sell a higher quantity at a lower price.

There is some concern that policy implications of the Gross Revenue Insurance Plan may have resulted in a shift away from oats to other cereal grains during the 1991-1992 crop year. In order to test whether this hypothesis affected the price relationships among feedgrains a second intervention parameter could be introduced into the time series modelling framework.

Conclusions were made regarding the composition of oat usage in Canada and the analysis was extended in order to make inferences regarding the human consumption market for oats.

United States figures for the human consumption of oats may have shed a different perspective on this section of the Western Canadian oat market analysis.

Topics for Further Research

Welfare losses were calculated using a price distortion model that primarily relied on pricing data from the open market and from the CWB. It would be interesting to determine whether a statistical correlation exists between the welfare losses reported in this manner, to CWB deficit accounts. More reliable elasticity estimates are available for barley and for wheat and therefore the welfare loss calculations would be more reliable. Calculating the welfare losses in this manner and comparing them to CWB deficit years, one could easily determine whether a statistical relationship exists between the two. If so, it may shed light on the theoretical inefficiencies of providing producers with an initial payment.

The crop district analysis utilizes annual data before and after the structural break in the market. Utilizing the same testing procedures with more years of post 1989 data, would surely provide more convincing results. For example, District 5 of Saskatchewan has witnessed the most dramatic increase in oat production across the Prairies. The magnitude of the increase resulted in a large standard deviation in the second period. As a result, the test statistic refused to acknowledge this change as being statistically significant. Another five years of data would surely confirm many of the suspicions that arose over the course of this analysis.

The section that examined product differentiation reported a number of inefficiencies inherent within the CWB marketing system in terms of selection procedures, transportation inefficiencies, and blending problems. A study that focussed primarily on these aspects would be of particular interest. The implications of restricting the movement towards comparative advantage is astounding. This could be examined in terms of production, proximity to end markets, end-user specifications, and transportation costs, and comparative advantage.

The northern region of Alberta has always experienced weather conditions favourable for high oat yield. Since 1989, oat production has increased dramatically in north-west Alberta. A number of conversations with industry participants indicated that there may have existed a shift away from barley towards oats as a result of the new market opportunities on the open market. A study examining this particular aspect may shed additional light on the issue of comparative advantage.

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Appendices

Appendix 1

Deficit Accounts

Crop Year	Deficit Amount
1957-58	$2,429,045.62
1958-59	$1,379,142.31
1963-64	$2,011,099.00
1968-69	$804,200.00
1977-78	$953,710.00
1979-80	$778,942.00
1981-82*	$2,291,454.00
1985-86*	$6,919,810.00
1988-89*	$32,361,239.00

*Deficit on Pool Account
Source: CWB Annual Report

Appendix 2

Welfare Loss Calculations

	Fixed	P	Q	t sqd	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Panel A Welfare Loss	Panel B Welfare Loss	Panel C Welfare Loss	Panel D Welfare Loss
1979/80	0.5	132.50	82,000	0.0151874	0.7	1.0	3.0	5.74	$57,751.71	$82,502.44	$247,507.31	$473,563.99
1980/81	0.5	171.30	80,000	0.020381855	0.7	1.0	3.0	5.74	$97,758.10	$139,654.44	$418,963.31	$801,616.46
1981/82	0.5	178.38	79,700	0.085439554	0.7	1.0	3.0	5.74	$425,129.61	$607,328.02	$1,821,984.05	$3,486,062.81
1982/83	0.5	148.76	81,900	0.110191859	0.7	1.0	3.0	5.74	$469,885.99	$671,265.69	$2,013,797.08	$3,853,065.08
1983/84	0.5	160.76	73,300	0.028985627	0.7	1.0	3.0	5.74	$119,544.74	$170,778.19	$512,334.58	$980,266.84
1984/85	0.5	157.74	74,000	0.028174041	0.7	1.0	3.0	5.74	$115,102.87	$164,432.67	$493,298.02	$943,843.54
1985/86	0.5	150.93	72,000	0.137849028	0.7	1.0	3.0	5.74	$524,305.74	$749,008.21	$2,247,024.62	$4,299,307.10
1986/87	0.5	141.50	82,000	0.208479903	0.7	1.0	3.0	5.74	$846,647.31	$1,209,496.16	$3,628,488.47	$6,942,507.94
1987/88	0.5	156.79	76,000	0.135850359	0.7	1.0	3.0	5.74	$566,588.44	$809,412.06	$2,428,236.19	$4,646,025.24
1988/89	0.5	250.67	93,000	0.175618948	0.7	1.0	3.0	5.74	$1,432,933.94	$2,047,048.48	$6,141,145.45	$11,750,058.30

Appendix 3
Crop District Map

Alberta · Saskatchewan · Manitoba
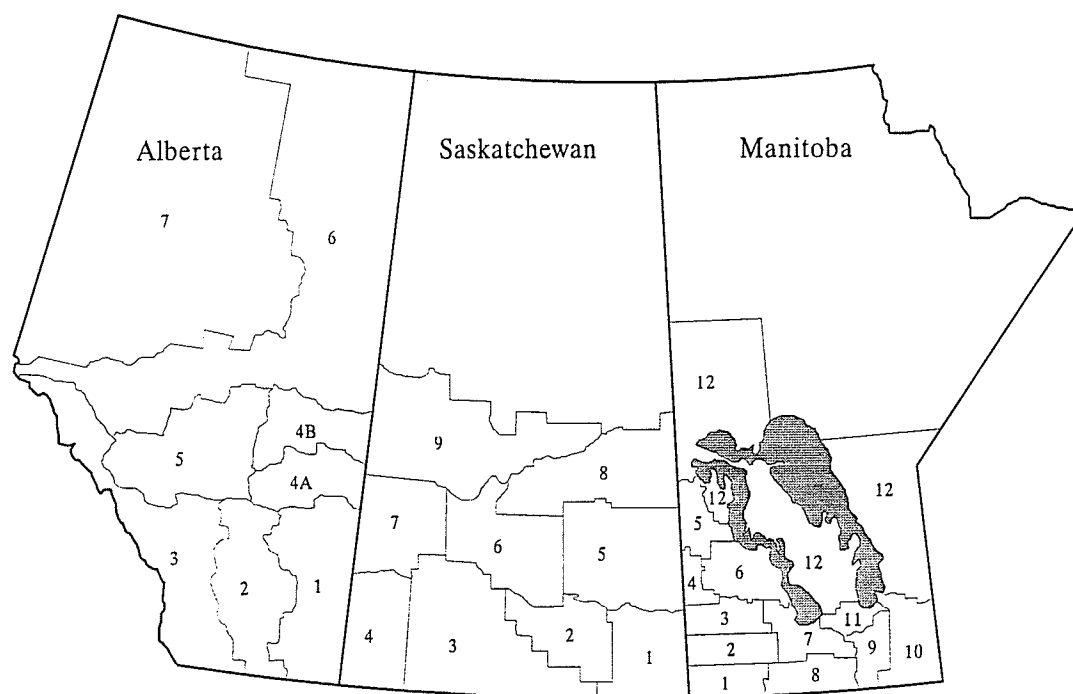
Appendix 4
Crop District Data
Harvested Area and Production

MANITOBA ~~excluding 1991 from data set~~
HARVESTED AREA

Crop Distric	1983	1984	1985	1986	1987	1988	Total	Average	Standard Dev	1989	1990	1992	1993	1994	Total	Average	Standard Dev
1	50	48	46	42	38	24	248	41.3	9.5	40	32	35	45	65	217	43.4	13.0
2	92	81	85	71	61	52	442	73.7	15.2	64	66	70	63	80	343	68.6	6.9
3	50	39	50	41	41	42	263	43.8	4.9	37	41	45	41	55	219	43.8	6.9
4	22	32	29	22	17	17	139	23.2	6.2	20	20	20	23	20	103	20.6	1.3
5	21	26	30	19	27	27	150	25.0	4.1	30	26	10	14	20	100	20.0	8.2
6	83	82	87	53	44	48	397	66.2	19.8	53	52	40	65	75	285	57.0	13.4
7	70	87	77	79	81	81	475	79.2	5.6	99	74	125	117	145	560	112.0	26.9
8	39	47	45	29	37	33	230	38.3	6.9	46	35	54	52	95	282	56.4	22.8
9	40	37	37	38	41	31	224	37.3	3.5	37	20	33	36	60	186	37.2	14.4
10	13	15	13	13	12	10	76	12.7	1.6	15	7	8	7	5	42	8.4	3.8
11	18	24	15	20	24	27	128	21.3	4.5	31	24	18	23	30	126	25.2	5.4
12	52	52	36	23	27	24	214	35.7	13.5	28	33	22	16	10	109	21.8	9.2
TOTAL	550	570	550	450	450	416	2,986	497.7		500	430	480	502	660	2,572	514.4	

MANITOBA
PRODUCTION (bushels)

Crop Distric	1983	1984	1985	1986	1987	1988	Total	Average	Standard Dev	1989	1990	1992	1993	1994	Total	Average	Standard Dev
1	2,241	2,062	3,088	2,752	1,813	621	12,577	2,096.2	859.3	1,363	1,945	2,500	3,094	3,000	11,902	2,380.4	730.1
2	4,451	3,296	4,957	4,993	3,489	1,536	22,722	3,787.0	1,316.1	1,622	4,170	5,100	4,313	4,400	19,605	3,921.0	1,334.2
3	2,605	1,597	3,154	2,798	2,604	1,639	14,397	2,399.5	637.9	1,507	2,645	3,250	2,831	3,400	13,633	2,726.6	747.1
4	1,081	1,432	1,885	1,370	1,028	872	7,448	1,241.3	409.2	888	1,247	700	1,321	1,000	5,156	1,031.2	255.8
5	906	1,255	1,948	1,095	1,446	1,364	8,014	1,335.7	356.9	1,302	1,436	600	858	800	4,796	959.2	384.0
6	3,839	4,233	5,447	3,244	2,566	1,884	21,213	3,535.5	1,263.7	2,246	2,747	2,600	4,077	5,100	16,772	3,354.4	1,197.0
7	3,427	4,841	5,480	5,791	5,388	2,687	27,614	4,602.3	1,257.6	5,200	4,287	10,700	7,826	11,400	39,393	7,878.6	3,185.2
8	2,041	2,799	3,612	2,152	2,386	970	13,970	2,328.3	875.0	1,908	2,510	4,700	3,375	6,800	19,293	3,858.6	1,950.5
9	2,028	2,219	2,562	2,447	2,688	1,148	13,092	2,182.0	559.4	2,237	1,347	2,700	2,121	4,100	12,505	2,501.0	1,017.6
10	487	819	864	643	620	420	3,853	642.2	175.7	682	435	500	262	200	2,059	411.8	185.9
11	775	1,477	985	1,327	1,475	1,100	7,139	1,189.8	284.5	1,627	1,589	1,500	1,179	2,300	8,195	1,639.0	409.4
12	2,119	2,970	2,039	1,378	1,497	959	10,961	1,826.8	707.1	1,436	2,162	1,150	943	500	6,191	1,238.2	618.9
TOTAL	26,000	29,000	36,000	33,000	27,000	15,000	163,000	27,166.7		22,000	26,500	36,000	32,000	43,000	159,500	31,900.0	

SASKATCHEWAN ~~excluding 1991 from data set~~
HARVESTED AREA

Crop Distric	1983	1984	1985	1986	1987	1988	Total	Average	Standard Dev	1989	1990	1992	1993	1994	Total	Average	Standard Dev
#1	115	101	113	124	119	118	691	115.1	7.9	164	104	143	160	188	759	151.8	31.0
#2	45	44	38	47	46	46	266	44.3	3.2	64	42	46	75	69	296	59.2	14.7
#3	93	52	41	56	88	93	453	75.5	22.9	138	94	90	91	118	531	106.1	21.1
#4	36	9	18	31	34	39	167	27.8	11.7	60	43	15	34	23	175	35.0	17.7
#5	173	190	189	143	141	144	980	163.3	23.5	205	135	187	253	435	1214	242.8	115.4
#6	65	74	97	89	88	90	503	83.8	11.9	128	84	104	130	170	616	123.1	32.2
#7	65	51	52	61	62	65	355	59.2	6.2	94	63	40	62	51	311	62.3	20.1
#8	48	64	56	36	37	40	281	46.8	11.3	59	41	57	94	154	405	81.0	45.4
#9	210	165	146	183	186	196	1086	181.0	22.7	288	195	148	201	242	1073	214.7	52.7
TOTAL	850	750	750	800	800	830	4780	796.7		1200	800	830	1100	1450	5380	1,076.0	

SASKATCHEWAN ('000 OF METRIC TONNES)
PRODUCTION

Crop Distric	1983	1984	1985	1986	1987	1988	Total	Average	Standard Dev	1989	1990	1992	1993	1994	Total	Average	Standard Dev
#1	68	38	71	125	99	54	453	75.5	32.0	65	99	121	153	164	602	120.4	40.1
#2	30	17	20	49	40	21	178	29.4	12.8	37	35	40	73	51	236	47.1	15.5
#3	65	19	11	65	72	36	287	44.6	26.2	84	71	71	87	84	397	79.4	7.8
#4	35	4	4	26	28	15	110	18.3	12.6	43	32	12	34	16	137	27.3	12.6
#5	130	124	169	133	132	95	783	130.5	23.7	154	122	152	234	436	1098	219.5	127.8
#6	53	32	68	78	74	33	338	56.4	20.3	74	62	85	139	161	521	104.2	43.4
#7	56	27	32	64	52	35	266	44.3	15.0	53	47	30	62	44	235	47.0	11.6
#8	42	51	58	32	35	25	243	40.5	12.3	49	40	41	99	191	420	84.0	64.7
#9	173	122	122	184	180	181	961	160.2	29.8	243	187	111	199	242	982	196.3	53.8
TOTAL	652	432	555	756	709	494	3598	599.6		802	694	663	1080	1388	4627	925.3	

ALBERTA ~~excluding 1991 from data set~~
HARVESTED AREA

Crop Distric	1983	1984	1985	1986	1987	1988	Total	Average	Standard Dev	1989	1990	1992	1993	1994	Total	Average	Standard Dev
1	113	44	70	80	31	64	402.0	67.0	28.7	71	42	48	74	90	325	64.9	19.7
2	49	46	59	71	51	53	329.0	54.8	9.0	67	66	47	36	30	246	49.2	16.9
3	139	86	51	113	81	97	567.0	94.5	29.9	141	87	71	68	65	432	86.5	31.6
4A	147	154	153	151	147	175	927.0	154.5	10.5	191	157	121	136	115	719	143.9	31.0
4B	183	219	181	219	204	238	1,244.0	207.3	22.4	242	189	213	224	186	1,054	210.7	23.6
5	205	247	226	227	240	284	1,409.0	234.8	20.3	263	178	207	206	188	1,043	208.5	32.9
6	228	251	268	281	280	311	1,599.0	266.5	28.1	297	202	231	233	261	1,224	244.9	35.9
7	86	103	92	158	186	248	873.0	145.5	64.0	277	229	262	224	215	1,207	241.3	26.6
TOTAL	1150	1150	1100	1300	1200	1450	7,350.0	1,225.0		1,549	1,150	1,200	1,200	1,150	6,249	1,249.8	

ALBERTA ('000 OF METRIC TONNES)
PRODUCTION

Crop Distric	1983	1984	1985	1986	1987	1988	Total	Average	Standard Dev	1989	1990	1992	1993	1994	Total	Average	Standard Dev
1	84	19	29	55	19	29	245	40.9	27.3	32	20	41	75	71	240	47.9	24.1
2	47	30	43	83	55	53	310	51.7	17.5	55	57	46	45	30	232	46.3	10.8
3	122	44	29	124	94	93	505	84.1	39.6	131	91	68	85	60	435	87.0	27.4
4A	128	105	122	174	130	149	808	134.7	24.0	139	139	100	150	98	624	124.9	24.5
4B	155	190	144	257	202	250	1,198	199.7	46.8	245	177	161	259	192	1,032	206.5	43.2
5	206	252	230	235	286	367	1,626	271.0	56.3	292	201	200	277	236	1,206	241.2	42.2
6	219	233	263	316	269	402	1,702	283.6	67.1	297	207	175	302	281	1,262	252.3	58.0
7	88	85	62	145	194	309	882	147.0	92.9	290	220	246	274	220	1,250	249.9	31.7
TOTAL	1,049	957	921	1,449	1,249	1,652	7,277	1,212.8		1,481	1,110	1,036	1,465	1,187	6,280	1,256.0	

APPENDIX 5

IDENTIFICATION FIT 1
SIX MONTH FUTURES SETTLEMENT
RATIO OF WCE TO CBE
PLOT OF   B
NUMBER OF CASES = 69
MEAN OF SERIES =   0.751
STANDARD DEVIATION OF SERIES =   0.125

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2 .0  .2  .4  .6  .8 1.0
            +----+----+----+----+----+----+----+----+----+----+
  1 .837  .120              (   |XXXXX)XXXXXXXXXXXXXXX
  2 .751  .187             (    |XXXXXXXX)XXXXXXXXX
  3 .711  .226            (     |XXXXXXXXXX)XXXXXX
  4 .614  .256           (      |XXXXXXXXXXX)XXX
  5 .549  .277          (       |XXXXXXXXXXXX)
  6 .490  .292         (        |XXXXXXXXXXXX )
  7 .467  .304         (        |XXXXXXXXXXX  )
  8 .407  .314         (        |XXXXXXXXXX  )
  9 .358  .322         (        |XXXXXXXXX    )
 10 .296  .327         (        |XXXXXXX     )
 11 .216  .331         (        |XXXXX      )
 12 .126  .333         (        |XXX      )
 13 .031  .334         (        |         )
 14 -.053 .334         (       X|         )
 15 -.133 .334         (      XXX|        )
 16 -.177 .335         (      XXXX|         )
 17 -.185 .336         (      XXXX|         )
 18 -.222 .338         (     XXXXX|          )
 19 -.253 .340         (    XXXXXX|          )
 20 -.291 .343         (   XXXXXXX|          )
 21 -.302 .346         (   XXXXXXX|          )
 22 -.297 .350         (   XXXXXXX|          )
 23 -.317 .354         (   XXXXXXX|          )
 24 -.320 .358         (  XXXXXXXX|           )
 25 -.310 .362         (   XXXXXXX|          )
```

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR    SE -1.0 -.8 -.6 -.4 -.2 .0  .2  .4  .6  .8 1.0
             +----+----+----+----+----+----+----+----+----+----+
  1 .837  .120           (   |XXXXX)XXXXXXXXXXXXXX
  2 .167  .120           (   |XXXX )
  3 .163  .120           (   |XXXX )
  4 -.135 .120           ( XXX|   )
  5 .011  .120           (   |   )
  6 -.030 .120           (   |   )
  7 .141  .120           (   |XXX )
  8 -.100 .120           ( XX|   )
  9 .004  .120           (   |   )
 10 -.145 .120           ( XXX|   )
 11 -.077 .120           (  X|   )
 12 -.169 .120           ( XXXX|   )
 13 -.099 .120           (  XX|   )
 14 -.118 .120           (  XX|   )
 15 -.057 .120           (  X|   )
 16 .020  .120           (   |   )
 17 .134  .120           (   |XXX )
 18 -.057 .120           (  X|   )
 19 -.014 .120           (   |   )
 20 -.114 .120           (  XX|   )
 21 .114  .120           (   |XX )
 22 .100  .120           (   |XX )
 23 .023  .120           (   |   )
 24 -.061 .120           (  X|   )
```

IDENTIFICATION FIT 1
PLOT OF RESIDUAL
NUMBER OF CASES = 69
MEAN OF SERIES =   0.001
STANDARD DEVIATION OF SERIES =   0.068

PLOT OF AUTOCORRELATIONS

```
LAG  CORR    SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
              +----+----+----+----+----+----+----+----+----+----+
  1 -.149  .120            ( XXX|   )
  2 -.066  .123            (   X|   )
  3  .233  .124            (    |XXXXX)
  4 -.023  .130            (    |   )
  5 -.015  .130            (    |   )
  6  .021  .130            (    |   )
  7  .153  .130            (    |XXX )
  8 -.023  .132            (    |   )
  9  .076  .133            (    |X  )
 10  .063  .133            (    |X  )
 11  .046  .134            (    |X  )
 12  .021  .134            (    |   )
 13 -.012  .134            (    |   )
 14 -.014  .134            (    |   )
 15 -.114  .134            (  XX|   )
 16 -.114  .135            (  XX|   )
 17  .062  .137            (    |X  )
```

PLOT OF RESIDUAL
PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR    SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
              +----+----+----+----+----+----+----+----+----+----+
  1 -.149  .120            ( XXX|   )
  2 -.091  .120            (  XX|   )
  3  .216  .120            (    |XXXXX)
  4  .041  .120            (    |X  )
  5  .016  .120            (    |   )
  6 -.032  .120            (    |   )
  7  .159  .120            (    |XXX )
  8  .025  .120            (    |   )
  9  .104  .120            (    |XX )
 10  .020  .120            (    |   )
 11  .078  .120            (    |X  )
 12  .007  .120            (    |   )
 13 -.016  .120            (    |   )
 14 -.078  .120            (   X|   )
 15 -.152  .120            ( XXX|   )
 16 -.210  .120            (XXXXX|   )
 17 -.009  .120            (    |   )
```

IDENTIFICATION FIT 2
SIX MONTH FUTURES SETTLEMENT
RATIO OF #1 C.W. OATS TO #1 FEED BARLEY

NUMBER OF CASES = 69
MEAN OF SERIES =   0.983
STANDARD DEVIATION OF SERIES =   0.112

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2 .0 .2 .4 .6 .8 1.0
            +----+----+----+----+----+----+----+----+----+----+
 1  .911  .120              (    |XXXXX)XXXXXXXXXXXXXXXX
 2  .772  .196              (    |XXXXXXXX)XXXXXXXXXX
 3  .626  .236             (     |XXXXXXXXXX)XXXX
 4  .488  .259            (      |XXXXXXXXXXX)
 5  .389  .272           (       |XXXXXXXXX )
 6  .343  .280          (        |XXXXXXXX   )
 7  .346  .286          (        |XXXXXXXX   )
 8  .372  .292          (        |XXXXXXXXX  )
 9  .402  .299          (        |XXXXXXXXXX )
10  .412  .307          (        |XXXXXXXXXX  )
11  .363  .315          (        |XXXXXXXXX   )
12  .280  .321          (        |XXXXXX      )
13  .174  .324          (        |XXXX       )
14  .067  .325          (        |X          )
15 -.017  .326          (        |           )
16 -.076  .326          (        X|          )
17 -.110  .326          (        XX|         )
18 -.126  .326          (        XXX|        )
19 -.119  .327          (        XX|         )
20 -.092  .328          (        XX|         )
21 -.070  .328          (        X|          )
22 -.059  .328          (        X|          )
23 -.070  .329          (        X|          )
24 -.099  .329          (        XX|         )
25 -.134  .329          (        XXX|        )
```

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2 .0 .2 .4 .6 .8 1.0
            +----+----+----+----+----+----+----+----+----+----+
 1  .911  .120              (    |XXXXX)XXXXXXXXXXXXXXXX
 2 -.338  .120           XX(XXXXX|    )
 3 -.047  .120              (  X| )
 4 -.029  .120              (   | )
 5  .128  .120              (   |XXX )
 6  .158  .120              (   |XXX )
 7  .137  .120              (   |XXX )
 8  .024  .120              (   |  )
 9  .019  .120              (   |  )
10 -.053  .120              ( X|  )
11 -.255  .120             (XXXXX|   )
12 -.017  .120              (  |  )
13 -.090  .120              ( XX|  )
14 -.009  .120              (  |  )
15  .004  .120              (  |  )
16 -.093  .120              ( XX|  )
17 -.067  .120              ( X|  )
18 -.066  .120              ( X|  )
19  .069  .120              ( |X  )
20  .120  .120              ( |XX )
21  .042  .120              ( |X  )
22  .007  .120              ( |  )
23 -.054  .120              ( X|  )
24 -.047  .120              ( X|  )
25  .008  .120              ( |  )
```

IDENTIFICATION FIT 2
PLOT OF RESIDUAL
NUMBER OF CASES = 69
MEAN OF SERIES = 0.005
STANDARD DEVIATION OF SERIES = 0.037

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
              +----+----+----+----+----+----+----+----+----+----+
 1  .027  .120              (   |   )
 2  .065  .120              (   |X  )
 3 -.111  .121              (  XX|   )
 4 -.100  .122              (  XX|   )
 5 -.268  .124              (XXXXX|   )
 6 -.159  .132              ( XXX|   )
 7 -.132  .135              ( XXX|   )
 8  .255  .136              (   |XXXXX)
 9 -.085  .143              (  XX|   )
10  .244  .144              (   |XXXXXX)
11  .069  .150              (   |X  )
12  .174  .150              (   |XXXX )
13 -.049  .153              (   X|   )
14 -.072  .153              (   X|   )
15 -.130  .154              (  XXX|   )
16  .114  .155              (   |XX  )
17 -.093  .157              (  XX|   )
```

PLOT OF RESIDUAL

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
              +----+----+----+----+----+----+----+----+----+----+
 1  .027  .120              (   |   )
 2  .064  .120              (   |X  )
 3 -.114  .120              (  XX|   )
 4 -.100  .120              (  XX|   )
 5 -.255  .120              (XXXXX|   )
 6 -.169  .120              ( XXXX|   )
 7 -.149  .120              ( XXX|   )
 8  .218  .120              (   |XXXXX)
 9 -.173  .120              (XXXX|   )
10  .131  .120              (   |XXX )
11  .014  .120              (   |   )
12  .131  .120              (   |XXX )
13  .032  .120              (   |   )
14 -.031  .120              (   |   )
15  .000  .120              (   |   )
16  .173  .120              (   |XXXX )
17  .092  .120              (   |XX  )
```

IDENTIFICATION FIT 3
CASH GRAIN PRICES
RATIO OF WCE TO U.S. OAT PRICES
NUMBER OF CASES = 77
MEAN OF SERIES =   0.741
STANDARD DEVIATION OF SERIES =   0.143

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
             +----+----+----+----+----+----+----+----+----+----+
  1  .930  .114                  (   |XXXX)XXXXXXXXXXXXXXXXXXXX
  2  .853  .188                (     |XXXXXXXXX)XXXXXXXXXXXXXX
  3  .812  .233                (     |XXXXXXXXXXX)XXXXXXXXXX
  4  .761  .267               (      |XXXXXXXXXXXXX)XXXXXXX
  5  .726  .294               (      |XXXXXXXXXXXXX)XXXX
  6  .692  .317              (       |XXXXXXXXXXXXXX)XX
  7  .650  .336             (        |XXXXXXXXXXXXXXX)
  8  .609  .352            (         |XXXXXXXXXXXXXXX )
  9  .534  .365           (          |XXXXXXXXXXXXX  )
 10  .458  .375           (          |XXXXXXXXXXX   )
 11  .405  .382          (           |XXXXXXXXXX    )
 12  .326  .388          (           |XXXXXXXXX     )
 13  .241  .391          (           |XXXXXX     )
 14  .169  .393          (           |XXXX      )
 15  .118  .394          (           |XX       )
 16  .100  .395          (           |XX       )
 17  .066  .395          (           |X       )
 18 -.011  .395          (           |        )
 19 -.079  .395          (          X|        )
 20 -.146  .395          (        XXX|        )
 21 -.217  .396          (       XXXXX|         )
 22 -.259  .398          (       XXXXXX|         )
 23 -.290  .400          (      XXXXXXX|          )
 24 -.312  .402          (      XXXXXXX|          )
 25 -.328  .406          (     XXXXXXXX|           )
```

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
             +----+----+----+----+----+----+----+----+----+----+
  1  .930  .114                  (   |XXXX)XXXXXXXXXXXXXXXXXXXX
  2 -.092  .114                  ( XX|  )
  3  .231  .114                  (   |XXXX)
  4 -.136  .114                  (XXX|  )
  5  .193  .114                  (   |XXXX)
  6 -.115  .114                  ( XX|  )
  7  .040  .114                  (   | )
  8 -.081  .114                  ( XX|  )
  9 -.265  .114                 X(XXXX|  )
 10 -.002  .114                  (   | )
 11 -.044  .114                  ( X| )
 12 -.225  .114                  (XXXX|  )
 13 -.093  .114                  ( XX| )
 14 -.084  .114                  ( XX| )
 15  .178  .114                  (   |XXXX)
 16  .184  .114                  (   |XXXX)
 17 -.054  .114                  ( X| )
 18 -.267  .114                 X(XXXX|  )
 19 -.019  .114                  (   | )
 20 -.064  .114                  ( X| )
 21 -.036  .114                  (   | )
 22  .005  .114                  (   | )
 23 -.067  .114                  ( X| )
 24  .056  .114                  (   |X )
 25  .088  .114                  (   |XX )
```

IDENTIFICATION FIT 3
PLOT OF RESIDUAL
NUMBER OF CASES = 77
MEAN OF SERIES = 0.001
STANDARD DEVIATION OF SERIES = 0.051

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
            +----+----+----+----+----+----+----+----+----+----+
 1  .076  .114              (   |X  )
 2 -.198  .115              (XXXX|   )
 3  .092  .119              (   |XX )
 4 -.066  .120              (  X|  )
 5  .023  .120              (   |   )
 6  .088  .120              (   |XX )
 7  .055  .121              (   |X  )
 8  .272  .122              (   |XXXXX)
 9  .013  .129              (   |   )
10 -.131  .129              ( XXX|   )
11  .206  .131              (   |XXXXX)
12  .052  .135              (   |X  )
13 -.081  .135              (  XX|  )
14 -.070  .136              (  X|  )
15 -.264  .136              (XXXXX|   )
16  .093  .143              (   |XX  )
17  .298  .144              (   |XXXXXX)
```

PLOT OF RESIDUAL

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
            +----+----+----+----+----+----+----+----+----+----+
 1  .076  .114              (   |X  )
 2 -.205  .114              (XXXX|   )
 3  .132  .114              (   |XXX)
 4 -.138  .114              ( XXX|   )
 5  .103  .114              (   |XX )
 6  .015  .114              (   |   )
 7  .100  .114              (   |XX )
 8  .282  .114              (   |XXXX)
 9 -.033  .114              (   |   )
10  .000  .114              (   |   )
11  .186  .114              (   |XXXX)
12  .013  .114              (   |   )
13 -.015  .114              (   |   )
14 -.180  .114              (XXXX|   )
15 -.334  .114              ( XXX|   )
16  .042  .114              (   |X  )
17  .188  .114              (   |XXXX)
```

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IDENTIFICATION FIT 4
CASH GRAIN PRICES
RATIO OF #1 C.W. OATS TO #1 FEED BARLEY
NUMBER OF CASES = 80
MEAN OF SERIES = 1.029
STANDARD DEVIATION OF SERIES = 0.164

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
              +----+----+----+----+----+----+----+----+----+----+
  1  .792  .112            (    |XXXX)XXXXXXXXXXXXXX
  2  .671  .168            (    |XXXXXXX)XXXXXXXX
  3  .546  .199           (    |XXXXXXXX)XXXX
  4  .463  .217           (    |XXXXXXXXX)X
  5  .402  .229          (    |XXXXXXXXXX)
  6  .354  .237          (    |XXXXXXXXX )
  7  .419  .244         (    |XXXXXXXXXX )
  8  .431  .253         (    |XXXXXXXXXX )
  9  .420  .262        (    |XXXXXXXXXX )
 10  .385  .270        (    |XXXXXXXXX  )
 11  .328  .277        (    |XXXXXXXX   )
 12  .277  .281        (    |XXXXXX    )
 13  .228  .285        (    |XXXXX    )
 14  .160  .287        (    |XXXX    )
 15  .139  .288        (    |XXX    )
 16  .105  .289        (    |XX     )
 17  .037  .290        (    |      )
 18 -.034  .290        (    |      )
 19 -.082  .290        (    XX|      )
 20 -.085  .290        (    XX|      )
 21 -.103  .290        (    XX|      )
 22 -.082  .291        (    XX|      )
 23 -.082  .291        (    XX|      )
 24 -.102  .291        (    XX|      )
 25 -.139  .292        (    XXX|      )
```

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
              +----+----+----+----+----+----+----+----+----+----+
  1  .792  .112            (    |XXXX)XXXXXXXXXXXXXX
  2  .118  .112            (    |XX )
  3 -.044  .112            (   X|  )
  4  .037  .112            (    |  )
  5  .041  .112            (    |X )
  6  .020  .112            (    |  )
  7  .300  .112            (    |XXXX)
  8  .023  .112            (    |  )
  9 -.051  .112            (   X|  )
 10 -.021  .112            (    |  )
 11 -.063  .112            (   X|  )
 12 -.018  .112            (    |  )
 13  .041  .112            (    |X )
 14 -.142  .112            (  XXX|  )
 15  .005  .112            (    |  )
 16 -.053  .112            (   X|  )
 17 -.200  .112            (XXXX|  )
 18 -.098  .112            ( XX|  )
 19 -.004  .112            (    |  )
 20  .024  .112            (    |  )
 21  .014  .112            (    |  )
 22  .073  .112            (    |X )
 23 -.080  .112            (   X|  )
 24 -.055  .112            (   X|  )
 25 -.013  .112            (    |  )
```

IDENTIFICATION FIT 4
PLOT OF RESIDUAL
NUMBER OF CASES = 80
MEAN OF SERIES =   0.003
STANDARD DEVIATION OF SERIES =   0.100

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
            +----+----+----+----+----+----+----+----+----+----+
 1 -.093 .112           ( XX|  )
 2  .086 .113           (  |XX )
 3 -.027 .114           (  |  )
 4  .004 .114           (  |  )
 5  .021 .114           (  |  )
 6 -.199 .114          (XXXX|  )
 7  .163 .118           (  |XXXX)
 8  .102 .121          (  |XX )
 9  .099 .122          (  |XX )
10  .090 .123          (  |XX )
11  .025 .124          (  |  )
12  .031 .124          (  |  )
13  .067 .124          (  |X  )
14 -.083 .124          ( XX|  )
15  .054 .125          (  |X  )
16  .085 .125          (  |XX )
17  .008 .126          (  |  )
```

PLOT OF RESIDUAL

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
            +----+----+----+----+----+----+----+----+----+----+
 1 -.093 .112           ( XX|  )
 2  .078 .112           (  |X  )
 3 -.012 .112           (  |  )
 4 -.006 .112           (  |  )
 5  .024 .112           (  |  )
 6 -.199 .112          (XXXX|  )
 7  .134 .112           (  |XXX )
 8  .167 .112           (  |XXXX)
 9  .092 .112           (  |XX )
10  .101 .112           (  |XX )
11  .035 .112           (  |  )
12 -.024 .112           (  |  )
13  .135 .112           (  |XXX )
14 -.043 .112           ( X|  )
15  .026 .112           (  |  )
16  .116 .112           (  |XX )
17 -.039 .112           (  |  )
```

IDENTIFICATION FIT 5
FARM GATE PRICES
RATIO OF #1 C.W. OATS TO FEED BARLEY
NUMBER OF CASES = 80
MEAN OF SERIES = 1.033
STANDARD DEVIATION OF SERIES = 0.208

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
               +----+----+----+----+----+----+----+----+----+----+
 1  .889  .112              ·    (  |XXXX)XXXXXXXXXXXXXXXXX
 2  .718  .180                 (     |XXXXXXX)XXXXXXXXX
 3  .552  .212                (      |XXXXXXXXX)XXX
 4  .405  .230               (       |XXXXXXXXXX)
 5  .298  .238               (       |XXXXXXX )
 6  .272  .243               (       |XXXXXX   )
 7  .286  .247               (       |XXXXXXX  )
 8  .307  .251               (       |XXXXXXX  )
 9  .310  .256               (       |XXXXXXX  )
10  .287  .260               (       |XXXXXXX   )
11  .225  .264               (       |XXXXX    )
12  .152  .267               (       |XXX     )
13  .056  .268               (       |X       )
14 -.050  .268               (       X|       )
15 -.121  .268               (      XXX|      )
16 -.175  .269               (      XXXX|      )
17 -.233  .270               (     XXXXX|       )
18 -.268  .273               (     XXXXXX|      )
19 -.258  .276               (     XXXXXX|      )
20 -.228  .279               (      XXXXX|      )
21 -.196  .281               (      XXXX|       )
22 -.169  .283               (      XXXX|       )
23 -.162  .284               (      XXXX|       )
24 -.181  .285               (      XXXX|       )
25 -.228  .287               (     XXXXX|       )
```

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2  .0  .2  .4  .6  .8 1.0
               +----+----+----+----+----+----+----+----+----+----+
 1  .889  .112               (  |XXXX)XXXXXXXXXXXXXXXXX
 2 -.342  .112             X(XXXX|  )
 3  .000  .112               (  |  )
 4 -.044  .112               ( X|  )
 5  .071  .112               ( |X )
 6  .262  .112               ( |XXXX)
 7 -.006  .112               ( |  )
 8  .020  .112               ( |  )
 9 -.077  .112               ( X|  )
10 -.031  .112               ( |  )
11 -.085  .112               ( XX|  )
12  .030  .112               ( |  )
13 -.198  .112               (XXXX|  )
14 -.103  .112               ( XX|  )
15  .054  .112               ( |X )
16 -.151  .112               ( XXX|  )
17 -.119  .112               ( XX|  )
18 -.010  .112               ( |  )
19  .122  .112               ( |XXX )
20  .049  .112               ( |X )
21  .007  .112               ( |  )
22 -.039  .112               ( |  )
23 -.032  .112               ( |  )
24  .015  .112               ( |  )
25 -.118  .112               ( XX|  )
```

IDENTIFICATION FIT 5
PLOT OF RESIDUAL
NUMBER OF CASES = 80
MEAN OF SERIES = 0.006
STANDARD DEVIATION OF SERIES = 0.094

PLOT OF AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2 .0 .2 .4 .6 .8 1.0
              +----+----+----+----+----+----+----+----+----+----+
 1  .327  .112              (  |XXXX)
 2  .012  .123              (  |   )
 3 -.043  .123              (  X|  )
 4 -.163  .123              ( XXXX|   )
 5 -.338  .126              (XXXXX|   )
 6 -.156  .137              ( XXX|  )
 7 -.022  .139              (  |   )
 8  .110  .139              (  |XX  )
 9  .138  .140              (  |XXX )
10  .196  .142              (  |XXXX )
11  .053  .145              (  |X  )
12  .119  .145              (  |XX  )
13  .056  .147              (  |X  )
14 -.185  .147              ( XXXX|   )
15 -.127  .150              ( XXX|   )
16  .033  .151              (  |  )
17 -.103  .151              ( XX|  )
```

PLOT OF RESIDUAL

PLOT OF PARTIAL AUTOCORRELATIONS

```
LAG  CORR   SE -1.0 -.8 -.6 -.4 -.2 .0 .2 .4 .6 .8 1.0
              +----+----+----+----+----+----+----+----+----+----+
 1  .327  .112              (  |XXXX)XXX
 2 -.106  .112              ( XX|  )
 3 -.014  .112              (  |  )
 4 -.160  .112              (XXXX|   )
 5 -.270  .112              X(XXXX|   )
 6  .030  .112              (  |  )
 7 -.018  .112              (  |  )
 8  .109  .112              (  |XX )
 9  .012  .112              (  |  )
10  .078  .112              (  |X )
11 -.068  .112              ( X|  )
12  .183  .112              (  |XXXX)
13  .044  .112              (  |X )
14 -.178  .112              (XXXX|   )
15  .081  .112              (  |XX )
16  .052  .112              (  |X )
17 -.099  .112              ( XX|  )
```

Appendix Six
Final Results of Intervention

Six Month Futures Settlement
Ratio of WCE to CBE Oats

Variables in the Model:

	Estimate	Approx. Std. Error	T-RATIO
AR1	.84191268	.04471989	18.826360
W_o	.1839600	.03805263	4.928362
Constant	.77967923	.03281925	23.756764

Six Month Futures Settlement
Ratio of #1 C.W. Oats to #1 Feed Barley

Variables in the Model:

	Estimate	Approx. Std. Error	T-RATIO
AR1	.9137312	.03791109	24.101948
MA1	-.2248364	.08649023	-2.599559
W_o	.11580684	.05260328	2.3282121
Constant	1.0567498	.06808157	15.521819

Cash Grain Prices
Ratio of WCE to U.S. Oats

Variables in the Model:

	Estimate	Approx. Std. Error	T-RATIO
AR1	.8756382	.04152935	22.656812
W_o	.09256301	.05652631	2.622631
Constant	.9356874	.0589625	14.729548

Cash Grain Prices
Ratio of #1 C.W. Oats to #1 Feed Barley

Variables in the Model:

	Estimate	Approx. Std. Error	T-RATIO
AR1	.8348868	.04411084	18.927020
W_0	.0506916	.06581340	.770232
Constant	1.0499975	.05396367	19.457489

Farm Gate Prices
Ratio of #1 C.W. Oats to Feed Barley

Variables in the Model:

	Estimate	Approx. Std. Error	T-RATIO
AR1	.89750911	.03530363	25.422575
W_0	.05427348	.07571106	.716850
Constant	.96831901	.07496254	12.917373