THE ECONOMICS OF VERTICAL COORDINATION IN THE ORGANIC WHEAT SUPPLY CHAIN

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Abstract

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The organic wheat supply chain in Canada operates in a relatively new sector for which there is very little public information to aid in price discovery. Organic wheat producers must use available information in order to decide when to sell their wheat and whom to sell to. The relatively low degree of market information, especially for producers, suggests a problem of information asymmetry, which may have ramifications for efficiency and the distribution of rents in the organic wheat supply chain.

The literature on Transaction Cost Economics, Agency Theory and the Economics of Information is used in the thesis to theorize differences between methods of selling organic wheat that vary in terms of vertical coordination. The analysis involves a comparison of selling to large and small grain companies, selling through Producer-Owned Firms (POFs) and selling directly to processors. The theory predicts that producers gain from using a POF because of savings in transaction costs and higher prices. These theorized differences in transaction costs and price are due to increased sharing of information between the producer and the marketing agent, enhanced producer control over the marketer, and incentive for the marketer to provide producers with a high price. These benefits can also be realized by selling directly to a processor, but only if the producer can effectively and efficiently perform his or her own marketing

functions. Average cost, price and profit margins are used as a metric for comparing each of the four governance structures.

A survey of organic wheat producers in Saskatchewan was undertaken in order to collect data on organic Hard Red Spring Wheat (HRSW) transactions. The results indicate that governance structure has a statistically significant effect on organic HRSW prices and on producer transaction costs. The analysis concludes that the producer receives the greatest profit margin from selling through the vertically coordinated POF, while a marketer receives the greatest profit margin if it operates as a large grain company and purchases HRSW on the spot market. The results also suggest that organic producers that "eliminate the middleman" and sell directly to processors cannot market as efficiently and effectively compared with producers that use a POF. The results of this thesis emphasize that increased coordination between producer and marketer through a POF can be advantageous for the producer, but not necessarily for the marketer, due to the difference in the distribution of rents.

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Chapter 1: Introduction

1.0 Introduction

The organic grain industry in Canada has quickly evolved from a cottage industry towards an industrialized system that exports internationally. The trend towards increased consumption of organic food products has catalyzed organic production around the world, creating a world market for organic grains. Supply chains for organic grains have evolved in a number of different forms, involving different economic agents and with different implications for efficiency. Supply chain efficiency is important at every level, including primary production, marketing, processing, through to the consumer. This thesis presents an analysis of the efficiency and the distribution of rents of alternative supply chain configurations in the Canadian organic wheat industry.

The organic wheat supply chain consists of several functions, including production, transportation, storage, cleaning, finding a buyer, price determination, controlling the logistics of all of these functions, etc. This wide array of functions is divided up among firms in the supply chain. In general, producers perform primary production functions. Marketers act as a middleman between the producer and the processor or foreign buyer, and perform much of the transportation, cleaning, marketing and logistics functions before the grain arrives at a processor for further processing. This common division of a grain supply chain exhibits low levels of vertical

coordination between the producer and marketer entities; the transaction between these firms are performed on the spot market, and producers and marketers have little or no involvement in each other's activities. This system is closely related to the conventional grain supply chain, where many of the organic grain buyers were doing business long before the organic sector emerged.

Deviations from typical low vertical coordination also exist in the organic wheat supply chain between producer and marketer firms. Some producers choose to eliminate the marketing firm middleman entirely. In this case they transact directly with processors and other foreign buyers instead of selling to an organic grain marketing firm. The producer performs the functions and incurs the expenses that are otherwise covered by the marketer, with the goal of achieving a higher price. Such direct marketing efforts by producers represent a type of vertical integration of the producer and marketer levels of the supply chain.

Some producers have chosen to market cooperatively as a group, with a marketing firm working on commission as their agent. While the producer and marketer entities are not entirely integrated in the group marketer approach, there is increased coordination between the producer members and their marketer. Producers may also choose to sell individually to brokers that work on a commission. In the group marketer and commission agent approaches, producers must perform more of the necessary supply chain functions, with the agent providing fewer functions apart from finding a buyer for the producers' grain.

It is assumed that the goal of producers and other firms in a supply chain is to maximize profit. For marketers, this objective is achieved by simultaneously finding a

buyer offering the highest price at the lowest cost possible. Cost efficiency is thus an important part of the marketing decision. While production costs would not differ considerably among producers' available marketing options, Transaction Cost Theory (TCE) tells us that transaction costs, which are the costs of performing transactions in the market, can differ between alternative governance structures and institutional arrangements. In TCE, governance structure can be defined as the set of rules that govern transactions between parties. Some rules in transactions are defined by the law (e.g.: contract law), while other rules are defined by social convention. The rules of a transaction culminate into a contract, which can be created verbally or in writing. The contract sets out the rights and obligations of the buyer and seller. Different governance structures are therefore characterized by contracts that differ in the extent, complexity, duration, etc. of the rights and obligations. Institutions are defined by North (1989) as rules, enforcement characteristics of rules and norms of behaviour. Institutions can manifest themselves through public or private organizations that affect transactions, and undertake functions such as transmitting information on market price and quantity, measuring quality, and enforcing contracts. The efficiency of transaction organizations has been examined in the poultry and pork industries (Boger 2001, Martinez et. al. 1998), where researchers have found that the drive towards transaction cost efficiency and increased product quality explains the increased vertical coordination in those sectors.

There is evidence that governance structures and their associated transaction costs are important to firms when making marketing choices. Several studies have concluded that transaction costs have a significant effect on the choice of vertical coordination by

producers. Hobbs (1996) found that transaction costs significantly influence the proportion of cattle sold by producers through auctions in the UK. Boger (2001) examined vertical coordination between Polish hog producers and buyers at a time when high quality markets were emerging, and found that transaction characteristics have a significant effect on the producers' choice of marketing channel.

While TCE posits that the governance structure that emerges is one that minimizes costs, including transaction costs, this rule ignores price differences that result from using different governance structures. Price differences can occur between different governance structures because they add different amounts of value to a product or because the governance structure facilitates finding higher prices. Both prices and costs under the different governance structures must therefore be compared to measure the optimal, profit maximizing governance structure. At present there have been no studies that attempt to determine the optimal governance structure for the organic wheat supply chain.

1.1 Need for the Study

Organic hard red spring wheat (HRSW) is one of the largest organic crops grown in Saskatchewan (AAFC 2004). Given the expected significance of governance structure in the efficiency of many agri-food supply chains and the continuing growth of the organic grain sector, it is timely to evaluate the relative prices and cost efficiency of governance structure alternatives in the organic wheat supply chain in Western Canada. An evaluation of this kind may assist firms in the supply chain to increase their profits or improve overall cost efficiency. Any improvement in cost efficiency is beneficial to the organic wheat supply chain, as it improves competitiveness with other countries' organic

wheat supply chains and with substitute products such as conventional wheat. To achieve this, a method of comparing alternative governance structures that considers both price and cost is needed.

1.2 Purpose and Objectives

The main purpose of this thesis is to measure the relative performance of the existing supply chain governance structures that are used to transact organic HRSW between producers and buyers in Saskatchewan.

There are several specific objectives of the study. The study endeavours to provide a better understanding of the functioning of the organic wheat supply chain. The study also seeks to provide a theory and method that can be used to measure the relative performance of alternative governance structures. In particular, the study aims to provide an explanation for why prices and costs may differ between governance structures. This explanation is complemented by providing an assessment of price variability and producers' concerns regarding price information asymmetry.

1.3 Hypothesis

The null hypothesis put forth in this thesis is that there are no significant differences in price or cost between the various governance structures that producers use to transact organic HRSW to downstream firms. Each alternative governance structure is tested for significant difference from a defined base governance structure. In the thesis, the base governance structure is the transaction with grain companies that are Canadian Wheat Board (CWB) handling agents. The alternative governance structures are transactions through Producer-Owned Firms, transactions direct to processors or other downstream firms, and transactions through grain companies that are not CWB

handling agents. The rejection of the hypothesis means that a particular governance structure is significantly different from the base governance structure.

1.4 Organization of the Thesis

This thesis is composed of nine chapters. A background on the organic wheat supply chain is provided in Chapter 2. A review of the relevant literature is included in Chapter 3. A description of the theoretical framework that is used to analyze the problem is given in Chapter 4, which includes a model that can quantitatively compare the prices, costs and profits of alternative governance structures. The methodology of the thesis is described in Chapter 5. The results of the hypothesis test are presented in Chapter 6. A methodology and results for measuring the nature of a HRSW price distribution and producers' opinions on information asymmetry is presented in Chapter 7 and Chapter 8 respectively. Conclusions follow in Chapter 9.

Chapter 2: Industry Characteristics and Background

2.0 Introduction

A brief background of the organic wheat industry and the organic wheat supply chain is provided in this chapter. The chapter begins by providing a general description of the size and growth of the industry, followed by a description of the alternative supply chain configurations. The involvement of organizations in the supply chain is then described, including the Canadian Wheat Board (CWB), price discovery organizations such as commodity exchanges and quality assurance organizations such as certification bodies. Vertical coordination in the organic wheat supply chain is then discussed, including the drivers of existing vertical coordination arrangements and their outcomes[1]. The history of vertical coordination in organic and conventional grain sectors concludes the chapter.

2.1 Industry Characteristics

Organic wheat production in Western Canada is small compared to conventional wheat production, but it is a fast growing segment of the wheat industry. Organic wheat acreage in Western Canada increased by 126 percent from 1998 to 2001 (AAFC 2002).

[1] A driver is defined in this context as an exogenous effect that causes increased vertical coordination to occur.

There are several components of the organic wheat supply chain, including primary producers, grain cleaners, grain companies, brokers, export buyers, and processors. There were approximately 3134 certified organic producers in Canada in 2003, of which 1049 are located in Saskatchewan, the most of any province (AAFC 2004). The number of certified organic grain producers continues to grow. In that same year, there were 456 certified processors and handlers in Canada, of which 94 were located in Saskatchewan. Saskatchewan had the largest acreage of organic crop production in Canada, totalling 386,000 acres with an estimated farmgate value of $92 million. Most certified organic producers in Saskatchewan are involved in growing grains or oilseeds. Saskatchewan producers grew 145,000 acres of organic wheat and durum in 2003. Given that Saskatchewan has a large share of Canadian grain production and producers, it is appropriate that this thesis examine the supply chain of Saskatchewan's largest organic crop, which is organic Hard Red Spring Wheat.

There are further upstream and downstream components of the supply chain, such as upstream seed providers and downstream distributors and retailers of wheat products. An analysis of these other components of the supply chain is beyond the scope of this thesis, which focuses on the primary production to processor stages of the supply chain.

2.2 Organizations in the Organic Wheat Sector

There are several organizations in Western Canada that have an influence on the organic wheat supply chain. While there are several governmental organizations that affect the grains industry, there are a few that are especially influential for organic wheat, including the Canadian Wheat Board and organizations that certify firms as organic. It is also interesting to note that there is an absence of organizations that

provide price information to firms in the organic wheat supply chain. This section describes these organizations.

2.2.1 The Canadian Wheat Board

The Canadian Wheat Board (CWB) is legislated to market all wheat and barley that is destined for export or domestic human consumption in the prairie region of Canada (CWB 2004). While the CWB has the power to market organic wheat or any other wheat that is graded by the CGC, it does not market organic wheat.

The CWB pools the revenues that it receives for conventional wheat so that the proceeds of each sale are put in a single account, which is distributed back to the producers so that each producer receives the same price for a given quality of wheat. Pooling is carried out on an annual basis, beginning August 1 and ending July 31. It is against the law for producers in the "CWB designated area" (including Manitoba, Saskatchewan, Alberta, and North-east British Columbia) to sell their wheat and barley outside of the CWB, unless the producer has sold their wheat to the CWB at the pooled price and then bought it back at the market price on that day. The process of selling at the pooled price and buying back at the market price that day is called a Producer Direct Sale (PDS). If the market price on the given day is greater than the pool price, then the difference is paid to the CWB. If the market price is less than the pool price, then the difference is paid to the producer. The difference between these prices can be very large, depending on the time of the sale. The pooled price from the CWB includes an initial payment issued at the time of the PDS, plus any other interim payments later in the crop year, and a final payment after the pool account is closed for the particular year.

Even though the CWB does not market organic wheat, the rules still apply so that organic producers cannot sell their wheat until they have performed the PDS. Organic producers are not allowed to sell outside of the pool because it is believed that the organic producers would compete with the CWB's own sales effort for conventional wheat, and could cause prices to decrease for producers in the pool. Moreover, producers that sold outside of the pool without performing a PDS would sell most often when the cash price of wheat is the highest, thus exacerbating the effect of competition on prices in the pool. Organic wheat is also capable of compromising the integrity of the conventional wheat pool accounts, since organic wheat that is not sold to an organic buyer may end up being sold in the conventional market, thus competing with the CWB and lowering pooled returns.

Producers incur transaction costs from CWB transactions. In transactions with companies that are not handling agents of the CWB, the PDS from the CWB typically costs producers $1.50 per tonne, which can be considered as a transaction cost[2]. In addition, the CWB initial, interim and final payments that organic producers receive already include marketing charges accrued to the particular pool account, despite the fact that the CWB has not performed any marketing tasks for organic producers.

A PDS is not necessarily a concern for the producers when organic wheat is sold to a company that is a handling agent of the CWB. The PDS process is internalized by the handling agent in these types of transactions(CWB 2004). When wheat is sold

[2] The CWB charges an additional $0.50 per tonne for producer direct sales where the producer is not required to pay the CWB's cash price immediately, but can wait until a later date, such as when they receive payment from their directly sold organic wheat.

through a CWB handling agent, the producer receives initial payment from the CWB and then the producer must negotiate for the organic premium with the CWB handling agent. Interim and final payments from the CWB are sent to the producer later in the crop year.

2.2.2 Price Discovery Organizations

Price discovery for organic wheat is very different from price discovery for conventional wheat. For conventional wheat, the CWB, the government and other private firms conduct extensive surveillance of the supply and demand situation in all world markets that have a bearing on the present and future Canadian wheat price. Public and private organizations use surveys to collect statistics on areas planted, yield, stocks, etc. These organizations disseminate and distribute this information for producers' use. There is one Canadian commodity exchange (the Winnipeg Commodity Exchange) with a futures contract for feed wheat, and there are three U.S. commodity exchanges with futures contracts for wheat of various qualities (the Chicago Board of Trade, Kansas Commodity Exchange and Minneapolis Grain Exchange). Futures contracts provide price data that can be interpreted directly by producers or through government or private firms to yield price discovery information. Exchanges also utilize cash closing committees that are responsible for reporting a daily cash price. Radio, television and newspaper communicate wheat price data on a daily basis to the public.

There is much less market information available to the organic wheat industry as there does not exist any organization that gathers and interprets organic wheat price data, nor is there a futures contract for organic wheat. While there are several wheat transactions made every week, there is no process to share this information that could

inform individuals on the market clearing price. Price information is thus private unless transacting individuals choose to make it known to others. Moreover, there is no way to verify the truth of individual's statements on prices paid and received. This results in significantly less market information and lower quality marketing information in the organic wheat supply chain regarding the prices of different sellers and expected prices in the future. Unlike downstream marketers and processors, most organic producers suffer to a greater extent because they do not have economies of scale related to price, supply and demand data collection and interpretation. Producers do not know all of the offer prices on a given day, and they have very little means to forecast organic grain prices in order to decide if they should sell now or wait for a higher price. As a result of these organizational limitations to price discovery, producers, intermediaries, and end-users discuss prices on a regular basis through person-to-person communication.

2.2.3 Certification Organizations

Organic producers, organic grain buyers, and other firms that buy and sell organic products must be certified before they can label their output as organic. The organic characteristic is a credence attribute, which means that it is an attribute that cannot be physically verified either before or after consumption (McCluskey 2000). The credence characteristic of organic foods necessitates certification in order for the organic attribute to be effectively signalled to buyers and ultimately to consumers.

Certification requires documentation by participating firms in order to provide sufficient proof that the original product was grown in accordance with organic production practices and that no contamination has occurred from non-organic sources. Producers must prove that they grow and handle their grains following the guidelines

established by organizations that establish standards for producing and handling organic grains. Other firms that handle the organic grains must prove that they handle the grains in their facilities using the required procedures. Firms in the organic wheat supply chain incur costs to acquire third party certifications by paying a certification body to provide the service.

2.3 The Transaction Process

Low degrees of vertical coordination characterize the organic wheat supply chain in Western Canada. The transactional relationships between producers and buyers of organic wheat are mainly market specification contracts, using the terminology of Mighell and Jones (1963). In market specification contracts, producers grow their wheat and then communicate their available quantities and qualities to potential buyers, or they contract prior to seeding or harvest. Producers and buyers must communicate individually with each other through telephone, fax, internet or in person. If demand exceeds supply a producer may be in a situation where buyers tender bids to the producers, but if supply exceeds demand the producer may become a price taker at the mercy of buyers. Contracts arranged prior to harvest are almost identical in form to those made after harvest, except that the buyer generally requires the land location of the contracted wheat field and estimated production in order to make sure that the producer does not shirk on his or her contractual obligations.

2.4 Supply Chain Configurations

In general, producers sell organic wheat directly to a processor or foreign importer, or producers sell to a middleman marketer that in turn sells to a processor or foreign importer. Horizontal transactions can also take place between marketers. Marketers

include grain companies, brokers and Producer-Owned Firms (POFs). Some grain companies are handling agents of the CWB, while others are not. Figure 2.1 illustrates the possible supply chain sequences for organic wheat. The supply chain levels that are within the scope of the thesis are illustrated in dark font in the figure.

2.5 Functions of Firms at Each Level of the Supply Chain

A simple way to describe the various firms that are components of the organic wheat supply chain is to describe their functions within the chain. Table 2.1 provides a summary of the division of functions for producers and specific types of marketer firms. In Table 2.1, an "I" indicates that the intermediary/marketer performs the function and a "P" indicates that the producer performs the function. Some functions are not performed and are designated by "n/a". This section begins with a description of the general functions of producers and marketers and then discusses the differences in functions among the different types of marketers.

2.5.1 Producer Functions

Producers perform the function of primary production of wheat. Producers can also perform functions that add value to their wheat, including cleaning, storage, transportation and processing. Producers also perform functions related to marketing their wheat, such as searching for a buyer that offers an acceptable price for the wheat, negotiating the details of the transaction, completing the associated paperwork for the transaction, and monitoring the buyer's action with respect to timing of payment and amount of payment. The number of marketing functions that are required of producers is determined by their choice of buyer, or "governance structure". By using the term "governance structure", it is implied that different buyer choices entail different rules

that govern the nature of the transaction, including the rights and obligations of each party.

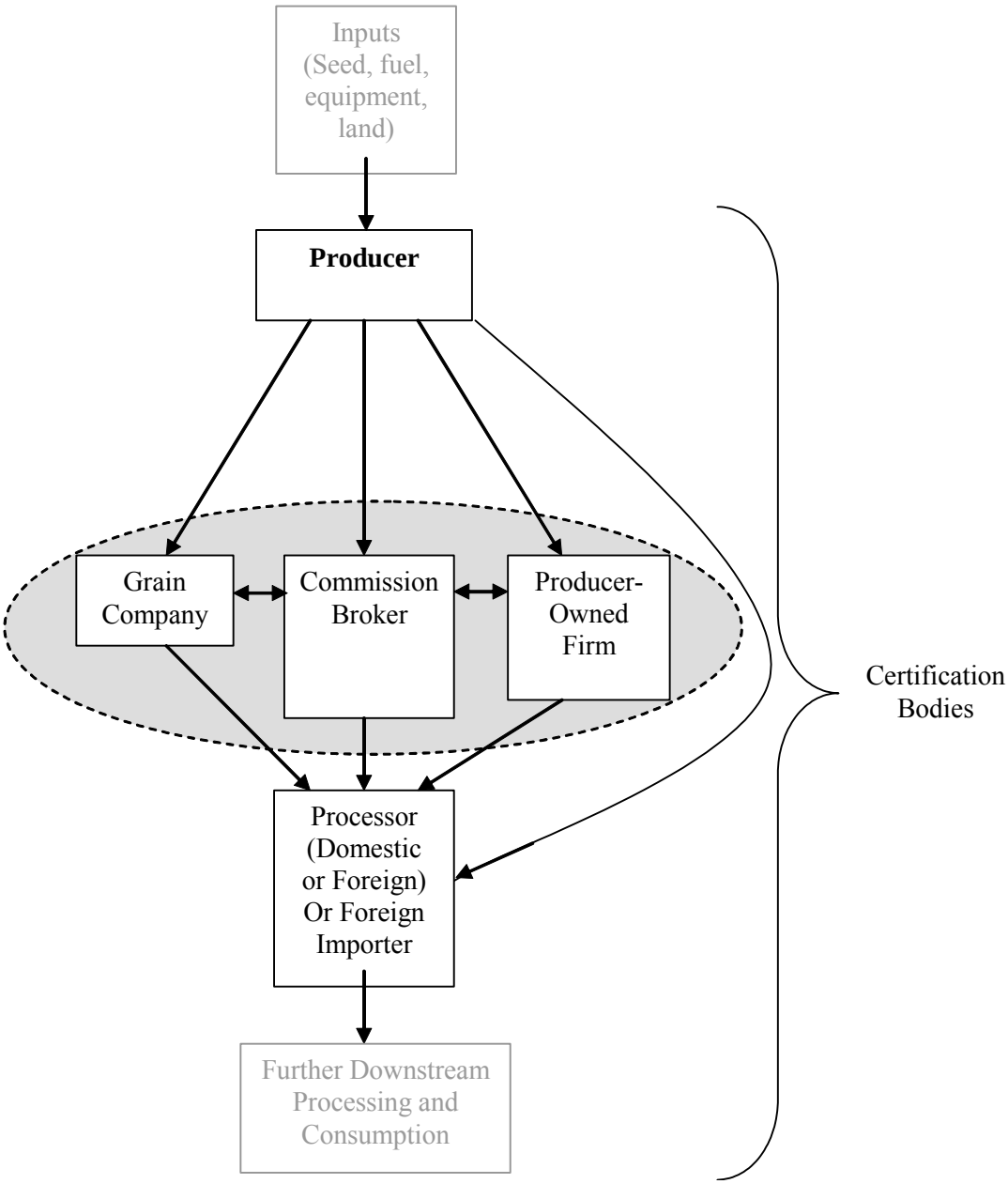

Figure 2.1 - Organic Wheat Supply Chain

Table 2.1 - Division of functions between producer and marketer levels for governance structures (P = performed by producer, I = performed by marketer)

Function	**Governance Structure** Increasing Vertical Coordination ---------->				
Marketer Type:	**Grain Companies**		**Brokers**		**None**
	CWB Agent	**Not CWB Agent**	**Brokers**	**POF Broker**	**Direct to Processor**
Transformation Functions:					
Production	P	P	P	P	P
Storage between production and delivery to downstream buyer	P / I	P / I	P	P	P
Transport from farm	I	I	P	P	P / I
Cleaning and transport from cleaner	I	I	P	P	P / I
Transport to processor/buyer	I	I	P	P	P / I
Transaction Functions:					
CWB PDS (wheat only)	I	P/I	P / I	P / I	P
Searching for marketers' prices	P	P	P	n/a	n/a
Searching for processor prices	I	I	I	I	P
Marketer reputation search	P	P	P	n/a	n/a
Downstream buyer reputation search	I	I	I	I	P
Quality testing	I	P / I	P	P	P
Sample delivery to marketer	P	P	P	P	n/a
Sample delivery to processor	I	I	I	I	P
Filling out paperwork	P / I	P / I	P / I	P / I	P
Monitoring producer	I	I	I	I	n/a
Monitoring marketer	P	P	P	P	n/a
Enforcing marketer payment	P	P	n/a	n/a	n/a
Enforcing downstream buyer payment	I	P / I	P / I	P / I	P

n/a = not an applicable cost
Source: Author's estimates, personal communications with grain companies

2.5.2 Marketer Functions

Marketers are defined in this thesis as firms that perform the functions that are necessary to transact between producers and downstream buyers such as processors and foreign buyers. The functions of the specific types of marketers are outlined in Table 2.1.

It is generally the case that marketers perform or coordinate the value-adding functions of cleaning, blending and transportation to the buyer's location. These value-adding functions entail a cost, referred to in this thesis as "transformation costs".

Marketer firms also perform functions in order to transact with both the upstream producer and the downstream processor/buyer. These transaction functions are numerous, and include negotiating with the upstream producer, monitoring the upstream producer, searching for a downstream buyer, negotiating with the downstream buyer, completing necessary accounting and certification paperwork with the producer and buyer, and enforcing buyer payment. These transaction functions entail a cost and are referred to as "transaction costs".

There are several types of marketers, including grain companies that are handling agents of the CWB (hereafter referred to as CWB agents), grain companies that are not handling agents of the CWB (hereafter referred to as non-agents), brokers and POFs. These marketers differ in the value-adding functions and transaction functions that they perform. The defining characteristics of the different marketer types is provided in the next section.

Grain Companies

Grain companies generally own an elevator at one or more locations. Organic wheat is purchased by the grain company and is delivered to the elevator, where it may be cleaned, stored, and possibly blended in order for it to meet the specifications of their customer. The organic wheat is then loaded into a truck or an inter-modal container for transport to the buyer. Grain companies generally pay for all transportation charges from the farm to the downstream buyer. Grain companies also perform several transaction functions, including PDS and certification paperwork, finding buyers, quality testing, sample delivery to the buyer, monitoring producer actions (in contracts), and enforcing buyer payment.

A fundamental difference between grain companies, brokers and POFs is that grain companies take ownership of the grain. Grain companies' margins are therefore not transparent to producers and buyers in the case of organic grains. The characteristics of grain companies that are CWB handling agents and are not CWB handling agents is provided in the next two sections.

CWB Handling Agent Grain Companies

Some grain companies are designated handling agents of the Canadian Wheat Board (CWB), which means that they can issue CWB initial payments to producers when producers deliver their organic wheat. CWB agents also have the privilege of being able to buy organic grain on the CWB account. These companies repay the CWB the conventional portion of the price on the given day that they actually sell the organic wheat, which acts as a type of hedge against price fluctuations in the conventional wheat market (that probably also affects the organic wheat price). The ability of CWB agents

to purchase organic wheat on the CWB account also acts as a loan that allows the CWB agent to purchase organic wheat from producers before the downstream buyer has paid. These companies pay the organic producer the conventional price, plus an organic premium. The organic premium is a cost that cannot be borrowed from the CWB and for which there exists no hedging mechanism.

It is generally the case that CWB agent grain companies sometimes buy producers' grain and hold the grain for a period of time before selling. This behaviour is different than other organic wheat buyers, and indicates that CWB agent grain companies may be speculating in the market, or they may be attempting to secure enough grain to make their commitments. If a CWB agent buys organic wheat from a producer and pays the producer an organic premium in advance of knowing the downstream price, it must discount the organic premium to account for the risk that the organic premium will decrease.

CWB agents that buy organic wheat are generally large grain companies with one or more elevator locations. Storage, blending and loading often occurs at the elevator locations. Cleaning may occur in the elevator or it may be performed by a fee-for-service grain cleaning firm. CWB agents buy the majority of the organic wheat in Saskatchewan, and likely have economies of scale with respect to their functions. Similar to other marketers, CWB agents use containers and bulk truck loads to transport organic grains. Organic wheat transaction quantities are not large enough for companies to use bulk boat shipments, as would occur in conventional wheat sales. CWB agents may receive discounts on trucking, rail, or marine transportation because of their size. Smaller grain companies, brokers and POFs may also receive discounts, but these would

be more idiosyncratic, depending on factors such as backhauls or other timing considerations.

Non-CWB Handling Agent Grain Companies

Grain companies that are not CWB handling agents may have a central physical location where cleaning, storage, blending and loading occurs. If they do not have these facilities, they may arrange for cleaning with a fee-for-service company and coordinate transportation directly from the producer's yard to the cleaning facility, and on to the customer.

Non-agents must arrange for the PDS to be performed with the CWB before the grain can be purchased by that grain company. The CWB is no longer involved once the PDS is completed, and a grain company that agrees to buy this wheat cannot buy it on the CWB account, but rather must pay the full amount directly to the producer. The inability of these companies to buy through the CWB means that they must finance the purchase on their own, through either a loan or by performing a "back-to-back" sale. A "back-to-back" sale is characterized by completing the transaction with the upstream producer at approximately the same time as the subsequent transaction with the downstream processor or buyer. In this situation, the downstream buyer pays the grain company and the grain company pays the producer shortly thereafter. Non-agents perform most of the same transaction functions as CWB agents, but they may not pay for quality testing, as some non-agents cannot justify the expense of owning testing equipment. Non-agents may not enforce downstream payment as strongly as CWB agents, since they are not as influential as larger CWB agent grain companies.

Brokers

In general, organic grain brokers can be defined as firms that act as agents to the upstream producers by negotiating sales in return for a fee or commission. Brokers generally do not take ownership of the wheat. The marketing margin of a broker is typically transparent to the producer.

Brokers do not perform as many value-adding functions as grain companies. Organic wheat sold by brokers may be stored and cleaned by the producer or by a fee-for-service company. Blending does not likely occur because the shipment would not enter an elevator facility. As in the grain company case, the broker makes arrangements for the organic wheat to be transported to the buyer by truck or intermodal container. The cost of transportation may be paid by the producer or by the broker.

Brokers perform many transaction functions, but not as many as grain companies. Brokers' transaction functions include finding buyers, sample delivery to the buyer, filling out paperwork, monitoring producer actions (in contracts), and enforcing buyer payment. PDS paperwork and quality testing are transaction functions that are not usually performed by brokers, with producers undertaking these functions instead. The producer does not receive payment until the broker has received payment from the buyer and deducts the commission.

Producer Owned Firms

Generally, POFs are similar to commission brokers, but they market the products of the producer owners over an extended period of time. The POF employs an agent to act on behalf of the members/owners. POFs are organized as either cooperatives or corporations. The marketing agent typically receives a percent commission as an

incentive to maximize prices to producers. The POF members do not receive payment until the POF has received payment from the buyer and deducts the commission and any applicable transformation costs.

Not all POFs are located on the same point on the continuum of vertical coordination. One POF in Saskatchewan (Marysburg Organic Producers) operates like a relational contract. Producers own shares in the corporation and employ a marketing agent. The obligations of the principal and agent are specified and self-enforced, which are characteristics of vertical financial integration. However, the agreement to cooperate is based more on goodwill than on a superior-subordinate relationship between the producer and marketer respectively, which are characteristics of a relational contract. The other POF in Saskatchewan (Farmer Direct) is cooperatively organized and displays the characteristics of strict vertical integration.

2.6 Vertical Coordination

This thesis focuses on vertical coordination between producers and marketers. Vertical coordination is defined by Mighell and Jones (1963) as:

> "…all the ways of harmonizing the successive vertical stages of production and marketing. The market-price system, vertical integration, contracting, cooperation singly or in combination are some of the alternative means of coordination" (p.1).

Organic producers' choice of buyer type can be measured in terms of the level of vertical coordination. As table 2.1 indicates, changing from a grain company governance structure to selling directly to processors entails increasing degrees of vertical coordination. Transactions through grain companies involve very little

coordination between the producer and the marketer other than arranging the sale and delivering. Transactions through brokers involve more vertical coordination between the producer and the broker agent, involving the coordination of the agent's actions with the producer. Even more coordination is necessary with a POF, since the arrangement lasts much longer. Transactions directly between producers and processors or foreign buyers represent vertical integration between the producer and marketer stages of the supply chain, as the producer must perform all of the value-adding and transaction tasks that a grain company would typically undertake. These choices are thus on a spectrum of vertical coordination.

2.6.1 History of Vertical Coordination in the Wheat Supply Chain

The principles of vertical coordination between producers and downstream firms in grain supply chains have been important for decades. Grain producers in the Prairie provinces first sought to gain control of the grain companies during the early 1900s. Producers wanted more control of grain companies so that the companies would work as agents on farmers' behalf instead of against the farmers. This movement was catalyzed by reports of grain companies taking advantage of producers by deducting excessive dockage and improperly weighing their loads (Fowke 1957). The companies were also accused of collusion in setting the purchase price. The goal of producers to have grain companies working for the producer manifested itself in the establishment of farmer-owned grain companies. Through the twentieth century, and until recently, these cooperatives became large and prosperous, while at the same time keeping their marketing margins low, to the benefit of their producer members.

Closer forms of vertical coordination have also occurred in the organic grain sector. The Girvin Cooperative was the first cooperative organic grain marketer and processor in Saskatchewan, emerging in the 1980s. The organization was abandoned in the early 1990s due to a lack of membership commitment.

Shortly after the demise of the Girvin Cooperative in 1993, a group of organic producers decided to organize a group marketing scheme, which started with six producers. One of the six producers volunteered to perform the function of marketing the group's grain. The organization grew to include approximately 40 shareholders. This group is known as Marysburg Organic Producers Inc, and continues to operate in Saskatoon, SK. An organic grain producer cooperative has recently formed, under the name Farmer Direct Cooperative Ltd. This organization has approximately 80 members, and it also markets organic grains from its Regina location (Farmer Direct 2004). Marysburg Organic Producers Inc. and Farmer Direct are the only two known POFs that sell organic grains in Saskatchewan. Although Marysburg Organic Producers is incorporated and Farmer Direct is organized as a cooperative, both organizations work on a percentage commission separately for each producer. No revenue pooling occurs within these organizations.

2.6.2 Drivers of Vertical Coordination

Hobbs and Young (2000) explain the trend towards increased vertical coordination by examining its technological, regulatory, and socio-economic drivers. Liability and traceability are examples of regulatory drivers. Perishability, product differentiation, and biotechnology are examples of technological drivers. Changes in consumer lifestyles and preferences are examples of socio-economic drivers.

Much of the increased coordination in grain markets has come in the form of increased contracting between producers and grain buyers, although this phenomenon is partially attributed to biotechnology in conventional grain supply chains. Organic supply chains are not affected by the biotechnology driver because genetically modified organisms are prohibited in organic production. However, organic wheat has its own set of influential drivers. Traceability drivers have already affected vertical coordination in organic wheat through the Identity Preservation (IP) and quality assurance systems required for organic certification. Consumer preferences for more direct interaction with agriculture (the "buy local" phenomenon) drive direct selling from producers to consumers.

The lack of organizations to aid in price discovery, and producers' subsequent belief that controlling their marketer's actions can aid the perceived problem of asymmetric price information, may be the most significant driver of vertical coordination in the organic grain supply chain. Some producers see vertical integration with the marketer as a method of gaining better information and therefore receive higher prices compared to marketing through other means.

2.7 Chapter Summary

A background of the organic wheat supply chain and its organizations was provided by this chapter. The organic wheat supply chain formally begins as certified organic primary producers purchase inputs and grow organic wheat. Producers sell their organic wheat to marketers who sell the organic wheat to processors or foreign importers. Organic wheat is transformed along the supply chain into a product that is

purchased by consumers. This thesis examines the various ways that producers sell their organic wheat to downstream firms.

There are five different types of organic wheat supply chains that producers can use. Producers can sell to marketers such as CWB agent grain companies, non-CWB agent grain companies, brokers, or POFs. Producers can bypass these agents and sell directly to millers or other downstream buyers. The different types of firms that producers transact with differ by the degree of vertical coordination that is required between the parties in the transaction. Transactions with grain companies entail the least vertical coordination, while POF and broker transactions entail higher amounts of vertical coordination. Eliminating the middleman entirely and selling directly to processors is a form of vertical integration of the production and marketing levels. The producers' choice of firm type therefore affects the vertical coordination in their transaction.

Organizations to assist in price discovery do not exist in the organic wheat supply chain. The CWB acts to ensure that organic wheat sales do not negatively affect the pool accounts by requiring that organic wheat be sold to the CWB at the pool price and bought back at the price that given day, known as a PDS. Certification bodies provide the service of third party organic certification, which is necessary to assure buyers that the wheat contains the organic attribute.

This chapter has provided a background on the relevance of vertical coordination in describing the organic wheat supply chain. A review of literature that relates to the analysis of vertical coordination is provided in the next chapter.

Chapter 3: Literature Review

3.0 Introduction

There are several areas of literature that provide the theory that is required to understand the effect of governance structure on prices and costs. Literature from several disciplines of economic theory is relevant to this thesis, including Transaction Cost Economics, Agency Theory, Competency Theory and the Economics of Information. Literature that uses welfare models to measure the effect of transaction cost changes is also relevant. The concepts from these areas of economic literature that are relevant to the theoretical framework, theoretical model and methodology chapters of this thesis are discussed in this chapter.

3.1 Transaction Cost Economics

The seminal literature on Transaction Cost Economics (TCE) is central to the theoretical framework of this thesis. The genesis of TCE was provided by Coase (1937) in his seminal paper "The Nature of the Firm." The central thesis of Coase's paper was that the fundamental purpose of a firm is to organize transactions, and that firms and markets are the alternative means of conducting transactions. Firms can choose to transact a good through the market mechanism or internalize the transaction within the firm. Coase posited that there is a cost to using the market mechanism for making vertical transactions between firms in a supply chain. Moreover, Coase suggested that

the number of successive stages of production that are contained within a firm was a decision variable that depended on the relative costs of using the market versus internalizing the transaction within the firm. A firm internalizes successive stages of production within a firm until the marginal benefit of transacting through the market is greater than the marginal benefit of internalizing the transaction. In this thesis, transactions with different types of buyers differ in the successive stages of production that are contained within the producer firm. Transactions with grain companies use the market, while selling through a broker, POF or directly to processor internalize more aspects of the transaction.

Williamson (1979) further developed Coase's concept and in doing so created modern TCE theory. Williamson postulated that the "governance structures" that determine the rules of transactions are not a given, but are decision variables that are chosen by comparing their relative costs. In this thesis, the five types of buyers of organic wheat are considered to be alternative "governance structures".

Williamson also posited that firms choose the governance structure that minimizes cost. The principle of cost minimization is incorporated into this thesis, as the methodology compares transaction costs amongst alternative governance structures.

Williamson's work also described the basic behavioural assumptions of TCE and the fundamental properties of transactions. The first main assumption of TCE is that parties in a transaction exhibit bounded rationality. In general, bounded rationality implies that individuals attempt to act rationally, but are unable to do so because they do not have complete information. The assumption of bounded rationality means that parties in a transaction will agree to a contract that is in their best interests, but they do

not have perfect information regarding the other party or what transpires in the future with respect to the contract.

The second assumption of TCE is that parties in a transaction may act opportunistically, which is defined by Williamson as "self-interest seeking with guile" (p.7). The opportunism assumption means that a party to a transaction may act in a way that exploits the other party to their own advantage. Combining the behaviours of bounded rationality and opportunism, parties to a transaction will not wilfully enter into a contract where their partner exploits them, but they may enter into a situation where they are exploited because they have no means of predicting future exploitation at the time that the contract is made. The theoretical framework of this thesis uses the behavioural assumptions of bounded rationality and opportunism.

Williamson proposed that transactions can be characterized by their endowments of uncertainty, asset specificity and frequency. The degree of uncertainty in transactions is the party's perception of the likeliness that a transaction will occur as expected, for example, in terms of price, time of payment, quality and quantity. The degree of asset specificity in transactions is determined by the degree to which one party has invested resources specific to the transaction that have little or no value in an alternative use. Williamson dubbed the term "fundamental transformation" as the change that occurs after specific assets become part of a contract and are then vulnerable to appropriation due to the bilateral trading relationship that is created. The presence of uncertainty and asset specificity may result in opportunistic behaviour. Parties are driven to reduce the risk of being exploited by incurring transaction costs. Increasing frequency of transactions results in less risk of opportunistic behaviour because individuals learn to

avoid exploitative situations and reputation effects reduce the payoff from opportunism. Frequent transactions with the same party involve relational contracting. That is, both parties have a mutual interest in maintaining the relationship and it is in both parties' interests to not exploit the other. This thesis analyzes the characteristics of organic wheat transactions in order to arrive at *a priori* beliefs on the differences in transaction costs between governance structures.

Williamson (1985) posited that there are four major types of asset specificity: site specificity, physical asset specificity, human asset specificity and dedicated assets. Site specificity occurs when an immobile asset must be located in a certain location in order to be of use in a particular transaction. Physical asset specificity occurs when an physical asset has a use limited to the particular transaction. Human asset specificity occurs when skills that are gained have a use limited to the particular transaction. Dedicated assets occur when assets are expanded on behalf of a particular buyer. The additional assets may have limited use if the particular buyer reduces its purchases at a later time.

Klein, Crawford and Alchian (1978) contributed to TCE by further explaining the effect of asset specificity on transactions. Klein et. al. developed the idea that specific assets in a transaction have a salvage value, which is the value of the asset if sold to another party. A party to a transaction could exploit the transaction-specific assets of the other party by worsening the terms of the contract by an amount such that the asset returns a value that is equal only to its salvage value. The exploited party has no choice but to accept the new terms of the contract because it cannot become better off by selling the asset. The difference between the original value and the salvage value of the specific

asset is the amount of "quasi-rents" that the opportunistically-behaving firm can appropriate. Klein et al.'s insights on asset specificity are applied to the case of organic wheat in this thesis.

Literature on the relevance of transaction cost concepts to contemporary supply chain management is found in Hobbs (1996). Hobbs explains the conceptual relevance of TCE in contemporary supply chain issues, and discusses the types of costs that arise in transactions. Transactions costs can be divided into information (or search) costs, negotiation costs and monitoring (or enforcement) costs. Information costs include searching for information about products, prices, inputs and the characteristics of buyers or sellers. Negotiation costs include the effort required in specifying the terms of the contract. Monitoring and enforcement costs arise after an exchange has been negotiated, and involve monitoring the behaviour of the transaction partner and enforcing the pre-agreed terms of the contract. Hobbs (1996) also discusses methodological issues regarding the testing of hypotheses using TCE theory. This thesis uses these definitions of transaction cost types to identify producers' transaction costs.

3.2 Agency Theory and Vertical Integration

Agency Theory can be defined as the economic analysis of cooperation in situations where externalities, uncertainty, limited observability, or asymmetric information exclude the pure market organization[3] (Bamberg and Spremann 1987). The problem of information asymmetry occurs because the agent often knows more about their own activities than the principal. The goal of the principal is to gain information or

[3] The "pure market organization" can be defined as the spot market where the price system works smoothly (Mahoney 1992) and no vertical coordination exists.

develop a system of incentives to ensure that the agent's actions are in the principal's interests.

Agency theory complements the transaction cost approach to the theoretical framework. It provides explanations of inefficiencies stemming from incentive problems when using more coordinated contracting and vertical integration. Sykuta and Cook (1995) posit that contracting efficiencies exist for producer-oriented firms (POFs) compared to investor-owned firms (IOFs) because the principal-agent relationship entails less incentive to withhold information and more trust when producers contract with a firm that they own and control. This principle is applied in this thesis to the case of POFs in the organic wheat supply chain.

Williamson (1971) states that the advantages of a vertically integrated firm can be divided into three components: incentives, controls, and "inherent strategic advantages." Incentive advantages include the ability of a vertically integrated firm to internalize and eliminate opportunism that may otherwise occur in market transactions. The firm can provide strong incentives for all parts of the firm to work as an agent to the owner-principal. Control advantages of vertical integration include the ability to perform more precise own-performance evaluations and control rewards and penalties within the organization. Other potential control benefits of vertical integration include easier conflict resolution, resulting in lower negotiation and enforcement costs for both parties and economies of market information exchange. An inherent strategic advantage of vertical integration between the production and marketing stages is that economies of information exchange can occur. Quality, price, and quantity information is allowed to flow more freely within the firm than between transaction partners. In this thesis,

Williamson's ideas on the advantages of vertical integration are applied to the organic wheat supply chain, particularly POF and direct to processor transactions.

3.3 Prediction of Organizational Choice

Mahoney (1992) adds to the literature on the choice of organization by providing a thorough literature review of the reasons for and against vertical integration, as well as providing a framework for predicting organizational form. Mahoney's framework is used in order to predict the governance structures that should emerge in the organic wheat supply chain. Predictions can be made from the perspective of both the organic producer and the organic marketing firm.

Mahoney states that the choice of organizational form may be determined from asset specificity and measurement uncertainty. The resulting framework applies insights from two theoretical perspectives – TCE and agency theory – and offers an integrative organizational efficiency approach to the prediction of governance structure choice. Measurement uncertainty consists of the uncertainty of observing output as a means to reward an agent's performance (the degree of "nonseparability") and the uncertainty of observing input as a means to reward an agent's performance (the degree of "task programmability").

Mahoney's framework for predicting governance structure choice can be summarized in eight different circumstances, which are shown in Table 3.1. When the output of the agent is easily measured (low nonseparability) and asset specificity is low (cases 1 and 5), the ease of input measurement (task programmability) is not important, and in either case the spot market should be chosen. Any sort of vertical coordination is

not likely to be useful in these two cases because it provides no benefit compared to the spot market transaction.

Table 3.1 – Predicting the Organizational Form of Vertical Control

	Low Task Programmability		High Task Programmability	
	Low Specificity	**High Specificity**	**Low Specificity**	**High Specificity**
Low Nonseparability	1: spot market	2: long-term contract	5: spot market	6: joint venture
High Nonseparability	3: relational contract	4: clan (hierarchy)	7: inside contract	8: hierarchy

Definitions:
Low task programmability: Observing input (effort) is a poor measure for making rewards.
High nonseparability: Observing output is a poor measure for making rewards.
High specificity: Human, physical and/or site firm-specific investments are high.
Spot market: The price system works smoothly.
Long-term contract: Obligations of principals and agents are specified and enforced by third-parties (courts).
Relational contract: Obligations of principals and agents are specified and self-enforced. Social conditioning is applicable.
Inside contract: A hybrid arrangement between contract and hierarchy that is best described as a 'manager as monitor' setup.
Joint ventures: An equity agreement whereby a separate entity is created.
Hierarchy: A superior-subordinate relationship; financial ownership (vertical integration).
Clan: Organization that is based on a vital sense of human solidarity.
Source: Mahoney (1992).

When the output of the agent is easily measured (low nonseparability) and asset specificity is high (cases 2 and 6) a long term relationship is necessary for the parties to commit to investing in the specific assets. Low nonseparability discourages vertical integration in these cases. Given these characteristics, high task programmability would be accommodated by a joint venture, and low task programmability would be best suited to a long-term contract.

When the output of the agent is hard to measure (high nonseparability) and asset specificity is low (cases 3 and 7) a long-term relationship is not required due to a lack of asset specificity. If task programmability is low, a relational contract that provides

incentive for cooperation between the parties is required since output and behavioural controls are ineffective. If task programmability is high then the "inside contract" is optimal. In an inside contracting system, agents are paid based on their effort, and any team production within these contracts is monitored by a manager.

When the output of the agent is difficult to measure (high nonseparability) and asset specificity is high (cases 4 and 8), contracting problems become severe. Under high task programmability, this scenario lends itself to hierarchy (vertical integration). Under low task programmability, this is the worst-case scenario where asset specificity is high and the input and output measurements are ineffective. A vertically integrated clan relationship is best under this case, where trust and human dignity are emphasized in order to alleviate opportunistic behaviour.

3.4 Competency Theory

Competency theory also complements the transaction cost approach, as it can explain vertical coordination inefficiencies that exhibit themselves through production costs. The idea of competence theory, as described by Hodgson (1998), is that on the margins of a firm's increasing scope, firms may not be as competent, and therefore, may not be as cost efficient as a firm that specializes in that given task. In this thesis, the principle of decreasing competence as firm scope increases is also applied to the case of producers vertically integrating with marketers, particularly in the case of transacting directly with processors.

3.5 Economics of Information

Stigler (1961) explains the effect of price information search costs on the frequency dispersion of asking prices in a market. Stigler's analysis relaxes the

assumption of neoclassical economics that all individuals have perfect information, and claims that the bidding price dispersion is a function of the amount of "ignorance" in the market regarding the amount of search required. The amount of search is a negative function of the cost per unit of search, and a positive function of the percentage of the seller's expected revenue and the percentage of experienced producers in the market. The variance of supply and demand in the organic wheat market can affect the size of the price dispersion, with greater variance leading to greater price dispersion. According to Stigler (1961), greater "geographical size" (p.219), which can be interpreted in the case of organic wheat as the difficulty of searching, can also lead to greater price dispersion, and can potentially affect the cost of search.

Individuals choose the optimum amount of search by searching until the marginal cost of search equals its marginal return. By turning Stigler's argument around to discuss bidding prices instead of asking prices, a conceptual framework for the effect of search costs on price can be developed for organic wheat.

3.6 Applications to Agri-Food Supply Chains

Hobbs and Young (2000) apply TCE to agricultural commodities by discussing the transaction characteristics and costs that drive vertical coordination. They state that uncertainty can be broken down into four components; quality, supply, price, and finding a buyer. As uncertainty increases, it is expected that tighter forms of vertical coordination are used rather than using the spot market. Hobbs and Young give examples of vertical coordination for several grain and livestock commodities. Increased vertical coordination has been occurring in chicken and pork industries for several years, but grain supply chains are beginning to adopt closer vertical

coordination. Technological, regulatory and sociological developments have been major drivers of closer vertical coordination in agriculture commodity supply chains. Regulatory developments include concern over liability and the requirement of traceability in supply chains. Technological developments that provide economies of size include relationship-specific investments in biotechnology. Socio-economic developments involve changes in consumer preferences, requiring tighter vertical coordination with suppliers in order to provide the attributes demanded by consumers. Following Hobbs and Young's paper, this thesis explores the drivers that have contributed to increased vertical coordination in the organic wheat supply chain.

Wilson and Dahl (1999) discuss the issue of quality uncertainty in grain markets. Quality uncertainty in the grain supply chain can be defined as "consistency in quality either within a lot, across lots, or over time" (p.222). Quality uncertainty can result in higher costs for buyers, processors and grain handlers by increasing search costs, inspection costs, defect rates, storage costs and processing costs. Firms in the grain supply chain have chosen vertical coordination strategies, such as Identity Preservation (IP), in order to ensure the supply of consistently high quality grains. Wilson and Dahl's descriptions of uncertainty in grain markets is applied to the case of organic wheat in this thesis.

Kennett et al. (1998) also discuss the issue of quality uncertainty and its effect on vertical coordination. Current wheat grading systems do not always meet the quality needs of end-users. Downstream wheat buying firms have therefore begun to use segregation and contracting in order to procure the desired specifications. Kennett models the procurement of milling wheat, and illustrates that grading schema are

ineffective when the end-users standards are higher than the grade cut-offs. The model also provides a measure of the willingness of a processor to pay for segregated wheat.

Kennett et al. state two conditions that must be present in order for an initiative in supply chain management to be sustainable. The first condition is that the economic rents created for the whole system must be greater than the economic rents generated from alternative systems. The second condition is that each party's share of the economic rent must exceed their costs. In the case of wheat segregation, the processor must compensate the upstream firms in the segregated supply chain for their extra costs and have remaining surplus in order for segregation to occur. Kennett et. al. examine the case of Warburtons Ltd. segregating milling wheat in Western Canada as an example of successful vertical coordination via segregation. Warburtons Ltd. is a UK baker that requires a certain variety and quality of wheat in its product. Kennett et al.'s two conditions for an initiative in supply chain management to be sustainable are incorporated into the criteria for governance structure comparison used in this thesis.

3.7 Welfare Modelling

As the measurement of the welfare effects of alternative governance structures is one objective of this thesis, relevant literature in this area is needed. Muth (1964) provides a model of vertical markets that uses a supply and demand framework to illustrate the effect of supply and demand shifts on prices, quantities and welfare in vertical markets. The Muth model consists of six equations describing a vertical market. The production function is a technology requiring two types of inputs and creating one type of output. The supply chain is described by a production function, a processor demand equation, two input supply equations and two equations setting out the marginal

conditions for profit maximization. The system contains six endogenous variables and six equations, allowing for a unique solution if demand functions have non-positive slopes and supply functions have non-negative slopes. The Muth model has been used to measure welfare effects in vertical markets in a vast array of agricultural economics literature. While this thesis does not use the Muth model, it is proposed as a model that can be used to measure transaction costs in certain situations.

Choosing the appropriate welfare model to find empirically the differences in price, cost and profit between governance structures is a very important part of this thesis. The use of supply and demand functions as a means for empirically evaluating alternative governance structures is controversial in the literature. Hobbs (1996) states that perceiving transaction costs as a measurable marginal cost may be "misguided" (p. 25). Dorward (2001) avoids the use of supply and demand functions in constructing a welfare model of the effect of transaction costs on price and welfare. These authors' main argument against using transaction costs in a supply and demand framework is that their existence is subtle. Transaction costs are not considered on the margin like production costs because data measuring transaction costs are not routinely collected by the standard accounting practices of firms. Moreover, transaction costs are harder to quantify than production costs.

Other studies have embraced the Muth model framework to examine the effects of transaction costs due to governance structure changes, and have included traditional welfare measurement (Martinez et. al. 1998, Kinnucan and Nelson 1993). These authors also implicitly assumed that marginal transaction costs are a part of the marginal costs that are a component of the supply curve.

Dorward (2001) develops a methodology for modelling the economic effect of governance structure choice. Dorward's model takes account of the effect of the contractual choice, the transaction parties' characteristics, the product characteristics, and the organizational environment on price, quantity and welfare. The Dorward model posits that the optimal form of transaction governance maximizes the "transaction margin", which is the difference between the total costs and total revenue net of pure transformation costs[4]. Total costs consist of transaction costs, associated transformation costs[5] and the risk of loss due to market conditions and seller behaviour. Dorward's approach allows for quantitative analysis of transaction costs. While this thesis does not use the entire Dorward model, it implements the graphical illustration of alternative governance structures to display the results of the governance structure comparison.

3.8 Applications of Welfare Modelling

There are no applied models of vertical coordination in the literature that exactly match the objectives of this thesis, but some studies exist that are similar in nature. A study by Lentz and Akridge (1997) has an objective that is most similar to this thesis. Lentz and Akridge evaluate the cost of alternative supply chains for the production of soybean peroxidase. The study empirically evaluates the production cost of the status quo and alternative soybean peroxidase supply chains. Lentz and Akridge do not use a supply and demand approach to analyzing differences between supply chains, but they

[4] Pure transformation costs are transformation (production) costs that occur across all governance structures.

[5] Associated transformation costs are transformation (production) costs that are particular to the governance structure used.

calculate the price, revenue and profit under each procurement scheme. This thesis closely follows the organization of the Lentz and Akridge paper.

Martinez, Smith, and Zering (1998) employ a transaction cost approach to analyze the effect of increased quality in the U.S. pork industry. The authors show the effects of decreased production and transaction costs from sorting and measuring efficiencies, coupled with a projected increase in demand, on the welfare of producers and consumers using a model similar to the Muth model. Decreased production and transaction costs at the packer level due to higher quality hogs shifts the retail supply curve to the right, while increased quality shifts the retail demand curve to the right. The expansion in demand and supply increases quantity, decreases retail price and increases consumer and producer surplus.

The concept of vertical coordination causing a shift in the supply curve was tested by Kinnucan and Nelson (1993). They found that the substantial decrease in the farm-retail price spread in the U.S. egg industry is explained by increased vertical control, exhibiting itself through a downward shift in the supply curve. Martinez et al. and Kinnucan and Nelson both provide applications of modelling vertical coordination that are relevant to the thesis as potential methods of modelling the effect of vertical coordination in the organic wheat supply chain.

3.9 Applied Price Dispersion Analysis

Since the Economics of Information literature proposes that a distribution of prices can develop in markets where search costs are positive, it is advantageous to explore the possibility of analysing price dispersion in the organic wheat supply chain. Analyses of price dispersion are not common in the literature, but an article by Lach (2002) provides

a rigourous analysis of store-level monthly prices of four household products sold in Israel. Lach studied the existence and characteristics of price dispersion for each good. Product heterogeneity was controlled for by employing a regression on prices, where the independent variables included the store effect, month effect, location effect and type-of-store effect. After calculating the regression, the variance of the residual terms indicated the degree of price dispersion. Lach found that price dispersion existed for each good after controlling for product heterogeneity. Moreover, Lach observed that intra-distribution mobility is significant, meaning that a given store's price moves to different parts of the price distribution over time. Consumers therefore cannot learn about stores that offer consistently lower prices, and price dispersion persists over time.

3.10 Chapter Summary

A summary of the literature that is relevant to the objective of this thesis was provided in this chapter. The common theme of the literature is to understand the effect of governance structure on prices and costs, and how to appropriately model these effects. Seminal TCE literature provided by Coase (1937) and Williamson (1979) is central to the theoretical framework of the thesis. The TCE theory is complemented by literature in the areas of Agency Theory, Competency Theory and a synthesis of Agency Theory and TCE theory by Mahoney (1992). A description of transaction characteristics for agricultural commodities provides a guide for understanding organic wheat transactions. The Economics of Information literature provides relevant theory to describe the nature of organic wheat prices. Literature that analyzes price dispersion is also described.

Muth (1964) and Dorward (2001) provide two alternative models that can be applied to governance structure effects on price and cost. The Muth model has been applied in the literature to model effects of vertical coordination, but the use of a supply and demand framework in governance structure comparison is less common. The next chapter applies the literature to the theoretical framework.

Chapter 4: Theoretical Framework

4.0 Introduction to the Theoretical Framework

The purpose of this chapter is to develop a set of theories to analyze the differences between governance structures that are used to transact organic wheat between producers and buyers. This framework is used to construct a methodology to test for significant differences in prices and costs and to measure differences in profit between governance structures..

The theoretical framework chapter proceeds as follows. The objective of firms in the organic wheat supply chain is first described and then the effects of governance structure are explained. The effects of governance structure in transactions can be separated into effects on transaction costs, which follows TCE theory, and effects on price, which follows the Economics of Information theory. After showing how governance structure affects transaction costs and price, the chapter continues by describing all factors that potentially affect producers' average transaction costs and prices. A discussion of governance structure comparison concludes the chapter, using a model adapted from Dorward (2001).

4.1 The Approach to Governance Structure Comparison

Organic wheat is grown by producers, and sold to a series of firms that eventually transform the wheat into a product that is purchased by consumers. This succession of firms that produce, purchase, transform, and sell the organic wheat product is known as a supply chain. The firms in the supply chain are assumed to maximize their utility, subject to constraints.

4.1.1 The Producer's Objective Function

Organic wheat producers have a utility function that is subject to constraints. Organic wheat producers are assumed to maximize their utility, which is comprised of profits derived from producing and selling organic wheat, and from other non-monetary characteristics of transactions. The utility of an individual organic producer in year *t* can be represented as

$$U^t = \Pi^t_{mkt} + \sum_{i=1}^{n} \mathbf{U}^t_{non-mkt} \tag{4.1}$$

where Π^t_{mkt} is the profits derived from organic wheat in year *t*, and $\mathbf{U}^t_{non-mkt}$ is a vector of non-market utilities that are associated with their choice of production and marketing practices in year *t*. The profit function of an organic producer is defined as

$$\Pi^t_{mkt} = (P \cdot Q) - \sum_{j=1}^{m} VTC_j - VPC \cdot Q - FTC - FPC \tag{4.2}$$

where *P* represents the price for organic wheat and *Q* is the quantity of organic wheat sold in year *t*. The term $\sum_{j=1}^{m} VTC_j$ represents the variable transaction costs associated with each transaction, where VTC_j is the variable transaction cost of the j^{th}

transaction in year *t*. Variable transaction costs are not accrued per unit of quantity, but rather per transaction. Moreover, each transaction may be unique and have its own level of variable cost, necessitating a separate calculation for each transaction. The size of the transaction thus affects average transaction costs. Variable transaction costs include search, negotiation, and monitoring costs that are required when transacting organic wheat, and are described in greater detail later in this chapter. *VPC* represents variable production (transformation) costs, which comprise mainly the cost of producing organic wheat.

Producers may also incur transportation and storage costs, depending on the conditions of their sales. The terms *FTC* and *FPC* represent the amounts of fixed transaction and production (transformation) costs respectively. Fixed transaction costs include those costs that are incurred regardless of the number of transactions performed, and include certification costs, marketing-related overhead items, and general marketing efforts that do not accrue to any one particular transaction. Fixed transformation costs include capital costs and overhead that are incurred regardless of the quantity of organic wheat produced.

Organic wheat producers maximize their profit by finding the highest price for their wheat and producing as much as possible while keeping costs low. The producer profit function differs from the typical description of the profit function in that it explicitly includes fixed and variable transaction costs.

The choice of governance structure does not affect all of the variables in the profit function. Theory indicates that variable and fixed transaction costs are affected by governance structure (Williamson 1979) and prices can be affected by search costs

(Stigler 1961), which are affected by governance structure choice. Pure transformation costs are assumed to be unaffected by governance structure choice[6]. The relationship between governance structure choice, price, and transaction costs are developed further in later sections of this chapter. Quantity is also assumed to be unaffected by the choice of governance structure, which restricts the analysis to the short run.

Producer profits are constrained by several factors. Firstly, producers have imperfect information on organic wheat prices across buyers and across time. Producers cannot survey all possible buyers of their wheat from various governance structures, nor can they know exactly when to sell, but they can search until they have conducted an "optimal" amount of search activities. This concept is developed later in this chapter.

Producers are also constrained by their ability to choose a governance structure. Not all producers are free to participate in POFs that have closed memberships. Producers that are not members of such organizations have the option to create their own producer-owned firm, but the large amounts of resources needed to accomplish this task relative to the expected pay-off may discourage producers from taking that initiative.

4.1.2 The Buyer's Objective Function

Several types of firms purchase organic wheat. These firms can be organized into five main categories: CWB agents, non-agents, brokers, POFs and processors. There is a succession of firms that buy and sell organic wheat before the wheat product is sold to

[6] The use of production specification contracts (Mighell and Jones 1963) can affect transformation costs by specifying production practices, thus affecting transformation costs. This type of contract is not used between organic wheat producers and their buyers, so it can be assumed that transformation costs are held constant.

consumers. Regardless of the firm type or position in the supply chain, each firm maximizes its profit as

$$\Pi^{t}_{buyer} = (P_{sell} - P_{buy}) \cdot Q - \sum_{j=1}^{m} VBTC_j - \sum_{k=1}^{n} VSTC_k - VPC \cdot Q - FTC - FPC \qquad (4.3)$$

where P_{sell} represents the buyer's selling price for organic wheat, P_{buy} is the buyer's purchase price of organic wheat and Q is the quantity of organic wheat sold in year t. $P_{sell} - P_{buy}$ represents the gross margin of the firm. The term $\sum_{j=1}^{m} VBTC_j$ represents the variable transaction costs associated with each buying transaction, where $VBTC_j$ is the variable transaction cost of the j^{th} purchase in year t. The term $\sum_{k=1}^{n} VSTC_k$ represents the variable transaction costs associated with each selling transaction, where $VSTC_k$ is the variable transaction cost of the k^{th} sale in year t. Variable transaction costs include the search, negotiation, and monitoring costs that are required when transacting organic wheat, either through buying from producers or selling to downstream firms. *VPC* is the amount of variable production (transformation) costs that the firm incurs, which is comprised mainly of the transportation, storage, blending and possibly milling costs.

The terms *FTC* and *FPC* are the amounts of fixed transaction and production (transformation) costs respectively. Fixed transaction costs include those costs that are incurred regardless of the number of transactions performed, and include certification costs, marketing-related overhead items, and general marketing efforts that do not accrue to any one particular transaction. Fixed transformation costs include capital costs and overhead that are incurred regardless of the quantity of organic wheat transacted.

Firms that buy organic wheat maximize profit by simultaneously buying at the lowest price possible, selling at the highest price possible (thereby maximizing their gross margin) and having as much throughput as possible, while keeping their transformation and transaction costs low. Economies of size and scope can effect the profits of marketing firms.

While the transformation costs associated with producers and their buyers are significant sources of costs, they are assumed to be unaffected by governance structure choice and therefore are not the focus of this thesis. The theoretical framework focuses on the affect of governance structure on transaction costs and prices. This focus begins in section 4.2 with respect to transaction costs and in section 4.3 with respect to prices.

4.2 The Effect of Governance Structure on Transaction Costs

The theory of TCE as developed by Coase (1937), Williamson (1979) and others forms the basis of this section. The central thesis of this section is that governance structures in the organic wheat supply chain between producers and buyers have differing transaction costs. The theoretical framework must therefore explain why differences in transaction costs occur. The behavioural assumptions of TCE as it relates to the organic wheat supply chain is first outlined, followed by the characteristics of organic wheat transactions and their connection to producer transaction costs. The predicted effect of more vertically-coordinated governance structures on transaction costs is then outlined.

4.2.1 Behavioural Assumptions for Firms in the Organic Wheat Supply Chain

There are two main behavioural assumptions with respect to transactions in the organic wheat supply chain. The first assumption is that organic wheat producers and

their buyers exhibit bounded rationality in organic wheat transactions. This assumption means that the producers and buyers act rationally, but their ability to act rationally is bounded by their knowledge of their transaction partner. These agents do not know how their transaction partner will behave in the future when engaged in organic wheat transactions. The second assumption is that organic wheat producers and their buyers may act opportunistically when conducting transactions. This assumption means that organic producers and their buyers may act in a manner that benefits themselves at the expense of their transaction partner. Bounded rationality and opportunism are core behavioural assumptions in the TCE literature (Williamson 1979).

4.2.2 Definition of Transaction Characteristics in the Organic Wheat Supply Chain

The combination of bounded rationality and opportunistic behaviour in transactions leads to the existence of transaction characteristics that hinge on these behaviours. The key characteristics of transactions are the degree of uncertainty surrounding the transaction, the degree of asset specificity surrounding the transaction, and the frequency of the transaction (Williamson 1979).

Uncertainty

Uncertainty can be defined in the context of the organic wheat supply chain as the lack of certainty regarding the outcome of an organic wheat transaction. Uncertainty is caused by the behavioural assumption of bounded rationality. If the rationality of producers and buyers is not bounded, this would imply that everyone has perfect information and there would be no uncertainty. There are several types of uncertainties that are involved in the outcome of organic wheat transactions. Some uncertainties are completely exogenous, such as price fluctuations due to changes in the supply and

demand of organic wheat, and they are not affected by governance structure choice. Other uncertainties, however, are affected by the choice of governance structure. These uncertainties are discussed further in section 4.3.4.

Asset Specificity

Asset specificity can be defined in the context of the organic wheat supply chain as an asset that is necessary to perform an organic wheat transaction with a particular party, but has a lower value when used in a transaction with any other party. There are several assets that a producer may own in order to produce organic wheat. These include land, equipment, human capital of time invested in learning organic farming techniques, and the organic wheat itself.

Land, equipment and human capital, and organic wheat that has not yet left the farmgate do not have the characteristics of asset specificity because they have equal value in alternative transactions. When organic wheat has been delivered to a buyer's location but has not yet changed hands, however, the organic wheat can become site specific (Williamson 1985) if there are few or no other organic wheat buyers in the vicinity. At the point where the organic wheat is at the buyer's location, the salvage value of that organic wheat equals the alternative buyer's price, less the cost to transport the organic wheat to the alternative buyer's location, less the added costs to the producer related to conducting the alternative transaction. The difference between the salvage value of the organic wheat and the initially agreed upon price represents the quasi-rents that can be extracted by the original transaction partner (Klein et. al. 1978). An asset specific investment by one party, combined with uncertainty resulting from bounded rationality, can result in opportunistic behaviour by the other party to the transaction in

order to capture the specialized appropriable quasi-rents. The quasi-rents of organic wheat in Western Canada can potentially be quite large because of the considerable distances between buyers in many cases, which leads to costly transportation in order to reach an alternative buyer.

Frequency

Frequency is defined as the number of times that a transaction occurs within a certain time interval. In the case of organic wheat transactions between producers and buyers, producers may sell organic wheat once or more times per year, depending on the size of the farm and the homogeneity of their organic wheat crop. The relatively infrequent nature of these transactions may amplify the probability of opportunistic behaviour. On the other hand, relationships that develop between producer and buyer may lead to a mutual interest in maintaining the relationship and not exploiting the other.

4.2.3 Definition of Transaction Costs in the Organic Wheat Supply Chain

Following Hobbs (1996), there are three main types of transaction costs in the organic wheat supply chain: information (or search) costs, negotiation costs and monitoring and enforcement costs. Information costs involve searching for information about organic wheat buyers, buyer reputations and organic wheat prices. Negotiation costs include costs of transacting the organic wheat, including negotiating the details of the sale, writing the contract, or paying for a broker or POF to perform this task. Monitoring and enforcement costs occur after the contract has been made. Costs are associated with monitoring quality. Monitoring the behaviour of the transaction partner may be necessary in order to ensure that the transacting partner follows the pre-agreed terms of the sale. Monitoring costs may also include the enforcement of a broken

contract. This thesis compares the size of these transaction costs across different governance structures.

4.2.4 Transaction Uncertainties, Asset Specificities and their Associated Transaction Costs in the Organic Wheat Supply Chain

There are five main types of uncertainties in organic wheat transactions between producer and buyers, defined as quality uncertainty, price uncertainty, supply and demand uncertainty (Hobbs and Young 2000). Payment uncertainty can also occur. Some aspects of quality, price, payment, supply and demand uncertainty are exogenous to the transaction and are unaffected by governance structure choice. While it is important to realize that exogenous uncertainties exist, they do not cause differences in transaction costs between governance structures. Uncertainties that are affected by governance structure, however, are the cause of differential transaction costs and are the focus of this section.

Quality Uncertainty

Weather is the greatest cause of wheat quality variability (Wilson and Dahl 1999). Buyers of organic wheat minimize this uncertainty by measuring its quality prior to purchase. Quality uncertainty is therefore independent of governance structure as long as the producer or buyer do not act opportunistically. The incidence of opportunistic behaviour, however, is dependent on the governance structure.

There is a possibility that organic wheat buyers could use a quality clause in a contract in an opportunistic manner if the wheat is delivered to the buyer (and is therefore site-specific) before quality is assessed by the buyer. The buyer may say, truthfully or not, that the quality of the organic wheat does not meet specifications and

that the agreed price must be discounted for the lower quality. The seller can settle the dispute by having the grain tested by a recognized 3rd party grain quality testing institution, but this recourse may not be feasible if waiting entails a cost. The discount would include some or all of the appropriable quasi-rents that are available to the buyer. A greater distance to an alternative organic wheat buyer would imply a greater available appropriable quasi-rent. It is expected that discounts for quality inadequacies in organic wheat would be greater than conventional wheat because most organic customers demand only high quality wheat for the human consumption market. Moreover, the distance between buyers that are willing to purchase a given quality of organic wheat is much larger than the distance between conventional wheat buyers. The fear of opportunistic behaviour is especially a concern in transactions with overseas buyers.

The inherent variability of organic wheat quality leads to measurement costs to determine its quality, which may include its grade, protein content, and other necessary characteristics. Marketers have many tools available them for ascertaining producers' wheat quality. Visual inspection by the buyer and even the downstream buyer may also be required. The quality of the organic attribute in the wheat is measured by a certification process and paper trail that accompanies organic grain shipments provides proof of organic authenticity.

The uncertainty over whether a buyer will act opportunistically may lead producers to incur information costs in order to determine the likelihood of opportunistic behaviour. These costs are defined as reputation search costs, and can involve communicating with other producers or with the Canadian Grain Commission (CGC) to determine if the buyer has a good reputation and is bonded. Negotiation costs may also

be incurred in order to specify a contract that describes the dispute resolution mechanism for quality problems. Monitoring costs may also be necessary to ensure the truthfulness of any quality-related disputes (via the CGC or another grain quality testing institution) and to enforce the pre-determined price if necessary.

Price Uncertainty

The price of organic wheat fluctuates depending on the complex world supply and demand situation, and the supply and demand of substitute products such as conventional wheat. Demand is affected by changing tastes and the adoption of organic foods by consumers. Supply is affected by the adoption of organic production by farmers, weather, and other factors. Governance structure is irrelevant to these exogenous sources of price uncertainty, but has a profound effect on opportunistic behaviour related to uncertain prices. Assuming that producers do not have perfect information about prices, and drawing on Stigler's work, one can expect that a distribution of organic wheat prices will exist. This price distribution results in the producer having uncertainty over present and future prices. This uncertainty can be divided into two main sources. Firstly, the producer is uncertain over the market-clearing level of prices on a given day and in the future. Secondly, the producer is uncertain of each buyer's offering price in terms of its position in the distribution of prices. The latter problem is a principal-agent problem of low task programmability and high nonseparability (Mahoney 1992), since the producer cannot adequately measure the input (effort) of the buyer in finding prices, nor can the producer measure the performance of the buyer's output (its bidding price). The decisions of when to sell and who to sell to are thus made in the context of price uncertainty.

The producer's pursuit of the highest price possible within the distribution of potential prices across several buyers and over time leads to information costs of price search. These price search costs occur over the entire year in order to follow the market-clearing price level, and are also accrued to individual transactions. Price search is performed by communicating with buyers and with other producers about the marketing-clearing price levels and the offer prices of particular buyers.

Payment Uncertainty

Payment uncertainty can be defined as the chance that an organic wheat buyer will not pay the producer within the time period specified by the contract, or will not pay at all. This uncertainty can cause injury to all firms upstream from the non-payer. While non-payment by a downstream customer is an exogenous uncertainty, different types of governance structures can differ in the uncertainty of producers receiving payment.

The uncertainty of the buyer delaying payment, for opportunistic reasons or because of non-payment by their downstream buyer, may lead producers to incur information costs to determine whether or not the buyer is likely to pay on time. Producers will thus search out the reputation of possible buyers by communicating with producers and buyers. Enforcement costs may include the expenditure by the producer to collect the payment from the buyer.

Supply and Demand Uncertainty

Supply uncertainty can be defined as the likelihood of the producer failing to provide enough organic wheat to fulfil his or her required quantity as specified in a sale contract. Weather can have a great effect on the quantity of organic wheat that is harvested by a producer. This exogenous uncertainty can pose a problem for the buyer

when it is planning future sales and when it has entered a contract to buy a specified quantity of organic wheat before it has been grown. The inability to deliver the required quantity can also result from opportunistic behaviour on the part of the producer. The producer may choose to deliver a portion of his or her organic wheat to a different buyer offering a higher spot price. The original buyer must then attempt to source organic wheat from a different producer. This problem is an issue of moral hazard, since the behaviour of the producer changes after the contract is signed.

Demand uncertainty is a problem for organic producers, as it is the uncertainty in finding a buyer. Buyers may not want to buy the producer's particular quality of wheat at the time that the producer wishes to sell.

Transaction costs to negate opportunistic behaviour relating to supply uncertainty are incurred by the buyer. The buyer's costs include monitoring the producer's production on contracted organic wheat fields, including the monitoring of storage after harvest. The buyer may also incur costs of seeking redress from producers due to damages caused by a supply shortfall. Damages could include the loss of business and additional search costs in order to find alternative supplies at short notice. Transaction costs to negate the uncertainty of demand for the producer's grain include search costs to find a buyer.

4.3 Prediction of Governance Structures Based on Transaction Characteristics

Given the uncertainties, asset specificities and measurement problems between producers and buyers in the organic wheat supply chain, the framework of Mahoney (1992) can be used to predict the governance structure that should emerge. Separate predictions can be made from the perspective of the buyer and the perspective of the

producer. If the endowments of asset specificity, task programmability and nonseparability are known then a prediction of organizational choice from Table 3.1 can be described.

Buyers of organic wheat do not have assets that are highly specific in transactions with particular producers. Buyers can adequately measure physical attributes of an organic producer's organic wheat (i.e. low nonseparability) through visual inspection, protein tests, etc. The only attribute that buyers cannot detect through output measurement is the organic quality of the wheat. However, organic certification organizations provide a suitable measurement of the organic quality attribute through measurement of producer input (effort). Organic wheat buyers thus interact with organic producers in a situation where task programmability is high and nonseparability is low. The Mahoney framework (Table 3.1) thus predicts that the marketer should use the spot market governance structure.

Organic wheat producers do not have assets that are highly specific in transactions with a particular buyer, apart from the situation where the wheat itself becomes specific to a buyer upon delivery. The endowments of task programmability and nonseparability that producers face in their transactions with buyers depend on the particular producer's perception of price uncertainty. Some producers may perceive that they can adequately measure the input (effort) of the buyer in finding prices (i.e. task programmability is high) and they can adequately determine if the buyer's bidding price is high relative to other buyers (i.e. nonseparability is low). The Mahoney framework thus predicts that producers that have these confident perceptions on price uncertainty should use the spot market governance structure. On the other hand, some producers may perceive that they

cannot measure the effort of the buyer in finding downstream customers with high prices (i.e. task programmability is low), and they may have no idea if a particular buyer's bidding price to producers is high compared to other bidding prices in the market (i.e. nonseparability is high). The Mahoney framework predicts that producers that perceive buyer input and output measurement problems should use a relational contract governance structure. Moreover, producers that perceive both measurement problems and a high threat of opportunistic behaviour (i.e. high asset specificity) should use vertical integration. Given the acute lack of price information in the market, it is most likely that producers cannot effectively measure buyers' input and output, which makes the relational contract the most plausible prediction for the producer.

In summary, the Mahoney framework for organizational form prediction uses the information available on transaction characteristics to predict the optimal governance structure. The framework predicts that organic wheat buyers should choose the spot market, while producers should choose relational contracting. This simple prediction is useful because it can be compared to the results of the empirical comparison of governance structures that is developed and tested in this thesis.

4.4 The Effect of Vertical Coordination on Transaction Costs

While the previous section provided predictions of governance structure based on characteristics of organic wheat transactions, this section provides a detailed description of the resulting advantages and disadvantages of using governance structures that are more vertically coordinated. The extent to which opportunistic behaviour is a problem, and therefore the extent to which producers and buyers incur transaction costs, can depend on the type of governance structure used to perform the transaction. As

mentioned earlier, the types of firms that producers transact with represent different governance structures. The range of different governance structures can be viewed on a continuum in terms of the degree of vertical coordination. Grain companies entail lower degrees of vertical coordination, while POFs entail higher amounts of vertical coordination. Similarly, direct sales to processors entail more vertical coordination than transacting through a grain company.

In examining the effect of vertical coordination on transaction costs, this section compares more vertically coordinated alternatives with the standard case of transacting through a CWB agent grain company, which is referred to as the "spot market" transaction. The effect of using a POF versus the spot market is first described, then the effect of selling directly to processors versus the spot market is assessed.

4.4.1 Producer-Owned Firm

Closer vertical coordination between producers and their adjacent downstream buyer can occur through a POF.The producers have the option of selling through their marketing firm, with the marketing entity financed via a commission. The POF is a form of tighter vertical coordination that has attributes of vertical integration. As indicated in chapter three, Williamson (1971) states that the advantages of a vertically integrated firm can be divided into three components: incentives, controls, and "inherent strategic advantages."

From an incentive perspective, vertical integration between producers and buyers could internalize any buyer opportunism manifesting itself in the form of quality disputes, price uncertainty or late payment. The integrated marketer would act as an agent to the producers and would be required to act in their interests. The problem then

becomes one of a principal and agent, with the marketer's effort unobservable to the principal(s) (producer-owners). The absence of opportunistic behaviour by the marketer with respect to quality disputes would decrease reputation search costs for both parties. Reputation search costs related to payment uncertainty for producers would also be eliminated. In other words, more precise control of marketer performance could be possible through a POF than through the spot market.

With respect to the control advantages of vertical coordination through a POF, the single entity is able to perform more precise own-performance evaluations and can control rewards and penalties within the organization. Other potential control benefits of vertical integration include easier conflict resolution, resulting in lower negotiation and enforcement costs for both parties and economies of market information exchange. The POF would also be required to sell members' grain, thus reducing demand uncertainty and lowering buyer search costs for the producer.

An inherent strategic advantage of vertical integration between the production and marketing stages is that economies of information exchange can occur. Quality, price, and quantity information is allowed to flow more freely between producer and POF agent, thus decreasing monitoring costs for the buyer and decreased quality uncertainties, causing lower negotiation costs for the buyer. POF producers would have access to information on current and future prices that other producers would likely not receive from buyers.

The control of producer strategic misrepresentation is a cost to buyers using any degree of vertical coordination, but may be more efficient through vertical integration because it is easier to ascertain the misrepresentation that has transpired (Williamson

1971). Moreover, contract relationships through a POF result in lower monitoring costs than would an investor-owned firm (IOF), since less information asymmetry would prevail regarding quality and quantity (Sykuta and Cook 1995). This is not to say that strategic misrepresentation by producer-owners would not occur in a POF. Producer-owners may be tempted to strategically misrepresent the quantity and/or quality of their wheat destined for sale through the vertically integrated firm. Producer-owners may not deliver all of their wheat to the POF if they find a better price elsewhere. An enforcement mechanism would have to be put in place in order to avoid this problem.

There would be a greater internal coordination cost under a POF governance structure compared to transacting through the spot market, mainly due to the propensity for a principal-agent problem to occur. These costs would include the resources expended by the producer owners to control the operations of the marketing agent and monitor the marketing agent's performance. The problem of moral hazard can result if the producers that own the marketing agency cannot induce the marketing agent to maximize the producers' profits by finding the highest prices. The greater the uncertainty of moral hazard, the greater the producer monitoring costs necessary to negate it.

The setup cost of the POF must also be considered as an additional cost. This cost is incurred by producers coordinating with each other in order to find a marketer, create the necessary contract with their agent, and make various decisions regarding the structure of their organization. These setup costs may also be amplified by learning costs as they move away from their core competencies (Hodgson 1998).

Moving from a spot market to more tightly coordinated transactions changes the sources from which producers are exposed to uncertainty. A POF does not shoulder any risk in the downstream transaction, and exposes producers to uncertainty that may otherwise accrue to a separate, independent marketer. The uncertainty includes quality, payment, price and demand uncertainty in transactions between the vertically integrated POF and its downstream buyer(s).

4.4.2 Direct Selling to Processor

Producers can elect to sell directly to downstream firms that typically are the customers of grain companies. By transacting in this manner the producer is eliminating the middleman, whether it is a grain company, a broker or a POF. Selling directly to processors is a form of vertical integration, wherein all of the transaction and transformation activities associated with the sale are under the full responsibility of the individual producer.

The advantages of completely eliminating the middleman from the transaction are very similar to the advantages of using a POF, and take Williamson's theorized advantages to the extreme. The necessary incentive, precise control and full flow of information for one's own marketing efforts is self-evident. It is clear that the producer will do the best job they can in order to find the best price possible. There are no opportunistic behaviours associated with middleman transactions that incur transaction costs, but there are, however, transaction costs associated with transacting directly with the downstream processor.

Transaction costs resulting from transacting with processors could be considerably larger than those accrued by a middleman firm for two main reasons. Firstly, the

producer may not have transaction cost economies as they typically transact much smaller quantities than middleman firms. Secondly, the producer may incur learning costs and diseconomies of scope as they move even further away from their "core competencies" (Hodgson 1998) compared to the grain company and the POF case. The effect of scope and scale diseconomies may be significant, depending on the marketing ability of the producer.

Coordination costs necessary under a POF governance structure in order to monitor marketer and producer-owner performance are non-existent in the direct sale case. Eliminating the middleman does not necessarily mean that transaction costs decrease, because the producer must deal with the processor instead of the marketer.

4.4.3 Summary of the Effect of Vertical Coordination on Transaction Costs

Section 4.3 has described several effects of more vertically coordinated governance structures on transaction costs and coordination costs. These cost differences were examined from the perspective of both the producer and the marketer. Given the array of cost differences, it is useful to summarize these differences for the reader. The hypothesized effect of increased vertical coordination on the various search, negotiation, and monitoring costs, and on coordination costs, compared to a spot market governance structure, is laid out in Table 4.1 and Table 4.2 for organic producers and a POF respectively. The signs indicate an expected positive or negative effect of governance structure on each producer cost.

The net benefit of vertical integration between the producer and marketing entities depends on whether market transaction cost savings exceed internal coordination costs. If coordination costs related to controlling the marketing agency or information agency

and monitoring the agent's actions are sufficiently high, or if marketing transaction cost savings are sufficiently low, there will be no net benefit to tighter vertical coordination initiatives. Overall, the POF governance structure is expected to lower producer transaction costs while the effect of a POF on marketer transaction costs is ambiguous. This reflects the prediction of the of Mahoney framework (1992) that greater vertical coordination is unnecessary from the marketer's perspective.

Table 4.1 - Summary of Vertical Coordination Effects on Producers Transaction Costs, Compared to the CWB agent Governance Structure

Producer Costs	Effect of POF	Effect of Direct Marketing
Information Costs		
Buyer Reputation Search	–	+/–
Price Search	–	+/–
Negotiation Costs	–	+/–
Monitoring and Enforcement Costs		
Monitoring	–	+/–
Enforcement	–	+/–
Coordination Costs		
Marketer Performance control	+	+

Source: Author's estimates

Table 4.2 - Summary of Vertical Coordination Effects on Marketer Transaction Costs, Compared to the CWB agent Governance Structure

Marketer Costs	Effect of POF
Search Costs	
Reputation Search (of producers)	–
Quantity Search	–
Quality Search	–
Negotiation Costs	–
Monitoring and Enforcement Costs	
Monitoring	+
Enforcement	+
Coordination Costs	
Misrepresentation control	+

Source: Author's estimates

4.5 The Effect of Vertical Coordination on Prices

4.5.1 Information Asymmetry in the Organic Wheat Supply Chain

There is no publicly available price data in the Canadian organic wheat market. There is no method for producers or other supply chain members to access price data, as a futures contract for organic wheat does not exist, and no agencies exist that report present cash prices. Direct communication with other supply chain members is the only method of obtaining price information in organic markets. Organic wheat marketers and processors transact wheat on a daily basis and, unlike producers, have economies of size in gathering and interpreting data on supply and demand factors that contribute to current and future price. Since organic wheat producers transact with marketers and processors who have superior information on current and future downstream prices, this situation can be characterized as an information asymmetry problem for producers. Organic wheat producers cannot undertake market surveillance that indicates the market clearing price in current and future periods. Without knowing the market clearing price, producers have difficulty measuring the effort of the buyer and the calibre of the buyer's price offer, known as the problems of low task programmability and high nonseparability (Mahoney 1992). The next section describes the theoretical process by which information asymmetry occurs and posits the implications of price information asymmetry.

4.5.2 The Economics of Information and Organic Wheat Prices

Given diminishing returns to search, an optimizing organic producer will search for organic wheat prices to the point where the marginal return from search equals its marginal cost. The producer will search for the time to sell and the buyer to sell to that

results in the highest price. The marginal return is the expected increase in price that results from undertaking one more unit of search. The marginal cost of search is the amount of time and other resources expended in order to undertake the additional unit of search.

Following Stigler (1961), the lack of price discovery mechanisms, other than by personal communication among individual producers, suggests that a bidding price dispersion may exist for organic wheat. The bidding price dispersion of organic wheat prices is a function of the amount of search that is undertaken by the producer. The amount of search is a negative function of the cost per unit of search, and a positive function of the percentage of the seller's expected revenue and the percentage of experienced producers in the market. Cost per unit of search for organic wheat producers is not prohibitively expensive, which allows for search to be undertaken. Wheat is the largest organic crop in Saskatchewan, and constitutes a large proportion of organic producers' revenue. Experienced organic producers exist in the market. These characteristics lead to some positive amount of search costs, and thus a bidding price dispersion of organic wheat prices. The variance of supply and demand in the organic wheat market can compound the size of the price dispersion.

It is assumed that a decrease in price dispersion will decrease the chance of transacting at lower prices, which will increase the average transaction price. Price dispersion can be decreased by increasing the amount of search, which can be made more economical by decreasing search costs.

There are several ways that search costs can be decreased. The cost of search for organic wheat prices can be a function of the geographic size of the market, but given

that telephone communication is currently the most common method of price search, geographical size should not be a significant determinant of search costs. A synthesis of TCE concepts reveals that the choice of governance structure can also affect the cost of search, which was described earlier in the chapter. The presence of organizations that transmit price information to individuals in the organic wheat supply chain can decrease the cost of search. The effect of governance structure and organizations on search cost and thus price dispersion and average price is described in the next section.

4.5.3 Governance Structure/Organizational Choice, Price Search Costs and Price Dispersion

A governance structure or organization that has economies of size in price information search, and that passes this information to the producer, can help to reduce or eliminate the information asymmetry problem. The POF allows producers to better measure the marketer effort and compare bidding prices. A POF that collects and disseminates price information to its members would decrease producer search costs, since those costs would be contained in the marketing commission earned by the marketing agent. The vertically integrated firm would have economies of size in price, supply and demand data collection. Moreover, the POF would provide a greater quantity of price information than could be found by the producer on his or her own, for a similar cost. Producer-members could also benefit from the POF's economies of market information exchange for use in transactions outside the vertically-coordinated arrangement. Typically, POFs are characterized by greater trust and less incentive to withhold information compared to Investor-Owned Firms (Sykuta and Cook 1995), which allows for this method of alleviating information asymmetry to function.

An organization that transmits price information to producers is an alternative to the vertical coordination solution to the problem of information asymmetry. Specifically, an organization that collects price information and distributes it to producers would effectively increase the amount of price search that producers could do at a lower cost than would be possible on their own. An example of such an organization in agriculture is the bi-weekly bulletin provided by the Market Analysis division of Agriculture and Agri-Food Canada in the grain industry or the market information provided by CANFAX in the Canadian cattle industry. The degree of cost saving would depend on the price charged by the organization for this information.

Increased vertical coordination through a POF or the use of a price information organization that decreases search costs and improves information quality would decrease price dispersion and therefore lower price uncertainty. Moreover, a decrease in search costs directly affects the efficiency of transactions between producers and buyers. It is important to note that the use of a price information organization may sufficiently decrease problems of information asymmetry such that spot market-type governance structures become transaction-cost efficient. Producers that are currently members of POFs may oppose the formation of a separate price information organization because it may allow producers that use the service to be more competitive with producers that already have superior information through a POF.

Some alternative governance structures do not have mechanisms that decrease search costs below that of a spot market transaction. Producers that choose to market directly to processors are expected to incur higher search costs in order to complete those transactions. Higher search costs are expected in these transactions because

producers must exert more effort to find buyers, particularly those in foreign countries. The process of finding processors or other customers in other locations can take considerable time and resources. The "direct to processor" governance structure thus does not have any characteristics that decrease search costs per unit. The extra effort that is exerted to find processors and other remote buyers is expected to result in higher prices. This does not result from lower search costs per unit, but from higher amounts of search that lead to finding higher prices in the distribution of available prices, assuming the search is effective.

Producers that choose the "direct to processor" governance structure may especially benefit from the presence of a price information organization, since they have the largest potential for search cost savings. The extent to which producers could benefit from price information would depend on the applicability of the information to their specific marketing strategy. The price information provided would have to relate to the region of the world to which they marketed their organic wheat. On the other hand, producers that market directly to processors may oppose the formation of a separate price information organization for similar reasons as POF members. An information organization may allow producers that use the service to more easily compete with producers that already sell to processors. Similarly, an increase in price information through a POF or a price information organization that benefits producers would do so at the expense of buyers. Buyers therefore may not see any benefit to becoming a POF marketer, which coincides with the prediction from the Mahoney framework that buyers prefer the status quo spot market governance structure.

The theoretical framework has thus far described the transaction characteristics and transaction costs in the organic wheat supply chain, and it has described how transaction costs and prices are affected by increased vertical coordination. The theoretical framework continues by developing a framework for comparing governance structures that differ in costs and prices.

4.6 Introduction to the Theoretical Model

The purpose of the theoretical model is to provide a general method for comparing alternative governance structures empirically. The remainder of this chapter brings the measurements of price and cost together to use profit per unit as a metric for comparing governance structures. The methodology chapter employs the model presented in this section as a means to illustrate the differences between governance structures.

Two models that can be used to compare governance structures in a supply chain are outlined in this chapter. These models illustrate the effect of alternative governance structures from the perspective of one and two levels of a supply chain respectively.

4.7 Dorward Model of Average Costs, Prices, and Profit Margins for One Level of a Market

4.7.1 Description

Figure 5.1 depicts, for two alternative governance structures, the profit margin per tonne of *one* input-providing firm in a supply chain. Firms can choose either governance structure, and they make this decision by maximizing their utility, as stated earlier in the theoretical framework.

The model, adapted from Dorward (2001), examines prices, costs, and profit per tonne for different governance structures transacting the same product. The effect of

governance structure on the quantity a firm sells is assumed to be negligible in this model. The profit margin is the difference between the net price (value added) that a firm receives and the sum of average transformation costs and average transaction costs incurred by that firm. The value that is added, the size of average transformation costs and the size of average transaction costs can differ between governance structures for a given firm. Differences in the degree of vertical coordination between the governance structures can explain why value-added and costs differ.

4.7.2 Evaluation Criteria

In Figure 4.1, a firm operating under governance structure 2 is illustrated as achieving a higher price per unit (P_2) than the firm operating under governance structure 1 (P_1). However, governance structure 2 results in a smaller profit margin ($M_2 < M_1$) for the firm. The discrepancy between the governance structure giving the highest price and the greatest profit margin occurs because the average transaction costs arising from governance structure 2 are much greater than the average transaction costs arising from governance structure 1. The optimal governance structure for a supply chain level is the one with the greatest profit margin per tonne, which is governance structure type 1 in Figure 4.1.

The governance structure with the highest price is not necessarily the optimal governance structure from the perspective of a firm at one level of a vertical market. A firm must consider both the price and the average transaction costs and transformation costs when choosing the optimal governance structure from the set available.

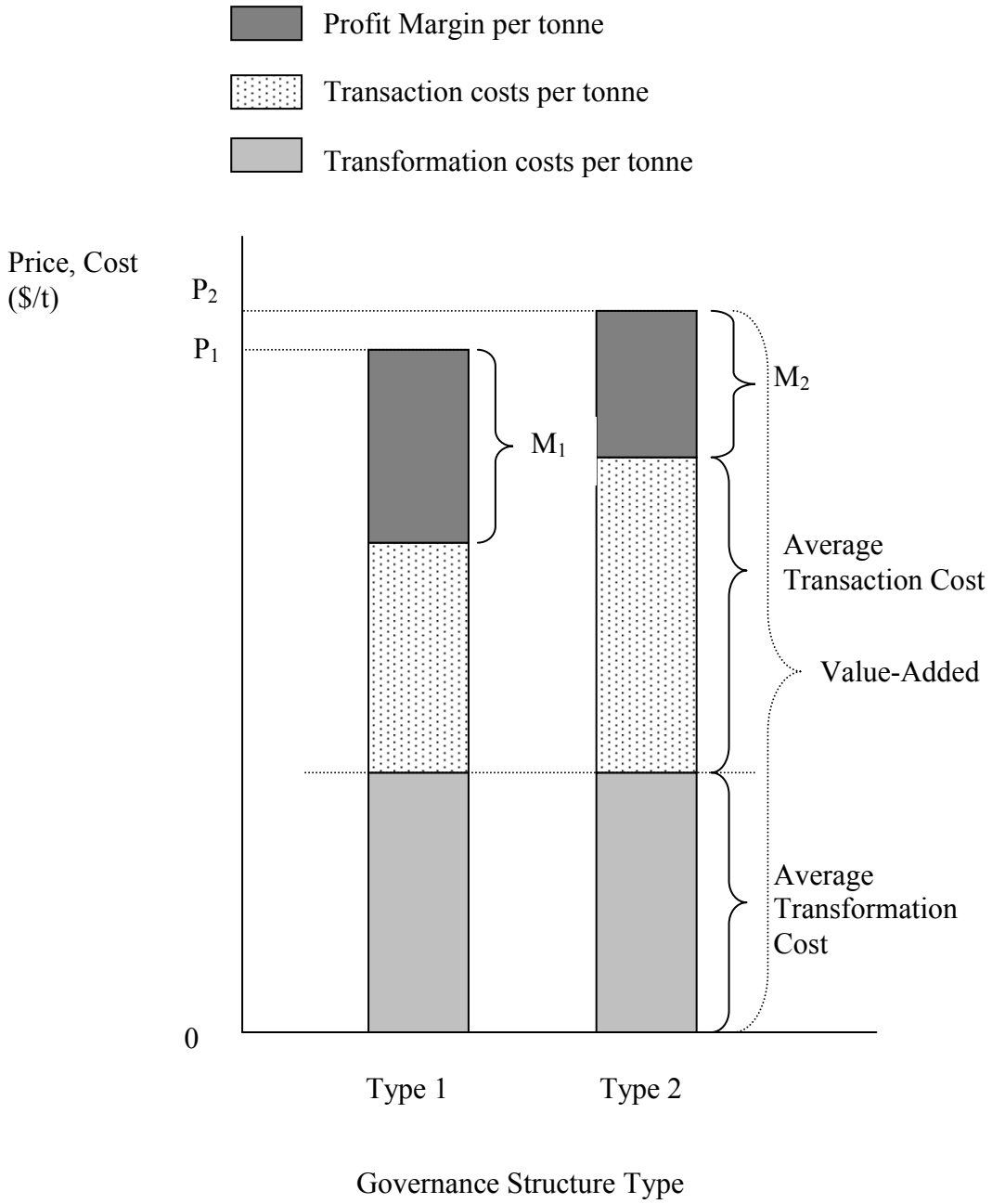

Figure 4.1 - Model of Two Alternative Governance Structures or One Supply Chain Level

4.8 Dorward Model of Average Costs, Prices, and Profit Margins For Two Adjacent Market Levels

4.8.1 Description

In the previous example, the implications of governance structure choice for one level of a vertical market was discussed. Figure 4.2 illustrates the implications of governance structure choice for two firms that are vertically adjacent to one another, an upstream firm and a downstream firm. The price that is achieved by the downstream level, P_p, can vary by governance structure, or it can be identical across governance structures. This would depend upon the available price data, and the assumptions made about the downstream market. If it is assumed that a governance structure has a differentiated product that achieves a different price, then the downstream prices can vary by governance structure. If it is assumed that all governance structures sell a homogeneous product, then the downstream price will be the same across all governance structures.

Figure 4.2 is also drawn to illustrate that both transformation and transaction costs can differ between governance structures at the upstream or downstream levels. The value added by the upstream level is the farm price, either P_1 or P_2. The value added by the downstream level is the vertical difference between either P_1 or P_2 and the processor price, P_p.

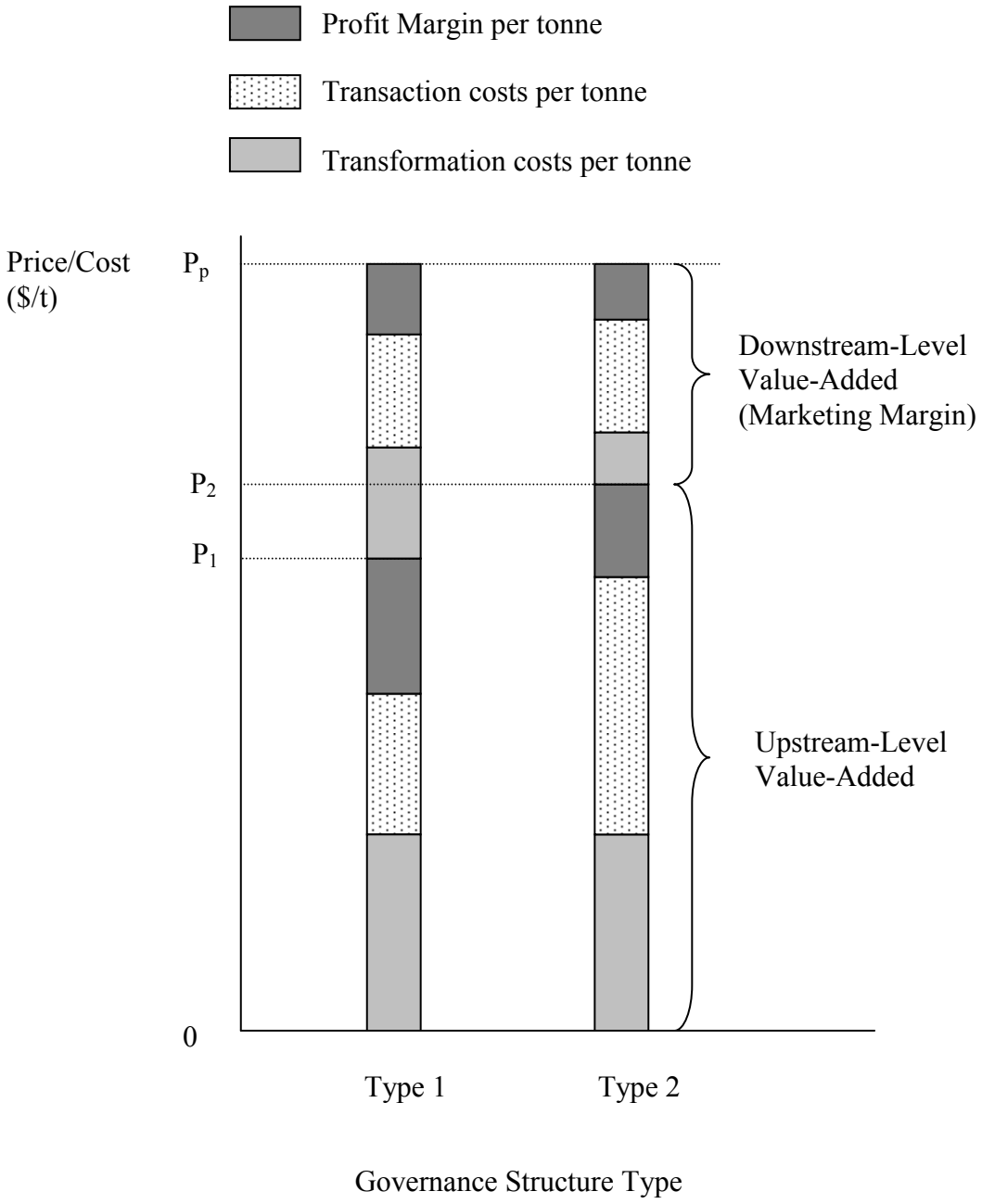

Figure 4.2 - Model of Two Alternative Governance Structures for Two Adjacent Supply Chain Levels

4.8.2 Evaluation Criteria

The value of average transformation costs and average transaction costs can differ between governance structures because the division of functions between the supply chain levels differ and the cost of each level to perform each function may differ. As with the previous model, differences in the degree of vertical coordination between the governance structures employed can explain why prices and costs differ.

The optimal governance structure from the perspective of the supply chain being evaluated (only two levels of a multi-level supply chain in this thesis) is the one that has the highest *combined* profit margin per tonne. If the downstream price, P_p, is identical across the governance structures, then the optimal governance structure is the one that minimizes average cost. If governance structures obtain different downstream prices, then the criteria for selection of the optimal supply chain is the one that maximizes the combined profit margin per tonne.

It follows that the optimal governance structure from a multi-level perspective may not necessarily be the best governance structure from the perspective of firms at each level. Whether indicated by governance structure predictions (Mahoney 1992) or by direct testimony from firms, vertically adjacent firms may or may not prefer different governance structures.

Differences in governance structure preferences by firms can be caused by differences in their approach to marketing. For example, a marketing firm without financing or information economies may find it optimal to enter into a long term contract with a group of producers and share information, in the hopes of creating a win-win situation. A marketing firm that has economies of size in financing and market

information may find it optimal to treat the market as a profit centre, where the traders are given license to use the firm's resources to maximize profit through speculation in the market, treating market intelligent as a competitive advantage. The differences in management approach and hence governance structure preference can be based on the characteristics of the firm when it enters the market.

A difference in governance structure preference between two levels could create a governance structure misalignment wherein one level would prefer to use one type of governance structure, but firms at the adjacent level are not willing to engage in that particular governance of the transaction. This situation has no direct pareto-improving options, as simply changing from one governance structure to the other will make one level (e.g.: producers) better off at the expense of the other level (e.g.: grain company).

Kennett et al. (1998) state that two conditions must exist in order for an initiative in supply chain management to be sustainable. The first condition is that the economic rents created for the whole system must be greater than the economic rents generated from alternative systems. The second condition is that each party's share of the economic rent must exceed their costs. Kennett's two conditions, assuming that producers are boundedly rational regarding governance structure choice, explain why there may be sub-optimal governance structures existing in the organic wheat market. Producers use the status-quo governance structure because they generate some profit and they are unaware of greater profit available from alternative supply chain configurations.

Kennett et al. does not explain conditions for a new initiative in supply chain management to emerge. In order for a new initiative in supply chain management to emerge, the economic rents accrued to each firm must be greater than the economic rents

generated from the status quo system. While quantities sold by producers likely do not change due to governance structure choice, the governance structure choice of marketing firms may affect marketing firms' quantity transacted, which directly affects marketer profits. Marketing firms can compete for market share in upstream markets by providing governance structures that producers prefer, providing that the marketer's performance downstream is not hindered as a result. If an emerging governance structure resulted in lower profits per tonne for the marketer, quantity transacted would have to sufficiently compensate for the decrease in profits per tonne for marketer to use the emerging system. Governance structures that differ in scope may have different limits to the size of the marketing firm. For example, a particular governance structure may not allow for large economies of size in marketing throughput, and may be suited to small marketing firms. Thus, a large firm may not be able to adapt to that particular governance structure. The relationship between governance structure choice and quantity transacted by the marketer is beyond the scope of this thesis, and considerations of quantity are not incorporated into the model.

4.9 Adaptation of the Dorward Model to the Organic Wheat Supply Chain

4.9.1 Description

Figures 4.1 and 4.2 can easily be adapted to represent the farm and buyer levels of the organic wheat supply chain. Figure 4.1 can represent a single farm, where the profit margin per tonne is the difference between the farm price and the sum of the farmer's average transformation and average transaction costs. Figure 4.1 is drawn to illustrate that at the farm level, the choice of governance structure does not affect production

costs. Production costs are only affected by governance structure if farm inputs are altered or production incentives are altered.

Figure 4.2 can represent a single farm and two different marketer choices in the organic wheat supply chain, where the farm firm is the upstream level and the marketer firms are the downstream level. Within a given governance structure, the marketer's profit margin is the difference between the value added at the marketing level (also known as the "marketing margin") and the sum of average transformation costs and average transaction costs. Since it is not possible to test for differences in downstream processor price between different governance structures, it is necessary to assume that downstream prices, P_p, are equal across all governance structures.[7]

4.9.2 Governance Structure Evaluation – Organic Wheat Supply Chain Example

In Figure 4.2 it can be seen that governance structure type 1 has higher marketer-firm average costs and lower farm average costs than governance structure type 2. Farm and marketing firms using governance structure type 1 have the lowest combined transformation and transaction average costs. Given the assumption of an equal processor price, this means that governance structure type 1 provides the highest combined *profit* margins and is thus the optimal governance structure, despite the fact that its upstream firm price, P_1, is lower than the upstream firm price for governance structure type 2, P_2.

[7] The prices that processors pay for organic wheat are not publicly available, and it is not possible to find out the prices received by marketing firms. A downstream price can be assumed, but the assumption must be identical for all firms. The assumed downstream price can be calculated by using the transparent marketing margin of POF transactions.

As described in the general model, the determination of the optimal governance structure from the perspective of one market level differs from the perspective of the entire supply chain. The optimal governance structure from the perspective of the producer level is the one that maximizes profit margin per tonne for the producer by a combination of a high farmgate price and/or low farm-level average costs. Given a common downstream price, P_p, a higher farmgate price is a direct result of a narrower marketing margin. The optimal governance structure from the perspective of a marketing firm is the one that maximizes the firm's profit margin per tonne, by a combination of a *low* farmgate price and/or low average costs. In Figure 4.2, governance structure type 1 offers both the farm-level and marketer-level firms the greatest profit margin per tonne.

As discussed earlier, firms may not have complete freedom in their choice of governance structure. For example, it would be very difficult for a large grain company to alter governance structure to become a POF due to several financial and governance constraints. Such corporate governance constraints may be alleviated by forming a subsidiary[8]. Certain governance structures may also have barriers to entry at the farm level, such as restricted membership in POFs.

4.9.3 Model Weaknesses

The model above offers a simple representation of alternative governance structures. A weakness of the model, however, is that it uses profit margins per tonne as

[8] Although a marketer firm can choose between governance structures in terms of input provision, production management contracts are not used in organic wheat in Western Canada and are not the focus of this thesis.

its metric, and ignores the effect of governance structure on quantity transacted, and the effect of quantity on firm profit. The exclusion of quantity in the model also prohibits the measurement of surplus in each market, which is often a popular tool to illustrate differences in efficiency between economic systems. The adapted Dorward model is thus best suited to short-run analyses that focus on a single agent's choice of governance structure.

The Muth model of fixed or variable proportions is an alternative model that can be used to measure the profit and welfare effects of transaction cost and price changes due to governance structure and organizational changes. The Muth model is well suited to analyses that examine welfare and profit for the aggregate market, as many firms' supply curves can be horizontally aggregated using this approach. The ability of an adapted Muth model to illustrate aggregate effects makes it best suited to examining governance structure effect on the entire market, such as a change in transaction costs that affects every unit transacted. An example of this application is found in Martinez et. al. (1998), where lower measurement costs shift the supply curve downward. The Muth model is not suited, however, to the task of measuring governance structure choices from the perspective of a single firm in the short run, since supply becomes very inelastic, demand becomes perfectly elastic, and the model comes to resemble the simpler Dorward model.

4.10 Chapter Summary

The purpose of this chapter was to develop a theoretical framework in which to analyze the differences between governance structures that are used to transact organic wheat between producers and their buyers. It was assumed that the objective of firms in

the organic wheat supply chain is to maximize utility. Utility includes profit from producing and transacting organic wheat as well as other non-monetary utility. The profit functions include transaction costs as well as transformation costs.

The central thesis of the theoretical framework is that governance structure choice has economic effects. The effects of governance structure in transactions can be separated into effects on transaction costs, which follows Transaction Cost Economics, and effects on price, which follows the Economics of Information. Given the assumptions of bounded rationality and opportunistic behaviour, the characteristics of uncertainty, asset specificity and frequency lead to transaction costs for organic wheat. A price distribution arises due to price search costs, which can lead to different prices being received by producers, depending on the governance structure chosen and the organizations functioning in the market. Using a framework proposed by Mahoney (1992), it is predicted that organic wheat buyers should choose the spot market governance structure, while producers should use relational contracting governance structure.

POF and processor governance structures, which exhibit closer vertical coordination than grain company governance structures, may decrease producers' transaction costs. Increased vertical coordination between producers and their buyer can decrease transaction costs through efficiencies that are gained by increased sharing of information between producers and marketing agents. Sharing information on price, quantity and quality information can lead to lower transaction costs for producer and marketer. The mutual gain derived from the vertically coordinated arrangement can reduce incentives for the producer and marketer to act opportunistically. Less chance of

opportunistic behaviour can lead to lower transaction costs, but coordination costs of maintaining the arrangement are an additional cost that must be considered.

Producers that sell directly to processors may lack the economies of size in transaction functions, which may negate the efficiencies of vertical integration between producer and marketer. Selling directly to a processor or through a POF may also be characterized by a lack of economies of size in transformation functions, which may lead to increased cost and lower efficiency. A lack of economies of scale may counteract any transaction cost savings from increased vertical coordination. Economies of size in transformation costs are not considered by this thesis, nor are economies of size in transaction costs at the marketer level.

This chapter also provided a general model for comparing governance structures and illustrating the effect of governance structure choice. This chapter has also provided general criteria for evaluating the optimal governance structure from the various perspectives of a supply chain.

In each model, the difference between average cost and price is calculated in order to calculate profit as a metric for governance structure comparison. The models illustrate the profit per tonne for one level and two levels respectively of a vertical market, and are adapted from Dorward (2001). The model can be illustrated for various governance structures employed in the supply chain. The optimal governance structure for a firm at a given level is that which creates the greatest profit. The choice of model used to illustrate governance structure differences depends on the type of analysis to be performed.

The next chapter describes the methodology of the analysis. The model of two adjacent supply chain levels provided in this chapter will be used to compare governance structure differences in price and cost.

Chapter 5: Methodology

5.0 Introduction

The methods used to test the null hypothesis of this thesis are outlined in this chapter. The null hypothesis is that there are no significant differences in price or cost between the various governance structures available for producers to transact their organic HRSW to downstream firms. The construction of the organic producer questionnaire and collection and calculation of transaction costs and prices through a survey is first described. The econometric approach to determine the effect of explanatory variables on average transaction costs and price is then provided. The procedure for using the regression data and other data to compare the governance structures concludes the chapter.

5.1 The Organic Producer Survey

Producer prices and transaction costs per tonne under each governance structure is the metric that is used to test the hypothesis. Transaction costs are included in the average cost calculation. As the transaction is the unit of analysis in this study, a random sample of transactions is required. The methodology must provide a procedure to isolate the effect of governance structure on price and average transaction costs from all other factors. The methodology must also allow for testing of significant differences in price and average transaction cost between governance structures. The construction

and intuition behind the questionnaire is first described, followed by an explanation of how the transaction cost and price data is used in the analysis.

5.1.1 Survey Construction

A lack of primary data on producer transaction costs, organic wheat prices and the associated transaction characteristics necessitated a survey of organic wheat producers. The survey needed to link transaction cost and price data with the governance structure used and the characteristics of the wheat (quality, location, date) and the characteristics of the producer (age, experience, education). The survey was constructed in a manner that collected this data in the most efficient way possible.

The survey gathered additional information for other research questions not part of this thesis, and the questionnaire was very detailed and required a large time requirement from producers. A copy of the questionnaire is contained in Appendix A. The questionnaire contained nine major parts. Parts one, two, four, six and nine in the questionnaire collected data necessary for this thesis.

Part one of the questionnaire asked producers to provide their first transition year of organic production and their first certified year of organic production. This data was used to calculate the producer's experience in organic farming. The producer was also asked to provide the number of acres that are certified organic, in transition to organic, and non-certified.

Part two of the questionnaire asked producers to provide information on specific transactions of HRSW, oats, brown flax and laird lentils. Producers were first asked to provide several details on each sale. The details included the buyer name or buyer type (which determines governance structure in this analysis), the crop type, the quantity

sold, the farm price, the quality of the grain, the date of contracting, price setting, delivery and payment, and other characteristics. The idea of the sale-specific data gathering was to understand as much as possible about each sale of HRSW used as data in the thesis. Producers could provide this detailed information for up to ten sales.

Part two continued by gathering data on producer transaction costs for a typical sale of HRSW, oats, brown flax or lentils. Questions 2.2.1 through 2.2.12 in the questionnaire asked producers to estimate the amount of time devoted to different transaction tasks. These transaction tasks are explained in detail in Section 5.2 of the thesis. Wherever possible, the questions were laid out in the same order that the tasks are actually undertaken by the producer in order for participants to more easily follow the questionnaire.

Part four of the questionnaire asked participants about their thoughts on the creation of a price information agency. These questions were asked in order to determine producers' interest and willingness to pay for more price information. Part six of the questionnaire asked participants several questions about their relationships with buyers. Question 6.2, titled "Marketing problems", asked producers to indicate the extent of several different problems that producers may have. Data from Parts four and six are analyzed in Chapter 8 of the thesis.

Part nine of the questionnaire was titled "Personal Information" and asked producers to provide several demographic characteristics, such as their age, education level and net farm income. Part nine also asked producers if they were interested in joining a POF, how much they value their time, whether or not they use the internet to market organic grains, and the amount of computer and fax machine usage they devote

to organic grain marketing. Much of the data collected in Part nine describes producer characteristics.

Prior to the construction of the survey it was necessary to understand the characteristics that potentially effect price and the transaction tasks that producers undertake. An accurate knowledge of producers' tasks allowed for very specific transaction cost questions to be asked in Part 2 of the questionnaire. It was also important to have a good understanding of the transaction problems that producers have in order to create questions that uncover the extent of producer problems in Parts four and six of the questionnaire.

5.1.2 Sample Description

After performing three pilot surveys, a sample of organic producers in Saskatchewan was compiled. The data on organic HRSW transactions consists of 76 observations that were taken from 31 randomly sampled and six non-randomly sampled certified organic producers in Saskatchewan. Saskatchewan producers were sampled because there is a large population and many of them produce organic wheat on their farms. The data were collected through a mail-out survey in November 2003-March 2004. A random sample of producers was first selected using lists requested from the various organizations that certify organic producers in SK. The randomly selected producers were contacted by telephone and asked if they would participate in the study by filling out a questionnaire. Questionnaires were mailed to producers that were receptive to participating in the survey. Ninety surveys were mailed, with 57 surveys returned. Thirty one of these producers recorded a total of 65 HRSW transactions.

As it was important to collect data on less common governance structures, it was deemed necessary to select several farmers from a list of members of the POF that chose to participate in the study. Eleven transactions from six of the POF members were included in the sample. In total, the survey collected data on 65 randomly-selected HRSW transactions and 11 non-random HRSW transactions, totalling 76 transaction observations.

The transaction of primary interest was the selling of organic HRSW into the human consumption market in bulk, which may or may not be cleaned before it leaves the farmgate. There are many deviations to this typical type of sale, such as selling organic HRSW as seed, animal feed, or selling in bags. As this analysis seeks to evaluate differences between governance structures for a "typical" organic HRSW transaction, any of these transactions that deviated from the norm were not included in the analysis. Five transactions were thus eliminated from the sample to arrive at the sample of 76 that conformed to the specifications of the study.

5.2 Transaction Cost Data

The survey gathered data on the costs and time spent for the various search, negotiation, monitoring and enforcement costs that the producers incur in their routine tasks in the marketing of organic wheat. Producers typically do not keep records of transaction costs, so it was necessary to ask for an estimate of these costs for the various "marketing tasks" and the annual costs of marketing.

5.2.1 Marketing Tasks - Single Sale-Specific and Multiple Sale-Specific

There are several tasks that producers undertake when selling their organic HRSW either through a single sale or multiple sales. The questionnaire included questions

about the time spent by the producer for several specific tasks. The data collected on producers' marketing tasks reflects their transaction costs. Transaction cost questions were not tied to specific transactions, but rather to all of the organic HRSW transactions that a producer had conducted during the sample period. The marketing tasks of the producer are described in Table 5.1, with the "X"s in the right columns denoting the classification of each cost as a core transaction cost (C), negotiation cost (N) and search cost (S). All costs in Table 5.1 are included as a part of total transaction cost. The far right column provides the question number in the questionnaire that asked for the particular data.

5.2.2 Determining the Reputation of a New Buyer

Determining the reputation of a new buyer is important when selling to that buyer for the first time. This represents a search cost to the producer. Attributes of reputation include trustworthiness, the ability to pay promptly, and whether or not the buyer is bonded with the Canadian Grain Commission (CGC)[9]. The producer may also contact other producers in order to determine the buyer's reputation. The producer may also attend meetings in order to ascertain a buyer's reputation. After a producer has made one or more sales to a specific buyer, it is assumed that their reputation is known and the producer does not incur any additional costs associated with determining the reputation

[9] The Canadian Grain Commission (CGC) is a Federal government body that is responsible for regulating the Canadian grain industry. The CGC requires that all grain buyers in Canada provide payment insurance to producers, in the form of a bond that covers their accounts receivable in the event that the buyer becomes bankrupt.

of that buyer. This activity represents a search cost to the producer. This information is attained in question 2.2.3 of the producer survey.

Table 5.1 - Average Transaction Cost Constituents

Task/Transaction Cost	Type	Details	C	N	S	#
Search						
Reputation search	Time	Talking to buyers and producers	X		X	2.2.3
Price search	Time	Talking to buyer and producers	X		X	2.2.4
Negotiation						
Negotiation	Time	Arranging sale, paperwork, loading truck	X	X		2.2.5
Extra time to sell to the U.S.	Time	Extra paperwork, faxing documents to the border	X	X		2.2.10
Customs agent fee (U.S.)	Fees	$/transaction	X	X		2.1.1w
Extra time to sell to RoW	Time	Extra paperwork	X	X		2.2.11
Producer Direct	Fee	$/t	X	X		2.2.1f
Sale (PDS)	Time	Paperwork	X	X		2.2.6i
	Driving	Driving to local elevator				2.2.6ii
Sample preparation and sending to buyers	Time	Prepare package, send by mail Or bus	X	X		2.2.8, 2.2.9
Quality testing	Fees	Depends on type of test	X	X		2.2.12
	Time	Preparing and sending sample 2.2.12	X	X		
	Driving	Driving to mail office or testing company				2.2.12
Monitoring/Enforcement						
Extra time	Time	Phoning buyer				2.3
Extra money	$	Legal fees etc.				2.3
Value lost/discount	$	$/t loss or discount				2.3
Fixed/Annual						
Marketing meetings (special trip)	Time, Driving	Grower meetings				2.2.2
Certification meetings	Time, Driving	Discuss certification body matters				2.2.2
General marketing Meeting	Time, Driving	Learning how to market etc.				2.2.2
Certification and general marketing meeting	Time, Driving	Combination of certification and marketing				2.2.2
Fax machine usage	$	$100 x % used for organic wheat marketing				10.9
Computer usage	$	$1000 x % used for organic wheat marketing				10.8
Coordination Cost						
POF Member	Time, Driving	Meetings to discuss POF performance				2.4.2

C = Core transaction costs
N = Negotiation costs
S = Search costs
# = Question Number in Questionnaire
Source: Producer Survey

5.2.3 Acquiring Information on Prices

Acquiring price information is an activity that a producer may take part in on a continual basis, in an effort to keep track of prices over the entire year. Some producers sell their grain soon after harvest, while others sell their grain later in the year if they believe that the price may improve. Acquiring price information represents a search cost to the producer. The producer may talk with or contact other producers and marketers in order to keep track of prices. Communication typically occurs on the telephone or in casual visits, but producers may also attend meetings organized by producer groups in order to find information on prices.

Producers also gather information on prices at the time that they want to sell their grain. The producer may contact several buyers and compare the various prices that they offer. Communication at this point typically occurs on the telephone, but may also include trips to visit a potential buyer. These activities represent search costs to the producer. This information is attained in question 2.2.4 of the producer survey.

5.2.4 Coordinating the Transaction with the Buyer and Completing Forms

Once the producer has found a buyer that has a satisfactory reputation and price offer, they begin to communicate regarding the details of the sale. This may include further negotiation of the price and date of the transaction. Both the producer and buyer must fill out forms in order to maintain the integrity of the audit trail that certifies that the wheat is organic. These forms include a transaction certificate that is issued by the producer's certifying body. The producer usually assists with the loading of the truck and signs an affidavit that the truck is clean prior to loading. Once the grain has left the farm, the producer may have to fax documents to the border in the case of export to the

U.S. and/or pay a customs agent fee (in the case of U.S. sales). All of these tasks represent negotiation costs to the producer. This information is attained in question 2.2.5 of the producer survey.

5.2.5 Performing the Producer Direct Sale

In the case of wheat, the producer may have to perform a producer direct sale, unless the buyer handles this task. If the producer is responsible for this activity, he or she can pay another grain company to perform this service, or they can fill out the form and complete this task on their own. Performing the PDS represents a negotiation cost to the producer. This information is attained by finding out how the producer performed the PDS (question 2.1.1w) and finding out the time spent to perform the PDS (question 2.2.6).

5.2.6 Sending Samples to the Prospective Buyer(s)

Prospective buyers may request that the producer send a sample of their grain so that they can determine its quality. Producers in Western Canada usually send a sample in the mail, bus, or courier to the buyer. This represents another negotiation cost to the producer. This information is attained by multiplying the number of samples sent for HRSW sales (attained in question 2.2.7) times the cost per sample (attained in question 2.2.9).

5.2.7 Sending Samples for Testing Quality

In some cases the buyer requires that the producer provide test results. In the case of wheat, this may include a test of grade, protein, or test weight. The producer must send a sample to a company that specializes in these tests. Quality testing tasks

represent a negotiation cost to the producer. This information is attained in question 2.2.12 of the producer survey.

5.2.8 Enforcing payment from buyer (if required)

If the buyer does not pay by the time that the producer has expected payment or pays an amount that is lower than expected, the producer may decide to spend time and money in order to enforce proper payment. This typically includes calling the buyer several times. In some cases the producer may drive to the buyer's location in order to discuss the matter with the buyer. Enforcing payment represents an enforcement cost to the producer. This information is attained in question 2.3 of the producer survey.

5.2.9 Monitoring Marketing Agent Performance

In the case where the producer hires an agent to market his or her grain, the producer may spend time and money in order to ensure that the marketer is doing a good job. The producer may meet with the marketer in order to ascertain the marketer's performance. In the group marketer case, a board of directors may oversee the marketer's activities, and meetings may be held in order to discuss the marketer's performance. This represents a monitoring cost to the producer. This information is attained in question 2.4.2 of the producer survey.

5.2.10 Multiple Sale-Specific Tasks – Special Trips

Several of the marketing tasks described in the previous section may include a special trip to a buyer or meeting. Moreover, these special trips may include several types of marketing tasks at once. The survey asked producers to explain the purpose of their trips, the time spent, and the distance driven. The purpose of this trip information

was categorized by the researcher as either for the purposes of certification, general marketing, a combination of certification and general marketing, or specific marketing meetings. The specific marketing meetings may include aspects of reputation search, price search or negotiation costs. Specific marketing trips include one-on-one discussions between the producer and buyer, dropping off a sample, or grower meetings, in which a buyer invites producers to hear about marketing opportunities. The information on special trip costs is attained in question 2.2.2 of the producer survey.

Some special trips are accrued to only one transaction, while others accrue to multiple transactions (such as dropping off samples for several sales). Certification and general marketing meetings are categorized as annual costs. Transaction costs for special trips are not separated into the marketing task categories of search, negotiation and monitoring discussed in the last section, but they are accounted separately and added to the other search, negotiation and monitoring costs.

5.2.11 Annual Costs

Producers incur transaction costs through certification fees and time spent at certification body meetings. Many certification bodies hold producer meetings several times per year that many organic producers attend. The survey collected information on the time that producers spend at these meetings. Information on certification body fees is collected from the various certification organizations in Saskatchewan. General marketing meetings may include learning about how to market organic grains.

Many organic farmers own a fax machine and/or a computer for the exclusive purpose of marketing. The annual cost of owning a computer and fax machine is assumed at $1000 and $100 respectively and the survey asked producers to estimate the

amount of their computer and fax usage that is devoted to marketing organic grain. Information on these costs is attained in questions 10.8 and 10.9 of the producer survey.

5.3 Transaction Cost Calculation

In the questionnaire, producers were asked about the time spent and kilometres driven for all of the sale-specific tasks, multiple sale-specific tasks and annual costs described above. For the sale-specific tasks, the survey asked for estimates of the average time taken per sale. Tasks that accrued to multiple sales, such as special trips to meetings, were accounted for by distributing the time spent at the meeting(s) over the multiple transactions to which those meetings are related.

Once the time and distance data was collected for the various transaction tasks, these numbers were converted into dollar values. A common time value of $10 per hour is also used across all respondents, which is a value used in several government publications as an estimate of labour cost per hour (SAFRR 2004, AAFRD 2001) A driving cost of $0.36 per kilometre was also assumed in order to convert driving distances into dollar values. The costs of various grain tests were taken from a local testing company.

Once all of the data were converted into dollar values, each cost was summed to provide a total transaction cost for each transaction in the sample. The average transaction cost per tonne is calculated as the sum of transaction costs for each transaction divided by the quantity of that transaction.

Examining the sum of all average transaction costs in one number is one method of comparing transaction costs between different governance structures. This method, however, does not explain differences in certain types of transaction costs between

governance structures. It is thus of interest to this thesis to examine the constituent transaction costs, which are summarized in Table 5.1. There are several ways of aggregating the transaction cost values, including search costs, negotiation costs, or "core" transaction costs. Core transaction costs represent search, negotiation and monitoring marketing tasks and do not include special trips or annual costs. Examining these particular groups of transaction costs may reveal differences in transaction costs that are not apparent in the total average transaction cost values.

5.4 Farmgate Price Data

There is very limited price information presently available for organic wheat. Moreover, the available price data does not identify the governance structure employed or any other factors that may determine price. Primary data were deemed necessary in order to glean this transaction-specific information, which was collected through the organic producer survey. Organic producers were asked to provide detailed information related to their Hard Red Spring Wheat (HRSW) transactions during the period between 2000 and 2003 in section 2.1.1 of the questionnaire. For each HRSW transaction, the survey collected data on the farmgate price that the producer received, plus any other characteristics of the wheat that may affect its price. These characteristics include the quantity, grade, protein content, the date of sale, whether or not it was cleaned, whether or not it was bagged, and other factors. The governance structure that was employed in each transaction was also established.

5.5 Measurement of Governance Structure Effects

An OLS regression can be used to separate the effect of governance structure from other factors that can affect prices and average transaction costs. The regression equations are given in Equations 5.1 and 5.2 respectively:

$$\begin{aligned} \mathrm{Pr}ice = {} & \beta_0 + \beta_1 Nonagent + \beta_2 POF + \beta_3 \mathrm{Pr}ocessor + \beta_4 Exper + \beta_5 Q \\ & + \beta_6 Numberbuyers + \beta_7 Trans\cos t + \beta_8 Thunder + \beta_9 \mathrm{Pr}otein + \beta_{10} Grade \\ & + \beta_{11} Volatileprices + \beta_{12} Wantmember + \beta_{13} Europe + \beta_{14} US + e \end{aligned} \tag{5.1}$$

$$\begin{aligned} Log(TotalATC) = {} & \beta_0 + \beta_1 Nonagent + \beta_2 POF + \beta_3 \mathrm{Pr}ocessor \\ & + \beta_4 Exper + \beta_5 Q + \beta_6 Trans + \beta_7 Volatileprices + \beta_8 Farmsize + e \end{aligned} \tag{5.2a}$$

$$\begin{aligned} Log(CoreTC) = {} & \beta_0 + \beta_1 Nonagent + \beta_2 POF + \beta_3 \mathrm{Pr}ocessor \\ & + \beta_4 Exper + \beta_5 Q + \beta_6 Trans + \beta_7 Volatileprices + \beta_8 Farmsize + e \end{aligned} \tag{5.2b}$$

$$\begin{aligned} Log(Search) = {} & \beta_0 + \beta_1 Nonagent + \beta_2 POF + \beta_3 \mathrm{Pr}ocessor \\ & + \beta_4 Exper + \beta_5 Q + \beta_6 Trans + \beta_7 Volatileprices + \beta_8 Farmsize + e \end{aligned} \tag{5.2c}$$

$$\begin{aligned} Log(Negot) = {} & \beta_0 + \beta_1 Nonagent + \beta_2 POF + \beta_3 \mathrm{Pr}ocessor \\ & + \beta_4 Exper + \beta_5 Q + \beta_6 Trans + \beta_7 Volatileprices + \beta_8 Farmsize + e \end{aligned} \tag{5.2d}$$

A description of each variable and the expected sign for equations 5.1 and 5.2 is given in Tables 5.2 and 5.3.

5.5.1 Price Regression Dependent Variable: Farmgate Price

The dependent variable in equation 5.1 is the farmgate price, with a few adjustments in order to improve the usefulness of the regression. The farmgate price is the net price that the producer receives, in dollars per tonne, after the CWB Producer Direct Sale (PDS) is performed and transportation charges accrued to the producer are deducted. The price is also adjusted for changes in price between crop year by

subtracting the CWB pool price from each observation. This approach simultaneously corrects changes in prices between crop years and provides a farmgate price that is adjusted for quality, at least by measures available in the conventional market, which is the price spreads in the final payments by the CWB (CWB 2001, 2002, 2003). The result of these adjustments is a crop year-adjusted, conventional quality-adjusted farmgate price.

Table 5.2 - Price Regression Variables

Variable Description	Variable Name	Measurement	Expected Sign
Dependent variable			
Organic Wheat Price in the Transaction	Price	Transaction prices ($/t)	
Explanatory variables			
Grain company (not CWB agent)	Nonagent	Non CWB agent or not (1-0)	+
Producer–Owned Marketing firm (POF)	POF	POF marketed or not (1-0)	+
Direct to processor	Processor	Marketed direct to processor or not (1-0)	+
Producer's experience as certified organic producer	Exper	(years)	+
Transaction quantity	Q	(tonnes)	+
Number of buyers contacted	Number buyers	Whole number	+
Transportation basis from farmgate to port	Transcost	Trucking cost + rail freight ($/t)	–
Effect of distance on transportation basis	Transcost* Trans	Interaction term	+
Conventional Wheat Price	Thunder	Domestic Human Consumption Price, basis Thunder Bay ($/t)	+
Protein content	Protein	%	+
CGC Grade	Grade	1-4	–
Producer's risk aversion	Volatile prices	Degree to which volatile prices are a problem (1-5)	+
Desire to become a member of a POF	Want member	Want to join a POF or not (1-0)	+
European sale by producer or though POF	Europe	European sale or not (1-0)	+
U.S. sale by producer or through POF	US	U.S. sale or not (1-0)	+
Farm size	Farm size	Cultivated area (acres)	+

Source: Author's estimates

Table 5.3 - Average Transaction Cost Regression Variables

Variable Description	Variable Name	Measurement	Expected Sign C	N	S	T
Dependent variable						
Producer Average Transaction Cost in the transaction	ATC	Average transaction costs ($/t)				
Explanatory variables						
Grain company (not CWB agent)	Nonagent	Non CWB agent or not (1-0)	+	+	+	+
Producer–Owned Marketing firm (POF)	POF	POF marketed or not (1-0)	–	–	–	–
Direct to processor	Processor	Marketed direct to processor or not (1-0)	–	–	–	–
Producer's experience	Exper	(years)	–	–	–	–
Transaction quantity	Q	(tonnes)	–	–	–	–
Distance to buyer	Trans	(km)	+	+	+	+
Producer's risk aversion	Volatile prices	Degree to which volatile prices are a problem (1-5)	+	+	+	+
Farm size	Farmsize	Cultivated area(acres)	–	–	–	–

C = Core transaction costs
N = Negotiation costs
S = Search costs
T = Total transaction costs
Source: Author's estimates

5.5.2 Cost Regression Dependent Variable: Average Transaction Cost

The dependent variable in equation 5.2 is average transaction cost. This variable can be defined in different ways, depending on the costs that are included in the calculation. Equation 5.2 is regressed using several different forms of average transaction cost. First, a total average transaction cost variable is used (5.2a), which includes all transaction costs. While the total average transaction cost encompasses all transaction costs, it is expected that transportation and quantity variables will explain most of the significance. The second, third and fourth regressions thus remove transaction costs that are transportation and quantity dependent, such as special trips, annual transaction costs and any other driving expenditures. In the second regression (5.2b), a "core transaction cost" variable is used, which includes only searching and negotiating costs, and excludes all driving costs. The core transaction costs are the

quantitative manifestation of the uncertainty and asset specificity problems developed in the theoretical framework. A third regression (5.2c) uses the sum of reputation and price search costs, representing "search costs", as the dependent variable. Search costs are interesting because they can cause bidding price dispersion, as discussed in the theoretical framework. A fourth regression (5.2d) sums negotiation costs as the dependent variable. The four different groupings of transaction costs are given in Table 5.1. Since the dependent variable may be regressed in logarithmic form, a value of 1 is added to all observations in order to preserve degrees of freedom. A discussion of this technique can be found in Woolridge (2003).

5.5.3 Price Regression Explanatory Variables: Factors That May Affect Farm Price

Since the hypothesis of this thesis posits that farm prices could differ depending on producers' governance structure choice, governance structure must be included as an explanatory variable. As prices can vary for several reasons other than governance structure, these other factors must also be present as explanatory variables. This section describes all of the factors that may affect farm price, which are contained in Equation 5.1.

Governance structure can affect farm prices by resulting in different downstream prices and/or having different marketing margins. The marketing margin can be affected by the number and types of functions that marketers perform, and by the effects of opportunism and information asymmetry described in the theoretical framework. Transportation, cleaning and blending functions at the marketing level entail transformation costs for the marketer, while opportunism and information asymmetry lead to transaction costs for the marketer. These costs are included in the firm's

marketing margin. The effect of vertical coordination on marketer costs is beyond the scope of this thesis, but a few points can be made. Governance structures employing more vertical coordination may have lower marketer transaction costs, which may be transmitted into a narrower marketing margin. On the other hand, governance structures employing more vertical coordination often lack the economies of scale that may lead to a narrower marketing margin.

The size of the marketing margin may also be affected by the degree of information asymmetry facing producers, which may be affected by governance structure. Governance structure choice may affect the distribution of prices offered, such that the mean price may be higher when information asymmetry is reduced. Since marketer cost structure is not known, it is not possible to measure how much of the marketing margin differences can be attributed to the marketer costs or marketer information advantages.

Dummy explanatory variables for each type of governance structure are included in the regression equation, including grain companies that are not CWB agents (*Nonagent*), Producer-owned firms (*POF*), and Direct to processor (*Processor*) transactions. These dummy variables take a value of 1 if the transaction uses that type of governance structure, and take a value of 0 otherwise. The governance structure that is not included in the regression (in order to avoid the dummy variable trap[10]) is grain companies that are handling agents of the CWB. CWB agents are the most common governance structure for organic wheat, and therefore provide a suitable benchmark

[10] The dummy variable trap is the problem of including a dummy for the base group when a constant term is already included in the regression.

from which to compare the other three governance structures. These governance structures are hereafter be referred to as non-agents, POFs, processors and CWB agents.

A significant coefficient on the *Nonagent, POF* or *Processor* variables indicates that those governance structures have a significantly different price compared to CWB agents. The POF and processor governance structures entail greater vertical coordination than the base CWB agent governance structure and it is expected that *POF* and *Processor* will have a positive sign. The non-agent governance structure, however, has similar levels of vertical coordination to the CWB agent governance structure, and differs in other attributes, such as risk sharing and scale. It was determined that non-CWB agents differed significantly enough from the base governance structure to merit a distinction in the regression. This sign of the *Nonagent* coefficient may be positive if non-agents do not incorporate a risk premium into their prices, due to the fact that they typically perform back-to-back sales. CWB-agents do not always perform back-to-back sales, but sometimes purchase a significant portion of their wheat from producers before downstream buyers have been arranged. CWB-agent companies may discount prices in order to account for the risk that the organic premium may decrease before a buyer can be found.

The experience of the organic producer (*Exper*) may also significantly affect farm price, whereby more experienced producers may have more efficacious price searches because they would know where to find higher prices (or alternatively, would know how to avoid low prices). The quantity of the transaction (*Q*) may affect price because price premiums may be given for larger transactions. This would arise because marketers could have economies of scale that are passed down to producers. The size of the farm

(*Farmsize*) may also affect price if larger farms receive higher prices because marketers want to attract the producer's business. The effort made to search for prices, as indicated by the number of buyers contacted before selling, (*Numberbuyers*) may also be a significant explanatory variable, which represents a return to price search that could indicate that a distribution of prices exists in the market.

Variables that proxy location attributes may be important in explaining organic HRSW prices. The transportation basis from the farmgate to export position, (*Transcost*) may affect farmgate price if it is assumed that buyers deduct truck and rail freight respectively from the farmgate price. The *Transcost* variable represents bulk wheat freight rates from the buyer's location plus the trucking cost from the farmgate to the buyer, assuming that the truck hauls 40 tonnes, and that the cost is $50 per load, plus $2.19 per km (Nolan 2004).

The organic wheat price on a given day may be affected by the conventional price on the same day, as represented by the #1 13.5% protein domestic human consumption HRSW price, basis Thunder Bay (*Thunder*). Within a given crop year, however, the performance of a PDS with the CWB essentially "cancels out" the effect of conventional prices that deviate from the CWB pool price. Over multiple crop years one would expect a relationship between organic and conventional prices, but this effect should not be present in the regression because this variable, like the dependent variable, is crop year adjusted by subtracting the CWB pool price from each observation.

There are two factors that may explain any explanatory power of the conventional price variable within a given crop year. Firstly, the price premium of organic HRSW may be correlated with the conventional price. This can occur if the organic premium

(organic price minus conventional price) is correlated with the conventional spot price over time. Thus, price spikes in conventional HRSW result in a higher organic premium, and thus an organic price that is elastic to conventional price changes. Secondly, some producers may not be performing the PDS when they sell their organic HRSW. If producers do not perform the PDS and report their price in the survey, the group of producers that "cheat" would exhibit a positive relationship between organic and conventional prices.[11] The inclusion of a conventional price variable in the regression partially controls for the effect of cheating on organic price and fully controls for any correlation between conventional and organic prices.[12] The Domestic human consumption daily prices and the CWB pool prices are taken from CWB records (2004).

The sensitivity of organic HRSW price to quality, as measured by protein levels (*Protein*) and grade number (*Grade*) may differ from the sensitivity of conventional HRSW. Since the dependent variable is adjusted for conventional price spreads in quality, any difference between organic price spreads and conventional price spreads are illustrated by the coefficients of the quality variables. The level of producers' risk averseness, as indicated by their opinion on the degree to which volatile prices are a problem (*Volatileprices*) is expected to positively affect prices, as more risk averse producers may exert more effort in order to find higher prices.

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[11] This idea assumes that organic and conventional HRSW prices are correlated over time

[12] Cheating can only be partially controlled for by the coefficient, as only some unknown portion of the sample of reported prices have not performed the PDS. The "cheaters" would have a greater effect on the *Thunder* coefficient than the non-cheating portion of the sample. The effect of the cheating portion on the *Thunder* coefficient is diluted by the non-cheating portion, since the coefficient represents the average effect of conventional prices over the entire sample, including possible cheaters and non-cheaters.

The location of the downstream buyer may affect the price that is paid to the producer. A dummy variable for European sales (*Europe*) and U.S. sales (*US*) is used to detect if buyer location affects price. Any significance in these dummy variables indicates that prices are significantly higher in those markets compared to other markets. A summary of the explanatory variables is found in Table 5.2.

5.5.4 Cost Regression Explanatory Variables: Factors that Affect Producers' Average Transaction Costs

The TCE theory explained in the theoretical framework chapter provides a strong argument that governance structure choice affects transaction costs for producers and their buyers. There are, however, several other characteristics of transactions that can affect transaction costs that are not explained by TCE theory. This section describes the factors affecting average transaction costs, which were used in regression equation 5.2.

Governance structure choice can affect transaction costs for organic wheat transactions between a producer and his or her buyer. As detailed in the theoretical framework, governance structures vary in the degree of uncertainty and asset specificity that accompany them. These differences in transaction characteristics result in transaction costs to mitigate their effect. Dummy explanatory variables for each type of governance structure are included in the regression equation, including non-agents (*Nonagent*), POFs (*POF*), and processor (*Processor*) transactions. These dummy variables take a value of 1 if the transaction uses that type of governance structure, and a value of 0 otherwise. The governance structure that is not included in the regression (in order to avoid the dummy variable trap) is grain companies that are CWB agents. A significant coefficient on the *Nonagent, POF* or *Processor* variables indicates that those

governance structures have a significantly different average transaction cost compared to CWB agents.

The experience of the producer (*Exper*) may have a negative effect on average transaction costs by efficiencies gained through experience as organic producers improve their searching, negotiating, and monitoring/enforcing techniques and learn how to avoid these costs. The size of the transactions (*Q*) can affect average transaction costs if larger transactions allow producers to capture economies of scale in transaction costs. Economies of scale exist because the same tasks are necessary in order to conduct a transaction regardless of the size of the transaction. Holding all other factors equal, the amount of average transaction costs decrease as a transaction quantity increases. Farm size (*Farmsize*) can also affect average transaction costs, since larger farms spread their annual transaction costs over more transactions. It is expected that the relationship between farm size and average transaction cost will be negative, but since this study focuses on the transaction as the unit of analysis, this effect may not be apparent in the data.

The degree of producers' risk aversion (*Volatileprices*) can affect producer transaction costs, with increasing risk aversion leading to increasing transaction costs. Risk aversion in transactions represents the degree to which an individual prefers a certain outcome of a transaction to an uncertain outcome. Producers that are more averse to transaction uncertainty take greater measures in order to ensure that the transaction is completed without problems related to opportunistic behaviour.

The transportation distance from the producer to the buyer, in km, (*Trans*) may affect the transaction cost dependent variable if it accounts for trips to visit the buyer to

negotiate a sale or drop off samples. With increasing distance, costs associated with driving time and vehicle mileage increase. The *Trans* variable may also be important because increasing distance may lead to increasing fear of opportunistic behaviour arising from the difficulty in monitoring and enforcing contracts over greater distances, thus increasing the producers' transaction costs. A summary of the explanatory variables is found in Table 5.3.

5.6 Comparison of Governance Structures

The methodology for comparing the price and cost of each governance structure is described in this section. Price and transaction cost under each governance structure is first predicted using the regression results, then the remaining transaction and transformation costs are added to the prediction in order to arrive at an average cost value and price value for each governance structure. These values are then illustrated using the Dorward model and the optimal governance structures from all perspectives is discussed. This methodology in more detail, followed by a presentation of the results, is described in this section.

5.6.1 Prediction of Price and Cost

Given the regression results, one can predict price and average cost for each cost regression, under each governance structure. This technique is especially useful in interpreting the coefficients of the log-linear cost regressions. Predictions are made by using values for the non-governance structure variables (experience, age, transaction quantity, farm size, and conventional price) and one of the governance structure variables at a time. The price and cost predictions for each governance structure include a 90% confidence interval, which illustrates the degree of error associated with the

predictions. The total transaction cost, search cost and negotiation cost regressions are not to be used in the theoretical model, but their predicted values are useful nonetheless in describing the differences in search costs and negotiation costs between governance structures.

5.6.2 Calculation of Average Cost

Total average cost is the sum of all average transaction and transformation costs for the producer. The predictions from either the total average transaction cost regression or the core transaction cost regression can be used to calculate total average costs. The most suitable prediction to use is the prediction that contains significance on the governance structure coefficients. The mean values of the other, non-core transaction costs, plus the average transformation cost estimate, can be added to the predicted core transaction cost values to create a total average cost variable.

Using the regression predictions from only the core transaction costs and simply adding the missing transaction costs to create a total implicitly assumes that the other transaction costs, specifically the special trip costs, travelling costs and annual costs, are identical across governance structures. An average cost of certification is also added to the cost of each governance structure, taken from Pro-Cert (2004). Annual certification costs for an experienced organic wheat producer include a $200 flat fee, plus a fee of $.50 per cultivated acre. Annual inspection costs an additional $50 to $100, depending on travel costs for the inspector. Assuming an inspection cost of $75, a farm size of 1220 acres and an organic wheat yield of 35.25 bu/ac (AAFRD 2001), the average certification is $0.73 per acre or $0.76 per tonne.

5.6.3 Transformation Cost

Transformation costs accrued to the producer include the cost of production. It is assumed that producers' costs of production are the same regardless of the governance structure that they employ. This assumption is appropriate because there does not appear to be any governance structures presently used in the organic wheat industry that affect the production techniques of producers. As mentioned in Chapter 2, production specification contracts are not used in organic wheat marketing in Canada, except the requirement that the wheat be certified organic. A single estimate of production costs taken from a study by Alberta Agriculture, Food and Rural Development (2001), for dryland organic wheat production, is assumed for all governance structures. A value of $124.55/tonne, which includes all variable and fixed production costs, is taken from the report. A detailed description of the production costs is given in Appendix B.

5.6.4 Governance Structure Comparison

Each governance structure is evaluated from the perspective of the producer, the marketer, and the system as a whole. As described in Chapter 4, the optimum governance structure from the perspective of the producer or marketer is that which results in the most individual profit per tonne. The optimum governance structure from the perspective of the supply chain as a whole is the one that results in the greatest combined profit per tonne.

The performance of each governance structure from the producers' perspective is compared by subtracting producer average cost from the price received to attain a measure of producer profit per tonne. The marketer profit per tonne is estimated by assuming that the POF marketing margin (the commission that the POF takes) equals the

marketer average cost, and that marketer average costs are identical across governance structures. This assumption ignores potential differences in transaction cost economies of size across governance structures. The profit per tonne for producers and their buyer under each governance structure is illustrated graphically using the adapted Dorward model.

Data on marketer average costs is not available, but a reasonable assumption can be made in order to estimate marketer profit per tonne. Assuming that the POF operates with zero profits, the POF sets its marketing margin equal to its average cost. Assuming that all four governance structures have similar average costs, the estimated marketer profit can be calculated for each governance structure. Given these assumptions, a wider marketing margin results in greater marketer profits per tonne. Note that the marketing margin does not include any value-added due to transformation costs; the downstream price is based on bulk HRSW from the marketer's location.

Given the estimates of producer and marketer profit for each governance structure, one can evaluate the optimal governance structure from the perspective of producers, marketers, and from a multi-level perspective.

5.7 Chapter Summary

The procedure for testing the hypothesis of the thesis was described in this chapter. The collection of the transaction cost and price data was first described. The method of converting the transaction cost information into dollar values was also described. The chapter continued by describing the regression approach to testing for significant differences in prices and transaction costs between governance structures. The independent and dependent variables were also discussed. In order to illustrate these

differences in price and cost and their effect on producer profits, a method of using predictions of prices and core transaction costs from their respective regressions was developed. The predicted core transaction costs are to be summed with all other relevant costs and plotted using the Dorward model to illustrate producer profit per tonne. The results of the hypothesis test are provided in the next chapter.

Chapter 6: Hypothesis Test Results

6.0 Introduction

The results of the hypothesis test are presented in this chapter. First, the sample statistics on the characteristics of each governance structure are given. Second, the transaction cost data is described in detail. Third, the descriptive statistics from the regression results are reported. Fourth, the calculations and final results of the governance structure comparison are provided.

6.1 Sample Descriptive Statistics

Table 6.1 provides the mean of several explanatory variables in the price and cost regressions, plus age, education level and annual income. These values are taken from the sample of HRSW transactions for each particular governance structure. The descriptive statistics are provided in order to illustrate differences in producer and transaction characteristics between governance structures. The descriptive statistics for each governance structure are random, so the sample means can be used to make inferences about the population of organic HRSW transactions.

The descriptive statistics illustrate that POF transactions involve producers with the most experience, most likely because membership has been closed for several years. CWB agent transactions clearly have the greatest quantity transacted, while processor

transactions have the least quantity transacted per sale. Producers making processor transactions contact the most buyers, while producers making POF transactions make the least contacts with buyers. The conventional HRSW price (domestic human consumption price, basis Thunder Bay, #1 13.5% protein), grade, protein and education are similar across all governance structures. Producer transactions with non-agent grain companies reported the highest aversion to volatile prices, but showed the least interest in joining a POF, were the oldest, and had the smallest farms. Producers that transacted with processors had showed the most interest in joining a POF and had the lowest income levels. Producers that transacted with CWB agent grain companies and POFs had the largest farm size and the highest incomes. Producers in POF transactions reported the largest transportation distance to their buyer, which contributed to their transportation cost to port.

Table 6.1 – Producer Sample Descriptive Statistics, by Governance Structure

Variable Name	Mean			
	CWB Agent n = 46	Non Agent n = 11	Processor n = 8	POF n = 11
Experience (years)	5.61	4.91	6.25	8.55
Quantity transacted (t)	95.63	42.12	34.81	59.94
Number of buyers contacted	8.39	7.27	10.00	3.27
Transportation cost to port	48.14	47.24	47.09	50.80
Domestic Human Consumption Price, Thunder Bay ($/tonne)	226.01	223.74	214.18	211.88
Protein (%)	13.68	13.93	14.23	13.94
Grade (1-3)	1.17	1.27	1.00	1.18
Volatile Prices problem (1-5)	1.80	2.27	1.88	1.64
Want Membership in POF (% reporting "yes")	50%	45%	63%	55%
Age (years)	41-50	51-60	41-50	41-50
Education	High School	High School	High School	High School
Annual Income ($ thousands)	30 to 40	20 to 30	10 to 20	30 to 40
Farm Size (cultivated acres)	1373.61	599.09	1149.63	1252.09
Transportation distance to buyer or marketer location (km)	231.83	267.36	196.50	323.09

Source: Producer survey, Author's calculations

The observations made from these statistics are consistent with expectations. It is important to note that from this information we are not able to conclude that these differences affected producers' choice of governance structure, nor can one conclude that these differences are an effect of governance structure choice.

6.2 Transaction Cost and Price Descriptive Statistics

The descriptive statistics for transaction costs derived from the producer sample, using a time value of $10 per hour, are given in Table 6.2. The first column lists the transaction costs, distinguishing between search costs and negotiation costs, and providing a core transaction cost value and total transaction cost value. The second column provides the average time or distance accrued to a single HRSW transaction. The third column provides the average valuation of time spent and distances traveled in dollars per tonne. The fourth column provides the standard deviation of the dollar per tonne estimate. It is important to note that the descriptive statistics of the sample are not completely random, and thus cannot be used to make any inferences about the population of organic HRSW transactions in general. Averages of the non-zero responses are given for costs that were seldom occurred in the sample, such as extra time selling the the U.S. or the Rest of the World (RoW), which are identified by an asterisk. The total average core transaction costs and total average transaction cost values are a sum of all values, however, including all responses for all of the different types of transaction costs.

Table 6.2 – Transaction Cost Statistics

Variable	Type	Average (hours, km)	Average $/t	Standard Deviation $/t
Core Transaction Costs:				
Search				
Reputation search	Time	1.47	0.25	0.75
Price search	Time	2.54	1.90	7.44
Negotiation				
Negotiation	Time	3.83	1.25	3.05
Extra time to sell to the U.S.	Time	0.44	1.07*	1.38*
Customs agent fee	Fee	0	0	0
Extra time to sell to RoW	Time	0.81	5.68*	0.79*
Producer Direct Sale	Fee		2*	0*
(PDS)	Time	1.01	0.37*	0.17*
Sample preparation and Sending to buyers	Time	1.17	0.88	1.98
Quality testing	Fees	17.40	0.68	1.41
	Time	1.06	0.58	2.33
A. AVERAGE CORE TRANSACTION COST:			**4.41**	
Non-Core Transaction Costs:				
Negotiation				
Producer Direct Sale	Driving	4.68	0.001*	0.001*
Quality Testing	Driving	9.68	6.79	31.08
Monitoring/Enforcement				
Extra time	Time	0.001	0.002	0.02
Extra money	$	23.53	1.31	9.82
Value lost/discount	$	0	0	0
Fixed/Annual				
Marketing meetings	Time	0.24	0.04	0.14
(special trip)	Driving	0.26	0.05	0.21
Certification meetings	Time	0.64	0.26	0.97
	Driving	0.41	0.20	0.83
General marketing	Time	0.25	0.09	0.38
Meeting	Driving	0.14	0.05	0.19
Certification and	Time	0	0	0
general marketing meeting	Driving	0	0	0
Fax machine usage	$	16.01	0.33	0.91
Computer usage	$	6.53	0.14	0.42
Coordination Cost				
POF Member	Time, Driving	4.55*	0.46*	0.97*
B. AVERAGE NON-CORE TRANSACTION COST:			**18.67**	
AVERAGE TOTAL TRANSACTION COST (A+B):			**23.08**	

* = calculated using only non-zero responses
Source: Producer Survey

Upon examining the second and third columns of Table 6.2, one can see that producers spend several hours searching and negotiating their transactions. Reputation search costs are relatively low, while price search costs are higher. The various negotiation costs involve considerable amounts of time and result in large costs per tonne. Negotiation time is increased in transactions to the U.S. and the rest of the world (RoW). Quality testing costs are very high, mainly due to the large distances traveled in some cases in order to have tests completed. Summing the search and negotiation costs (excluding driving costs[13]) provides an estimate of the "core transaction costs" in HRSW transactions. The value of $4.42 per tonne indicates that search and negotiation tasks are a small cost for producers. Monitoring and enforcement costs are relatively low. It is important to note that only two of the transactions in the sample reported any monitoring costs. Meetings accrued low costs in terms of time spent but high driving costs because of the long distances between the farm and the meeting location. Costs for fax machine and computer usage were low. Of the transactions that were made through a POF, the coordination costs related to monitoring POF performance were high. In total, the sum of all transaction costs equal $19.59 per tonne on average. Compared to producer transformation costs of about $125/tonne, transaction costs are a considerable part of producer costs.

The survey sample revealed an average farmgate price of $289.65, with a standard deviation of $56.24. Note that this statistic represents the average prices derived from several transactions that differ in many attributes, including quality, location and time.

[13] Driving costs are dependent on the distance from the farm to the buyer. It would be erroneous to include such a cost in the same category as searching and negotiating.

6.3 Regression Descriptive Statistics

A summary of the descriptive statistics for the regression variables is contained in Table 6.3. Again, it is important to note that the descriptive statistics of the sample are not completely random, and thus cannot be used to make any inferences about the population of organic HRSW transactions. The descriptive statistics of the price regression variables are first described, followed by a discussion of the variables that are unique to the cost regression.

In the price regression, the average farmgate price, adjusted for crop year and conventional HRSW quality, is $289.65. Producers have an average of six years of experience transacting HRSW (*Exper*). The average quantity of organic HRSW (*Q*) sales is 76.31 tonnes. Producers contact between seven and eight buyers before they make a sale of organic HRSW (*Numberbuyers*). The average farm size (*Farmsize*) is 1220 acres, which is very similar to the average farm size in Saskatchewan. The average transportation basis from the farmgate to export position (*Transcost*) is estimated at $48.28. The conventional HRSW price for #1, 13.5% protein, basis Thunder Bay (*Thunder*), is approximately $222.39 per tonne. Producers believe that price uncertainty (*Volatileprices*) is a "minor problem," with an average response of 1.86 on a scale of one to five.

While some variables are used in both the price regression and the cost regression (indicated by "*"), other variables are specific to the cost regression. The cost variables (*TotalATC, CoreTC, Negotcost, Searchcost*) are characterized by relatively large standard deviations. Note that each cost variable uses a time value of $10 per hour and 1 is added to all observations. The measure of transportation distance between the

producer and buyer (*Trans*) indicates that distances are large (246.46km), which can lead to large driving costs if the producer travels to meet the buyer.

Table 6.3 – Regression Descriptive Statistics

Variable Name	Mean	Standard Deviation
Price Regression:		
Organic price-pool price + 219.08	$289.65/t	53.58
Nonagent*	0.145 (11 out of 76 obs.)	0.354
POF*	0.145 (11 out of 76 obs.)	0.354
Processor*	0.105 (8 out of 76 obs.)	0.309
Exper*	6 years	4.99
Q*	76.31 tonnes	117.07
Numberbuyers	7.65 buyers	8.74
Transcost	$48.28/t	9.50
Thunder	$222.39/t	24.13
Protein	13.8	1.17
Grade	1.2	0.53
Volatileprices*	1.86	0.98
Cost Regression:		
TotalATC	$23.08/t	72.30
CoreTC	$4.41/t	8.62
Negotcost	$2.83/t	3.72
Searchcost	$2.58/t	6.97
FarmSize	1220 acres	943
Trans	246 km	246

* = variable used in price and cost regressions
Source: Author's calculations

6.4 Regression Results

The results of the price and cost regressions are reviewed in this section. Several regressions were performed on price and different combinations of transaction costs. The transaction cost regressions were performed using a common time value of $10 per hour across all observations, since using producer-chosen time values did not improve the explanatory power of the regression.

The reported regression results consist of one price regression and four transaction cost regressions. Regressions using the dependent variables of crop year and quality-adjusted farmgate price (*Price*), total average transaction costs (*TotalATC*), core transaction costs (*CoreTC*), search costs only (*Search*) and negotiation costs only (*Negot*) are given in Table 6.4. It is assumed that the error term is distributed independently of the independent variables (i.e. no endogeneity exists).

6.4.1 Price Regression

The price regression (Equation 5.1) regressed farmgate organic HRSW prices on several variables that were hypothesized to explain prices. A linear specification was used because it yielded a normally distributed error term (Prob(Jarque-Bera statistic)=0.292) and the coefficients are easy to interpret. The R-squared was reasonable ($R^2 = 0.495$), but approximately half of variations in price remain unexplained by the independent variables. The coefficient of the constant has no meaningful interpretation, other than to say that it represents the organic HRSW price when all other explanatory variables equal zero. The governance structure dummy variables (*Nonagent, POF, Processor*) are all positive, but *POF* was the only statistically significant governance structure variable. The coefficients indicate that the POF prices are $59/tonne higher than the base CWB agent governance structure, non-agent prices are $17/tonne higher, and processor prices are $15/tonne higher.

Experience does not have a significant effect on price, but a one tonne increase in the quantity of the sale results in a statistically significant $0.077 increase in price. The number of buyers contacted before the sale (*Numberbuyers*) has the expected positive sign but is not significant. The transportation basis (*Transcost*) has the expected

negative effect on price and is statistically significant. The *Transcost* coefficient indicates that a one dollar increase in conventional transportation cost results in a statistically significant $0.80/tonne reduction in farmgate price. The results thus suggest a clear transportation basis incorporated into the prices that buyers offer.

The conventional price (*Thunder*) has a positive but insignificant (p=0.102) effect on organic HRSW price within a crop year. The *Thunder* coefficient suggests that a one dollar increase in conventional price leads to a $0.34 increase in organic farmgate price. Since all producers should receive the CWB price plus an organic premium, and assuming that all transactions in the sample performed the PDS, the results suggest that a one dollar increase in conventional price leads to a $0.34 increase in the organic premium over and above the CWB price. If one assumes that cheating did occur, and some transactions were made without performing the PDS with the CWB, then the coefficient may be overestimated due to the prices reported without deducting the PDS.

The protein level (*Protein*) had an expected positive sign, indicating that organic price is more sensitive to protein than conventional prices, but this effect was not significant. The grade of the HRSW (*Grade*) variable is found to have a negative but insignificant effect on price (p=0.128). It was expected that protein would have a significantly greater effect on price, since it is generally understood that wheat buyers pay premiums for protein above those received for conventional HRSW. The quality variables indicate that protein levels and grade in organic HRSW do not have effects on price that are significantly different than those found in conventional HRSW. The variable that aims to measure the effect of risk averseness (*Volatileprices*) is not significant, indicating that risk aversion does not affect price.

Table 6.4 – Regression Results

	Equation Number				
	5.1	**5.2a**	**5.2b**	**5.2c**	**5.2d**
Dependent Variable	**Price**	**Log(Total ATC)**	**Log(CoreTC)**	**Log(Search)**	**Log(Negot)**
Independent Variable			**Coefficient (Standard Error)**		
Constant	293.17***	0.333	0.183	0.174	-.0085
	(73.39)	(0.489)	(0.293)	(0.239)	(0.236)
Nonagent	16.69	0.412	0.276	-0.268	0.0487
	(15.71)	(0.530)	(0.415)	(0.360)	(0.243)
POF	58.74***	0.223	-0.186	-0.318***	-0.0237
	(17.50)	(0.370)	(0.206)	(0.0741)	(0.204)
Processor	14.59	0.308	0.718**	0.498*	0.559
	(11.99)	(0.383)	(0.348)	(0.270)	(0.353)
Exper	-1.46	0.0105	0.001	-0.0114	0.0149
	(0.975)	(0.0369)	(0.0224)	(0.0165)	(0.0180)
Q	0.077*	-3.55E-3***	-1.46E-3**	-1.51E-3**	-5.34E-4
	(0.0387)	(0.00114)	(7.26E-4)	(6.38E-4)	(4.71E-4)
Numberbuyers	0.677				
	(0.689)				
Transcost	-0.800*				
	(0.463)				
Trans		6.10E-4	1.22E-4	8.36E-5	3.52E-5
		(7.77E-4)	(2.00E-4)	(1.35E-4)	(1.74E-4)
Thunder	0.344				
	(0.207)				
Protein	1.84				
	(4.89)				
Grade	-12.39				
	(8.03)				
Volatileprices	1.36	0.417**	0.317**	0.0564***	0.334***
	(6.79)	(0.161)	(0.120)	(0.0739)	(0.108)
Europe	124.34*				
	(73.89)				
US	28.81*				
	(20.01)				
Farmsize		5.07E-4**	4.56E-5	1.96E-4**	-7.90E-5***
		(2.05E-4)	(1.30E-4)	(9.38E-5)	(1.15E-4)
N	76	76	76	76	76
Adjusted R^2	0.495	0.23	0.19	0.14	0.20
Prob(F-statistic)	0.000015	0.0011	0.0045	0.02	0.003

*** = p<0.01, ***= p<0.05, *= p<0.10

Source: Author's calculations

Finally, the effect of selling overseas has a positive effect on prices. Selling to Europe (*Europe*) results in a statistically significant $124/tonne increase in price. Selling to the United States (*US*) results in a statistically insignificant $29/tonne increase in price. The results suggest that prices in Europe and the US are higher than prices in other regions and thus the "law of one price" does not hold in the international organic wheat market. As noted in Table 6.1, there is a slightly higher cost associated with marketing to the U.S. and Europe, but the higher prices outweigh the higher cost.

It is important to note that even after accounting for several effects on price (quantity, searching, transportation costs, conventional price effects, quality, risk aversion, and country), the governance structure dummy variables are still positive and the *POF* variable is statistically significant. The result means that the POF is the only governance structure with producer prices that are significantly different from the base governance structure. The price regression results reject the hypothesis that there is no significant difference in prices between governance structures for organic HRSW.

6.4.2 Transaction Cost Regressions

The transaction cost regressions (Equations 5.2a, 5.2b, 5.2c, 5.2d) regressed four forms of producer transaction cost on several variables that explain those costs. Each regression was performed using the log form of the dependent variable. The log-linear specification was used in order to create a more normally distributed error term and to improve the explanatory power of the regression. The log-linear specification of the regressions provides semi-elasticity coefficients. These coefficients are interpreted as a percentage change in the dependent variable caused by a one-unit change in the independent variable.

The transaction cost regressions had a relatively poor fit, with adjusted R-squared values between 0.14 and 0.23. Nonetheless, the F-statistics were all statistically significant. The transaction cost dependent variables were characterized by relatively large standard errors, which resulted in lower explanatory power in the regressions.

The governance structure dummy variables were positive and insignificant in the regression using *TotalATC* as the dependent variable (equation 5.2a). While the coefficients suggested that using the alternative governance structures caused total average transaction costs to rise between 22-41%, the standard errors of these coefficients were too great to yield statistical significance.

The *CoreTC* regression (equation 5.2b) yielded significant results for one governance structure variable, with *Processor* having a positive significant effect on core transaction costs. The results suggest that as far as the core transaction costs of searching and negotiating are concerned, selling to processors is the only governance structure that results in significantly higher costs for producers, with 72% higher core transaction costs than selling to CWB agents. Higher costs of searching for processor reputations and processor prices and higher costs of quality testing are the main reasons for the cost difference. The higher costs associated with processor transactions are offset by higher prices in the same transactions.

The regression using *Search* (equation 5.2c) as the dependent variable yielded significant results for two of the three governance structures. The regression indicated that selling through a POF resulted in a statistically significant decrease in search costs, while selling to a processor significantly increased search costs. The coefficients suggests that selling through a POF results in search costs that are 32% lower than

selling through CWB agents. On the other hand, producers selling through a processor have search costs that are 50% higher. These results are consistent with the theoretical framework, as POF members allow their marketing agent to search on their behalf, while producers that sell to processors typically spend more time searching for reputation and prices. The *Negot* regression (equation 5.2d) exhibited small and insignificant governance structure coefficients.

The experience of the producer at the time the transaction is made (*Exper*) was found to have an ambiguous effect on transaction costs for all of the cost regressions. This result is somewhat surprising, as the expectation was that greater experience would lead to lower transaction costs.

The quantity of the transaction (*Q*) had the expected negative effect on costs and was statistically significant in all regressions except for the *Negot* regression. A one tonne increase in transaction quantity resulted in average cost decreases ranging from 0.36% to 0.14%, which suggests that there are economies of scale in HRSW transactions. Distance from the farmgate to buyer (*Trans*) had the expected positive effect on costs in all cost regressions, but was not statistically significant. The effect of risk aversion on transaction costs (*Volatileprices*) is positive and significant in all cost regressions, with an increase in the producers' risk aversion by one point on the five-point scale increasing total average transaction costs by 42%, core transaction costs by 32%, search costs by 3% and negotiation costs by 33%. A producer's risk aversion, as measured by the proxy variable, thus appears to have a large effect on their transaction costs.

The size of the producer's farm in the transaction (*Farmsize*) had inconclusive effects on transaction costs. While farm size had a positive significant effect on total average transaction costs and search costs, it had a negative significant effect on negotiation costs. The theory of the thesis does not explain this result.

Overall, the cost regressions suffered from poorer fit and significance compared to the price regression. Despite the poorer results, the significance of governance structure variables in the regressions of core transaction costs and search costs rejects the hypothesis that there are no significant differences in transaction costs between governance structures.

6.5 Comparison of Governance Structures

The results from comparing the price and cost of each governance structure are described in this section. Price and transaction cost under each governance structure is first predicted using the regression results, then the remaining transaction and transformation costs are added to the prediction in order to arrive at an average cost value and price value for each governance structure. These values are then illustrated using the Dorward model and the optimal governance structures from all perspectives is discussed.

6.5.1 Prediction Results

A summary of the predictions of price and transaction costs are outlined in Table 6.5. The predictions are organized in the table by the regression (as defined by the dependent variable), then by the prediction for each governance structure. The predictions are made using average values for the other variables in the regression equation. The bold font indicates statistical significance from the price and cost

regressions from which the predictions were made. It should be noted that these predictions are based on the regressions, which had relatively low measures of goodness of fit. The mean absolute percent error for forecasts from the price regression was 10.2%, while the mean absolute percent error for forecasts from the cost regressions ranged from 29.0% to 64.0%. Predictions from the price regression thus appear more accurate than predictions from the cost regressions.

Table 6.5 – Predicted Price and Transaction Costs

Regression	Governance Structure	Prediction ($/tonne)	90% Confidence Interval ($/tonne)	
			Lower CI	Upper CI
Price	Nonagent	290.49	266.83	314.14
	POF	**332.54**	**305.76**	**359.32**
	Processor	288.38	270.50	306.27
	CWB agent	273.80	262.78	284.82
TotalATC	Nonagent	12.19	9.14	51.14
	POF	9.92	10.11	31.63
	Processor	10.89	10.77	35.49
	CWB agent	7.74	10.26	19.60
CoreTC	Nonagent	3.35	1.28	7.28
	POF	1.74	1.07	2.62
	Processor	**5.76**	**3.00**	**10.42**
	CWB agent	2.30	1.72	3.00
Search	Nonagent	2.11	0.74	4.55
	POF	**0.38**	**0.62**	**0.84**
	Processor	**2.13**	**1.55**	**5.00**
	CWB agent	0.90	1.12	1.67
Negot	Nonagent	1.58	0.83	2.64
	POF	1.40	0.80	2.19
	Processor	3.30	1.52	6.34
	CWB agent	1.46	1.05	1.95

Bold indicates significant difference between governance structures from regressions
Source: Author's calculations

After accounting for all other factors that affect price, the POF price prediction is $332.54 when the CWB agent price is $273.80. This corresponds with the significant

POF coefficient in the price regression. On average, accounting for all other factors that affect core transaction costs, core transaction costs when transacting with processors were $3.46/t higher compared with CWB agent transactions. Search costs in POF transactions are significantly lower compared to CWB agent transactions. On average, accounting for all other factors that affect core search costs, search costs when transacting with POFs were $0.38/t compared to $0.90/t through CWB agent transactions. Non-agents showed no significant differences in price or transaction costs compared to grain companies that are CWB agents, but this is to be expected since the CWB agent and non-agent transactions use similar vertical coordination.

6.5.2 Average Cost Calculation Results

The calculation of average cost is given in Table 6.6. Core transaction costs are small compared to non-core transaction costs and transformation costs. After all of the average costs are summed, the difference between CWB agent and Processor transaction costs, the lowest and highest cost groups respectively, is only $3.46/tonne.

6.5.3 Governance Structure Comparison

The graphical comparison of governance structures is given in Figure 6.1 and Table 6.6. While costs are similar across all governance structures, prices differ to a greater extent, which results in different net prices across governance structures. It is not possible to collect data on downstream prices that marketers obtain, except for the POF marketer involved in this study, which takes a commission on sales. It is thus assumed that downstream prices are equal across all governance structures. Assuming a 4% commission by the POF (which does not include transformation costs), the downstream price is equal to 104% of the predicted POF price, or $345.84/tonne. As the downstream

price is assumed to be identical across all four governance structures, a higher price to the farmer results in a smaller margin for the marketer. The POF governance structure thus results in the lowest marketing margin, at $13.30/tonne. The marketing margin for the other three governance structures is significantly larger than the POF case. CWB agents, non-agents and processors are estimated to have a margin of $72/tonne, $55/tonne and $57/tonne respectively.

Table 6.6 – Cost, Price and Profit Summary

Average Cost, Price, Profit	**Governance Structure**			
	CWB agent	**Non-agent**	**POF**	**Processor**
Producer				
A. Core Transaction Cost	2.30	3.34	1.74	5.76
B. Non-Core Transaction Cost	18.67	18.67	18.67	18.67
C. POF Member Cost			0.46	
D. Certification Cost	0.76	0.76	0.76	0.76
E. Average Transaction Cost (A+B+C+D)	21.73	22.77	21.63	25.19
F. Average Transformation Cost	124.55	124.55	124.55	124.55
G. PRODUCER AVERAGE COST (E+F)	**$146.28**	**$147.32**	**$146.18**	**$149.74**
H. PRODUCER PRICE	**$273.80**	**$290.49**	**$332.54**	**$288.38**
I. PRODUCER PROFIT (H-G)	**$127.52**	**$143.16**	**$186.36**	**$138.65**
Marketer				
J. Marketer Price	$345.84	$345.84	$345.84	$345.84
K. Marketing Margin	$72.04	$55.36	$13.30	$57.46
L. Marketer Average Cost (excluding transformation cost)	$13.30	$13.30	$13.30	$13.30
M. Marketer Profit (K-L)	$58.74	$42.05	$0	$44.16

Source: Author's calculations

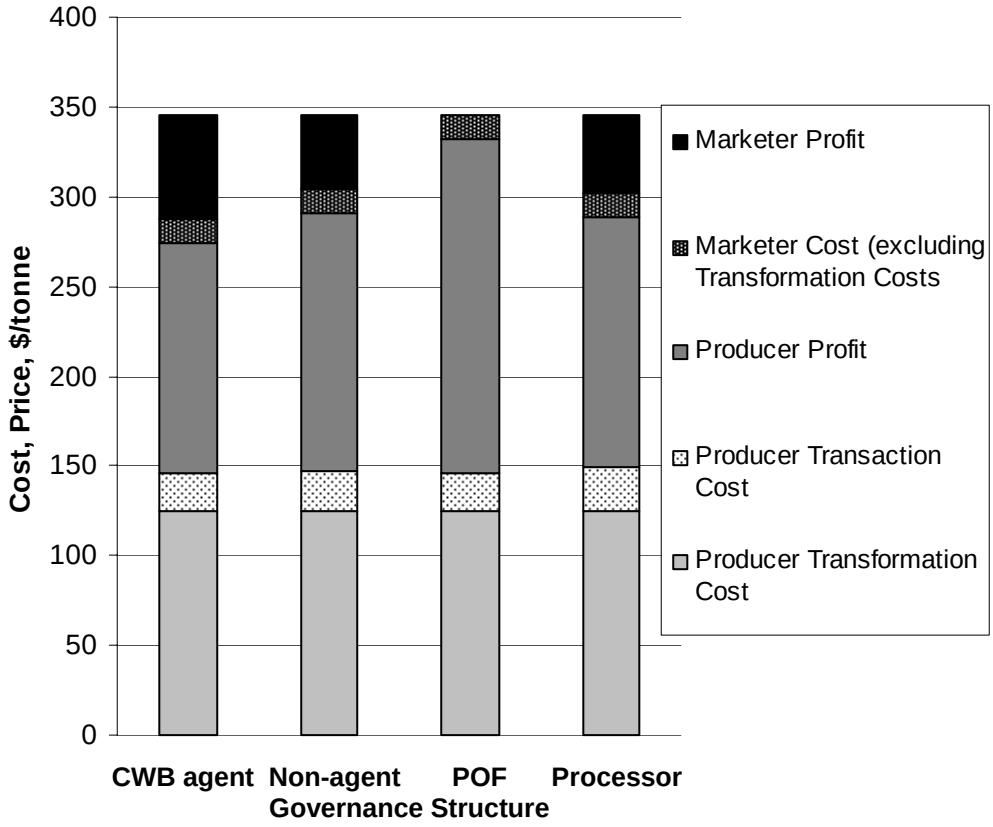

Figure 6.1 Dorward Model of Cost, Price and Marketing Margin

Given the estimates of producer and marketer profit for each governance structure, one can evaluate the optimal governance structure from the perspective of producers, marketers, and from a multi-level perspective. This evaluation is presented in Table 6.7. The POF governance structure is the optimal choice for the producers, since it provides the greatest profit per tonne. The other three governance structures provide much lower profits per tonne. The CWB agent governance structure, however, is the optimal choice for marketers, at least on a per-tonne basis. The results thus illustrate that producers and marketers should have different governance structure preferences based on the metric of

individual profit per tonne. Producers should prefer the POF governance structure, while marketers appear to profit most as CWB agents.

The optimal governance structure for producers and marketers from the combined producer and marketer perspective is the governance structure that provides the greatest combined profits per tonne. All four governance structures have similar levels of combined profits, since they differ as a result of cost differences in the supply chain, which were found to be minimal. The POF and CWB agent governance structures had the highest combined profits per tonne, and the processor governance structure had the lowest combined profits per tonne.

Overall, the results thus suggest that the least attractive marketing option for producers (selling through a CWB agent) is the best option for marketers and for these two levels of the supply chain as a whole. This empirical comparison corresponds with the predictions of the Mahoney framework, which predicted that producers should prefer a vertically coordinated governance structure such as relational contracting while the marketer should prefer the spot market. The POF examined in this analysis shares many characteristics of a relational contract, making the Mahoney prediction very close to the resulting optimal outcome for producers.

Table 6.7 – Profit per Tonne Comparison

Profit per tonne	Governance Structure			
	CWB agent	**Non-agent**	**POF**	**Processor**
Producer	$127.52	$143.16	$186.36	$138.65
Marketer	$58.74	$42.05	$0	$44.16
TOTAL	$186.26	$185.22	$186.36	$182.80

Source: Author's calculations

6.6 Limitations of the Analysis

There are several limitations of the approach used to compare profit from alternative governance structures. Firstly, the approach ignores differences in risk sharing among the governance structure alternatives. Specifically, CWB agents typically purchase HRSW earlier in the year than the other marketers, often without a buyer to sell to, and these firms must discount their prices to control for the risk that prices may fall. The lower price paid by CWB agent grain companies is the reward for speculating in the market. Marketing firms that make back-to-back sales do not speculate in the market and do not require compensation for speculation risk. Secondly, producers may discount having to hold onto wheat until later in the crop year because they need cash flow after harvest. The principle that prices may be discounted into the future is not considered by the methodology. Thirdly, this analysis implicitly assumes that a POF already exists, so the costs associated with creating a POF are not included.

It may be possible to account for lower prices given by CWB agents due to their greater risk-bearing by comparing non-agent price with CWB agent price. The difference between the CWB agent price and the non-agent price may represent the effect of increased risk-bearing on price, since these two types of firms are similar in most other respects.

The price regression may also suffer from bias due to respondents that have reported a price that has not incorporated the PDS. Producers may be avoiding the PDS when conventional cash price is above the CWB pool price (i.e. cheating), since this necessitates a large payment to the CWB for the difference. The price regression may overestimate other coefficients that are correlated with cheating, which limits the

methodology's ability to differentiate the effect of cheating from other factors. For example, if many producers using a particular governance structure did not perform the PDS, this would translate into a greater coefficient for that governance structure and a higher price prediction. The legitimate price would be less than the predicted price. While the conventional price variable may correct for some of this overestimate of legitimate prices, the methodology is not able to fully correct for the effect of cheating on the price predictions.

Another limitation of the price regression in testing for significant differences in price between governance structures is that it analyzes all crop years at once, and does not test for stability of price differences across different crop years. If the price premium of the POF is not significant in each year, then it is doubtful that it is the POF's inherent characteristics that allow it to capture higher prices. However, if the price premium of the POF is statistically significant in each year, this lends support to the claims of the theoretical framework for explaining higher POF prices. This issue is examined in Appendix C, with the result that the POF prices were strongly significant in one year and weakly significant in the other year.

The most significant limitation of the cost regression results is that the predictions made from the cost regression have a large degree of error. Using the predictions of core transaction cost had very little effect on the results, as the magnitude of the differences in predicted values were small in comparison to differences and price and to the total average cost values.

The assumption that all governance structures sell for the same price to downstream customers is not realistic. Different governance structures may fetch

different prices due to differences in their marketing strategy or customer base. The assumption that all governance structures have the same average transaction costs is also unrealistic, as it ignores cost differences that could result from differences in economies of size. The calculated marketing margins and profit margins of the marketer under each governance structure are subject to criticism due to the assumptions on marketer price and marketer transaction costs.

6.7 Chapter Summary

The results of testing the hypothesis of the thesis were described in this chapter. The descriptive statistics for the characteristics of producers in different governance structures were first given. Interesting differences in characteristics across governance structures were found. The descriptive statistics of the transaction costs were also presented. Producer transaction costs were found to be a small compared to producer transformation costs. The results of the regression on organic HRSW price and four types of transaction costs associated with the HRSW sales were then reported. Significant differences in price, core transaction costs and search costs were found in the regression. Based on the regression results it was possible to reject the hypothesis that there are no significant differences between governance structures in price and cost. In order to illustrate the differences in price and cost and their effect on producer profits, predictions of prices and core transaction costs under the four governance structures were made using their respective regressions. The predicted core transaction costs were summed with all other relevant costs and plotted to illustrate producer profit per tonne. Marketer profit per tonne was also estimated through two assumptions. Comparing the profits from the alternative governance structures indicated that the optimal governance

structure for the producer, given the assumptions made by the study, is not the optimal governance structure for the marketer.

The next two chapters complement the results of this chapter. A methodology is provided to detect the presence of a price distribution in the organic wheat market in Chapter 7, and the results are reported. Testimonial evidence that organic producers suffer from price information asymmetry is presented in Chapter 8

Chapter 7: Price Distribution Detection Methodology and Results

7.0 Introduction

The theoretical framework of the thesis proposes that there is not only one price for a given quality of organic wheat, but rather a dispersion of bidding prices. Furthermore, the theory posited that price dispersion decreased for producers who could more effectively search for prices by transacting with POFs and processors. This chapter complements the main results by providing empirical evidence that price dispersion exists in the sample of transactions collected through the producer survey and discusses whether or not price dispersion differs across different governance structures used to transact organic HRSW between producers and buyers.

7.1 The Approach to Residual Analysis

Figure 7.1 shows the conventional HRSW[14] and the organic farmgate HRSW prices over time and is derived from data collected from the producer survey. The figure illustrates that producers obtain a wide variety of prices for the organic HRSW that they grow. The organic HRSW prices shown in Figure 7.1 include transactions of heterogeneous quality, location, and other factors, and are not a good measure of a price distribution because they include heterogeneous characteristics of the product.

[14] The conventional price is the #1, 13.5% protein domestic human consumption price, basis Thunder Bay.

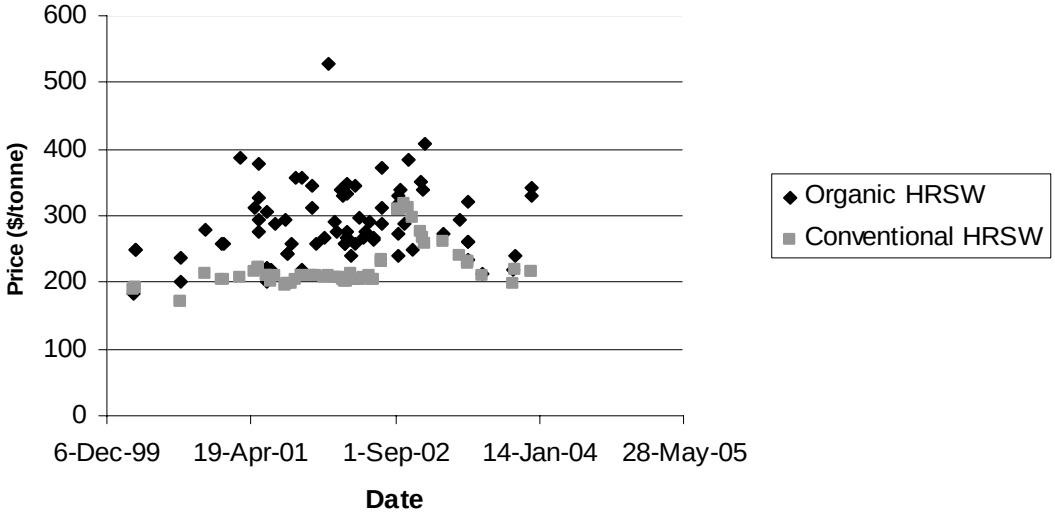

Figure 7.1 – Farmgate Organic HRSW Price, Unadjusted for Product Heterogeneity

Other studies (Lach 2002) have detected selling price distributions for goods by surveying the same stores in weekly intervals over several weeks. Lach used a regression to control for product heterogeneity, then analyzed the residuals from the regression. While the available survey data for organic HRSW does not have panel-style data on transaction prices, it does include detailed information about each sale, such as the price, the date of setting the price, the location, quality and other attributes. The dispersion of organic HRSW prices is analyzed using the residual values from the price regression performed in Chapter 6. This section begins by proposing a methodology for examining the residuals from the price regression, then reporting the results of the residual analysis.

7.2 Residual Analysis Methodology

The residuals from the price regression are the difference between the price predicted by the regression and the actual price received by the producer. A negative residual value for an observation indicates that the actual price was below the predicted price. A positive residual value for an observation indicates that the actual price was above the predicted price. Given the theory that transactions within more vertically coordinated governance structures may have lower price dispersion due to lower search costs, one would expect that more vertically coordinated governance structures with low price search costs would have smaller residuals. A formal method of comparing the dispersion across governance structures is to calculate the standard deviation of the error terms belonging to each governance structure. One can also visually examine a ranking of the regression residuals in order to detect whether or not POF and processor transactions result in less dispersion. These methods, used by Lach (2002), provide a conservative estimate of price dispersion, since the price regression used in this thesis controls for far more than product heterogeneity.

The residuals are analyzed by three methods. First, the residuals of the original price regression are compared with the non-dummy explanatory variables to detect if there are any correlations. Second, the standard error is calculated for the residuals under each governance structure. Third, the residuals are plotted in order of value, and the plotted observations are distinguished based on governance structure.

It is expected that CWB agent transactions will have the lowest standard deviation of error terms, since these buyers typically offer to buy HRSW earlier in the year, take a long position in the market, and thus shoulder more risk. Non-agent, POF and Processor

transactions are expected to have higher standard deviations than CWB agents, because they cannot afford to speculate in the market and shoulder risk of price changes.

7.3 Residual Analysis Results

The residuals of the price regression were plotted against each of the non-dummy explanatory variables to detect if any relationships exist. None of these explanatory variables exhibited a relationship with the residuals. These results suggest that price dispersion is not a function of location, quality, or the other attributes.

The standard deviation of the residuals under each governance structure is given in Table 7.1. Processor transactions have the lowest error standard deviation, while POF transactions have the highest standard deviation. Grain company transactions have a standard deviation between the two extremes. This result indicates that the degree of price dispersion is most pronounced in POF transactions. The POF result does not correspond with expectations based on the idea that lower search costs through a POF lead to less price dispersion, but differences in risk shouldering between governance structures may provide a suitable explanation. POF marketers transmit all price risk back to the producer members, while grain companies appear to transmit less price risk back to producers. The speculative nature of CWB agent grain companies may explain why they transmit the least price risk, as they offer prices to producers before they have found a buyer, and therefore cannot transmit the ups and downs of price back to producers. Following this explanation, processors may be willing to absorb the ups and downs of price in order to receive a consistent product.

Table 7.1 – Price Regression Residual Dispersion

Measurement	Governance Structure			
	CWB agent	Non-agent	POF	Processor
Standard Deviation	36.34	36.45	39.49	32.64

Source: Author's calculations

The residuals from the price regression, ranked separately for each governance structure, are plotted in order of value in Figure 7.2. It is apparent that the residuals from CWB agent transactions have residuals that are more concentrated at the zero compared to the other governance structures. Although the abundance of observations for the CWB agent transactions makes it difficult to directly compare the rankings across governance structures, the residuals of the other three governance structures are not concentrated at the mean and thus are much more evenly dispersed. On the other hand, it is evident that the processor transactions have a much lower range of residual values, which explains their lack of dispersion.

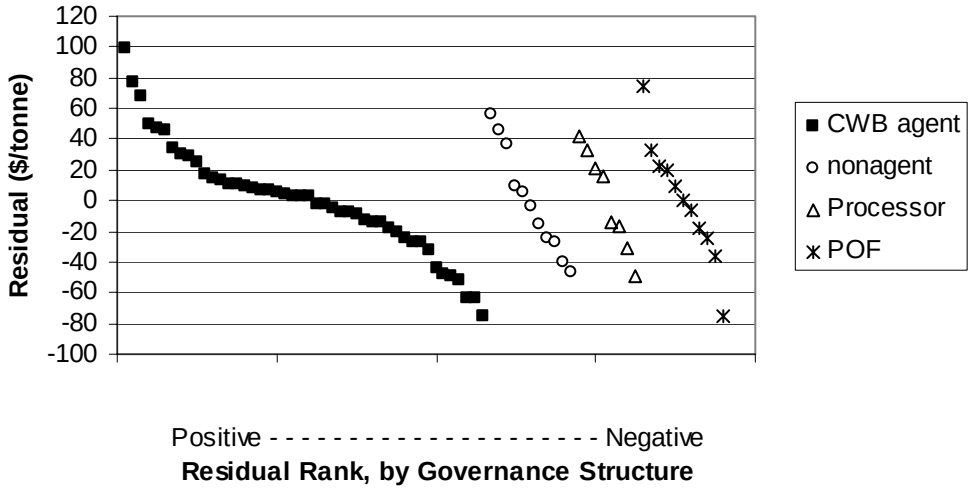

Figure 7.2 – HRSW Price Regression Residual Rankings, by Governance Structure

7.4 Chapter Summary and Conclusions

A methodology for detecting the presence of price dispersion in organic HRSW and the results of the residual analysis were provided in this chapter. Limitations in the nature of the price data prohibit the use of more sophisticated residual price analyses, but a methodology to work with the given data is provided. Differences in the error standard deviation across governance structures suggest that price dispersion is not a function of vertical coordination, but rather a function of the buyer's risk-shouldering. While the POF transactions had the largest dispersion, the processor transactions had the least dispersion. The ranking of the residuals indicates that the distribution of prices does not exhibit a peak near the mean.

The results of this chapter and Chapter 6 suggest that the vertically-coordinated POF governance structure provides higher prices, but more volatile prices. On the other hand, the processor governance structure provides prices similar to CWB agent prices, but offers less price volatility than other governance structures.

Chapter 8: Information Asymmetry: Producer Perceptions

8.0 Introduction

The producer survey collected data on organic producers' opinions regarding the prevalence of information asymmetry in their markets. While chapters 6 and 7 measure the effect of information asymmetry on average price levels and price dispersion, this chapter complements those results by providing testimonial evidence that information asymmetry is a problem for producers. The sample of organic producers is first described, then the surveying techniques are described and the results of the survey are reported.

8.1 Sample Description

The original sample of organic producers, which was used in the organic HRSW analysis of chapters 6 and 7, yielded 57 surveys that answered the questions relating to information asymmetry. The sample was not completely random, as six extra observations from POF members were added to the random sample.

8.2 Information Asymmetry Problems

Section 6.2 of the questionnaire was titled "Marketing Problems," which contained a list of potential marketing problems and asked producers to indicate the extent to which each was a problem to them when selling organic grains. These marketing

problems represent producers' perceptions of transaction costs. The managerial perceptions of transaction costs are very important, as they direct future actions by managers (Buckley and Chapman 1997).The responses were reported on a scale of 1 to 5, where 1 indicated that there was "not a problem" and 5 indicated that there was a "major problem". The complete survey is given in Appendix A.

The list of producer marketing problems and the average producer response is reported in Table 8.1. Problems 1 and 2 measures producers' perceptions of grain companies and processors opportunistic behaviour with respect to quality upon delivery, which translate into reputation search costs. Problem 3 measures producers' perceptions of quantity uncertainty, which translates into negotiation costs for the producer and buyer. Problems 4 and 5 measure producers' perceptions of the general uncertainty regarding buyers fulfilling contractual obligations, which translates into reputation search costs. Problem 6 measures producers' perceptions of price uncertainty, while problems 7 and 8 measure producers perceptions of price information asymmetry. Perceptions of price uncertainty and information asymmetry translate into price search costs. Problem 9 measures producers' perceptions of transaction barriers, which translate into negotiation costs. Problems 10 and 11 measure producers' perceptions of information asymmetry regarding downstream market conditions, which translates into search costs. Problem 12 measures producers' perception of the increase in uncertainty that may come with processor transactions, which translates into increased search and negotiation costs in processor transactions.

Table 8.1 – Producer Marketing Problems

Problem	Average Response*
1) Processors dispute quality upon delivery	1.16
2) Grain companies dispute quality upon delivery	1.18
3) Difficult to provide enough high quality grain to meet requirements	1.77
4) Buyers do not honour contracts	1.24
5) Buyers do not pay on time	1.59
6) Prices are volatile	1.95
7) Buyers have much better information on prices than I do	2.44
8) I do not get the best price possible when I sell	1.98
9) Not being able to find a buyer when I want to sell	2.05
10) I have a poor understanding of the final market for the products resulting from my crops	1.74
11) I have a poor understanding of my buyers' business situation and problems	1.77
12) Having problems/disputes with buyers when I try to market "on my own."	1.32

* a higher rating indicates that the problem is greater
Source: Producer questionnaire

Problems 7 and 8, which measured producers' perceptions of price information asymmetry, ranked highest and second highest respectively as potential marketing problems. Problem 6, which measured producers' perception of price uncertainty, ranked third highest. This result suggests that price information asymmetry is "a problem" for producers. The ratings were not very high for any of the questions, indicating that producers do not perceive any of these as a "major problem". Overall, the results reveal that producers are somewhat aware of their lack of information.

8.3 Marketing Information Sources

Question 2.2.4c in the survey asked producers to estimate the amount of money they pay per year for marketing publications, etc. Question 2.2.4d asked producers to describe the type of marketing information that they purchase. These questions were

asked in order to find out how much marketing and specifically price information that producers are able to access for a fee.

Producers bought an average $26.23 of marketing information per year. Several producers responded that they did not spend any money on marketing information, while the highest response was $300 per year. The marketing information that was described by the producers included farm papers, newsletters and books. However, organic producers do not appear to have access to organic price information. The author of this study is not aware of any price information for organic grains that is available for purchase or free of charge, other than the Organic Agriculture Centre of Canada (OACC) that reports wheat flour prices weekly on their website, and provides historical grain prices. The results suggest that there is almost no public or private price information available to organic grain producers.

8.4 Producer Interest in Price Information

Part 4 of the survey asked producers for their thoughts on hypothetical price information. The survey asked producers to rate the value of different types of price information and their willingness to pay for that price information, as well as the amount of time that price information would save them. Producers were asked to rate four hypothetical types of price information, including: 1) monthly prices that other farmers have received, plus their inventories, 2) monthly market outlook and future price forecasts, 3) daily price quotes from organic grain buyers, and 4) weekly price quotes from organic grain buyers. The rating of each option was given on a scale of 1 to 5 where, 1 represented a poor rating and 5 represented a very good rating. The willingness to pay question was provided as the amount that the respondent would be willing to pay

per year for the information. The time saving question asked producers to provide an estimate of the time that the information would save them per sale. These questions were asked in order to find out the kinds of information that organic producers would be interested in receiving.

The results of the price information questions are given in Table 8.2. The ratings on a 1-5 scale were all within a range between 2 and 3, indicating small differences in preferences among the information options. Producers rated weekly price offers from organic grain buyers the highest, and also perceived this option to result in the highest time saved per week and were willing to pay the highest annual fee for this service. Monthly market outlook and future forecasts and monthly prices received plus inventories ranked second on the rating scale. Daily price offers from organic grain buyers were rated the lowest. The results suggest that weekly price offers is the price information service that these organic producers would value the most.

Table 8.2 – Price Information Ratings

Information service that is provided	Average Response		
	Rate 1-5*	**$ you would pay****	**Time Saved (hrs)*****
1) Monthly prices that farmers have recently received plus their inventories	2.42	21.45	0.84
2) Monthly market outlook and future price forecasts	2.51	18.54	1.03
3) Daily price offers from organic grain buyers	2.18	17.30	1.01
4) Weekly price offers form organic grain buyers	2.84	23.57	1.34

* a higher rating indicates that the problem is greater
** $ paid per year for the information service
*** time saved per sale
Source: Producer questionnaire

8.5 Synthesis of the Results

The results from the producer marketing problem data suggest that producers are somewhat aware that price variability exists and that they have very little information on prices compared to those who buy their grain. Furthermore, producer responses in the survey indicate that almost no public or private price information exists for organic producers. This situation is very different from conventional HRSW producers who have access to a large amount of public and private information. Given this situation of asymmetric information, the survey indicates that producers are interested in having more price information and they perceive substantial time savings if they had such information. One can conclude from the results that there may be a role for public or private price information organizations in the organic wheat sector. However, the apparent lack of willingness to pay for price information suggests that the role of private firms to provide price information may be limited at the present time. A publicly funded price information service may be the most viable method of transmitting price information to firms in the organic wheat sector.

8.6 Chapter Summary

In this chapter the survey data that related to producers' perceptions of information asymmetry, their current price information resources, and their perceptions of hypothetical price information services was summarized. The results highlighted the fact that price information asymmetry is a problem for organic producers and that they desire more price information.

This chapter ends the presentation of the results of this thesis. The next chapter concludes the thesis by briefly synthesizing all of the results and discussing the limitations and recommendations for further study.

Chapter 9: Conclusion

9.0 Introduction

The purpose of this chapter is to present the conclusions that can be drawn based on the results and analyses. First, a summary of the conclusions of the study are provided, followed by a discussion of the limitations of the study. The chapter concludes by making recommendations for further research.

9.1 Summary of Conclusions

9.1.1 Test of Hypothesis

The primary conclusion of this thesis is drawn from testing the hypothesis. The null hypothesis was that there were no significant differences in price or transaction costs between governance structures used to transact organic HRSW between producers and buyers. This hypothesis was rejected for prices, core transaction costs and search costs.

Predictions made from the price regression indicated that POF transactions obtained significantly higher prices compared with the base CWB agent governance structure. Predictions made from the transaction cost regression using core transaction costs as the dependent variable indicated that processor transactions incurred significantly higher core transaction costs compared to the base CWB agent governance structure and the POF governance structure. Predictions made from the transaction cost

regression using search costs as the dependent variable indicated that POF transactions incurred significantly lower search costs compared to the base CWB agent and processor governance structures. While both POF and processor governance structures are both characterized by greater vertical coordination, they exhibit significantly different transaction costs for producers.

While statistical significance was found for both price and average core transaction costs, price differences between governance structures were far greater in magnitude than core transaction cost differences. The difference between the highest and lowest price prediction was $76/tonne, while the difference between the highest and lowest average core transaction cost prediction was only $4/tonne.

9.1.2 Producer Profit Comparison

The producer profit calculation indicated that POF transactions resulted in the highest profit per tonne, mainly due to the effect of higher prices. CWB agent transactions resulted in the lowest profit per tonne, mainly due to the effect of lower prices. Processor transactions resulted in profits per tonne that were only slightly higher compared with CWB agents. The lacklustre performance of the processor governance structure conflicts with the belief that producers should "eliminate the middleman" in order to gain higher prices. The results suggest that processor transactions in the organic HRSW market require much more effort for very little reward.

Overall, the POF governance structure appears to be the optimal choice for the producer, while the results suggest that this governance structure is the least appealing for the marketer on a profit per tonne basis. Given the assumptions on downstream prices and marketer costs, marketers derive the most profits per tonne from the CWB

agent governance structure. These results suggest that producers and marketers should prefer different governance structures. This result corresponds with the prediction using the Mahoney (1992) framework that marketers should use the spot market governance structure while producers should prefer a more vertically coordinated governance structure. The results suggest that the push for POF marketers must come from producers.

9.1.3 Explaining the Performance of the POF

The POF governance structure clearly emerged from this study as the optimal marketer for organic HRSW producers. The theoretical framework suggested that a POF governance structure would result in lower search costs for producers and more effective searching on their behalf through the marketing agent. The more effective searching via a POF was posited to result in those producers obtaining prices that were higher in the distribution of available prices. The results suggest that this is true, since POF search costs were significantly lower and POF prices were found to be significantly higher.

The POF governance structure is fundamentally different from the others because a marketing agent is working on the producers' behalf. With a commission arrangement, the marketing agent has the incentive to find the highest price possible, and is required to pass that price upstream to the producer. The CWB agent and non-agent governance structures do not share this important characteristic, and prices and price dispersion reflect this. Producers using the processor governance structure also receive the full downstream price, but they do not have the search cost efficiencies that benefit the POF and they suffer from relatively lower prices. On the other hand, the POF's full

pass-through of downstream price back to the producer also transmits more price volatility, as indicated by the residual analysis in Chapter 7.

Although it is impossible to know the strategies of most grain buyers, the results of the study support the idea that grain companies and processors know that producers have less price information and this allows them to offer lower prices. Producers that are less aware of market prices may transact at these lower prices, while more aware producers may not. Marketing through a POF that has as much price information as the other buyers eliminates the effect of ignorance on offer prices. Producers are somewhat aware of their lack of information, and they want to have more tools available to them in order to have more market knowledge. This thesis does not make any inferences about the optimal governance choice of governance structure for producers that already have more market knowledge.

9.2 Limitations of the Study

There are several limitations of this study. One major limitation is that it only uses costs and prices to measure the performance of governance structures. The theoretical framework and methodology ignores differences in risk sharing among the governance structure alternatives. Differences in risk sharing may explain some of the differences in producer farmgate prices. The residual analysis revealed differences in price volatility between governance structures, which may be attributed to differences in marketer risk shouldering, but this analysis was not directly involved in the test of hypothesis.

Another major limitation of the theoretical framework and methodology is that it does not incorporate the effect of governance structure on quantity. While quantities

sold by producers may not vary across governance structures, the quantities transacted by marketers vary considerably depending on the governance structures used. This limitation may bias the determination of the optimum marketer governance structure, but it should not bias the determination of the optimum producer governance structure. The incorporation of quantity into the analysis would allow for traditional measures of profit and surplus.

Although the POF governance structure is optimal for producers, other governance structures are used by producers in the organic HRSW market. There must obviously be a reason why governance structures that deliver lower prices are used by producers. The utility gained from other governance structures or the effect of non-maximizing behaviour by producers presumably must counter the lower prices that the producers receive. This study does not analyze the factors that affect governance structure choice, which may reveal some non-profit utilities that result from choosing less profitable governance structures. Some non-profit reasons for choosing a governance structure may include the timing of sales during the year, the proximity of the buyer and the degree of trust between the producer and the buyer. Another reason for not choosing a POF governance structure is the cost and feasibility of setting up a POF. The fixed costs associated with POF setup are not incorporated into this analysis.

The small sample size of this analysis may be another limitation on the inferences that can be made from the thesis. The sample may also have been affected by non-response bias, where producers that did not want to participate would have provided different answers than those that chose to participate.

This thesis did not include an examination of industry structure, which may have been useful in understanding the behaviour of firms in the organic wheat supply chain. There may be issues of oligopoly, price leadership, dominance of a single firm or restriction of entry in the organic wheat supply chain that were ignored by this thesis.

9.3 Recommendations for Further Research

There are many opportunities for further research in the area of organic supply chain economics. A study similar to this thesis could be performed on other types of organic grains. The organic producer survey collected data on flax, oats and lentil prices, which may lend itself to an analysis similar to the one performed in this study. Further research could also be performed that incorporate the limitations of this study. The effect of governance structure on quantity and risk sharing would allow for more rigorous conclusions to be made. A complementary study on the factors that affect governance structure choice, such as transacting through grain companies, processors or POFs would also be useful in understanding producers' transaction behaviour. Mirror-image questions from the organic producer survey could also be studied in order to determine if producer and buyers priorities are in accordance.

Industrial organization theory could also be used to understand the pricing and buying behaviour of organic grain buyers. An industrial organization approach to organic grain markets may yield interesting analysis, looking at characteristics such as concentration and pricing behaviour.

Finally, the involvement of the CWB in the organic wheat industry could be examined more fully, including issues such as the viability of the CWB marketing of organic grains or examining the options for less CWB involvement with organic wheat.

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Appendix A: Organic Producer Survey

UNIVERSITY OF SASKATCHEWAN **Code # _____**

CONFIDENTIAL

Organic Producer Survey

Shon Ferguson (306-966-4043 or 306-652-3059)
Gary Storey (306-966-4020 or 306-374-1693)

Thank you for agreeing to take part in this survey. All information will be treated in the strictest of confidence.

Part 1 Production Information for Organic Commodities Produced.

1.1 When was your first transition year for organic production? _____

1.2 When was your first certification year for organic production? _____

1.3 Please tell us the total cultivated area of your farm for the previous three years.

Cultivated Area:	Certified Organic (acres)	Transition (acres)	Non-Certified (acres)	Total land (acres)
2003				
2002				
2001				

Part 2 Marketing Organic Crops

We are particularly interested in all aspects of crop marketing, including who buys your crops, your marketing practices, the particular problems you have, and suggestions for improvement.

2.1 Marketing of Hard Red Spring Wheat (HRSW), oats, lentils and flaxseed

2.1.1) We are interested in the prices that you receive for the different market outlets that you use to sell your organic crops. Please fill in the information for HRSW, oats, brown flax and laird lentil sales that you have made in the calendar years of 2001 and 2002.

If you do not have the exact information in your records, please make an approximation. In the case where dates are asked and you do not know the exact date, please approximate to the part of the month (ex: early March)
NOTE: If you are uncomfortable including the name of your buyer, please describe the type of buyer it is (ex: large grain company, small grain company, local farmer, miller, broker working on commission, Marysburg group, Farmer Direct, etc.)
The buyer's location can be described by their country, state or province.

Sale #1 Buyer name (or buyer type) and location: _____
a) Crop and Variety _____
b) Quantity _____
c) Farm Price _____
d) Marketer name (if different from buyer)_____ Marketing tariff ($ or %)_____
e) Who did the Producer Direct Sale? (HRSW sales only) _____
f) What was the Producer Direct Sale fee? (HRSW sales only) _____$/tonne
g) Did you pay for cleaning? Yes ____ No _____
h) Did you pay for bagging? Yes ____ No _____
i) Grade _____
j) Protein content (HRSW only)_____
k) Date that contract was made _____
l) Date that the price was set _____
m) Delivery date _____
n) Did the buyer pay for trucking from the farm? Yes____ No____
o) Where did the truck take your grain? _____ unsure ___
p)Date that you were paid _____
q) How was sample delivered? Personally ____ Mail ____ Bus ____ No sample___
r) First time selling to this buyer? Yes____ No____
s) Was the buyer bonded? Yes____ No_____ Unsure _____
t) Were there any problems? Yes _____ No _____
u) What tests did you provide the buyer? (tick)
v) Protein___ Falling #___ Test weight___ Other (describe)_____
w) U.S. sales only: v) Did you fax documents to the U.S. border? Yes___ No___
x) Did you pay the customs agent fee? Yes___ No___

Sale #2 Buyer's Name (or buyer type) and Location _____
a) Crop and Variety _____
b) Quantity _____
c) Price _____
d) Marketer name (if different from buyer)_____ Marketing tariff ($ or %) __
e) Who did the Producer Direct Sale? (HRSW only) _____
f) What was the Producer Direct Sale fee? (HRSW only) _____$/tonne
g) Sold cleaned? Yes ____ No _____
h) Sold bagged? Yes ____ No _____
i) Grade _____
j) Protein content (HRSW only)_____
k) Date that contract was made _____
l) Date that the price was set _____
m) Delivery date _____
n) Did the buyer pay for trucking from the farm? Yes____ No____
o) Where did the truck take your grain? _____ I don't know ___
p) Date that you were paid _____
q) How was sample delivered? Personally ____ Mail ____ Bus ____ No sample___
r) First time selling to this buyer? Yes____ No____
s) Was the buyer bonded? Yes____ No_____ Unsure _____
t) Were there any problems? Yes _____ No _____
u) What tests did you provide the buyer?
v) Protein___ Falling #___ Test weight___ Other (describe)_____
w) U.S. sales only: v) Did you fax documents to the U.S. border? Yes___ No___
x) Did you pay the customs agent fee? Yes___ No___

2.2 Costs and Time Spent on Marketing Organic Crops

2.2.1) How far away are the cleaning plants that you use to clean your grains before you sell? (This question may not be applicable if you never clean your grain before selling it)

Grain	Distance (km, one-way)
HRSW	
Oats	
Flax	
Lentils	

2.2.2) Please describe any trips that you made in 2001 and 2002 that were related to marketing your crops. This can include grower meetings, personal meetings, discussing samples in person, certification meetings, group marketing meetings, etc. Please write in the sale numbers from part 2.1

Special Trip	**Which sales were involved?**	**What was the purpose of the trip?**	**Total time spent (incl. driving)**	**Km (one-way)**
1				
2				
3				
4				
5				
6				
7				
8				

Please answer the following questions using a typical year as your point of reference. That is, do not use as your point of reference a year in which you had little crop to market due to drought, hail, or other reasons.

Questions 2.2.3 through 2.2.12 ask you about the rest of the time that you spent marketing, not including the special trips and meetings that you mentioned above.

2.2.3 a) Not including special trips or meetings, how much time do you devote per sale to determine the reputation of a new buyer? (such as trustworthyness, paying promptly, bonded, etc.)
write in the time you spend for each crop:

	HRSW	Oats	Flax	Lentils
Time per sale				

b) Please explain your specific activities to determine their reputation:

_____

2.2.4 a) Not including special trips or meetings, how much time do you spend per sale, to get information on HRSW, oats, flax and lentil prices? Consider time taken to call other producers or buyers, time spent reading information, etc.

write in the time you spend for each crop

	HRSW	Oats	Flax	Lentils
Time per sale				

b) Please explain your specific activities:

_____

_____

c) How much do you pay for marketing publications, information, etc. per year? ____

What type of info do you buy? _____

2.2.5 a) Not including special trips or meetings or getting price information, how much time do you spend communicating with your buyer to coordinate a sale, on average? (talking on the phone and exchanging information, negotiating the details, preparing the transaction certificate, loading the truck or rail car, etc.)

write in the time you spend for each crop

	HRSW	Oats	Flax	Lentils
Time per sale				

b) Please explain your specific activities:

_____

_____

2.2.6) Producer Direct Sale (PDS)

a) If you made HRSW sales where another company performed the Producer Direct Sale:

i. How much of your time does it take to perform a PDS, in ☐ hours?
ii. What activities does this include? (driving, etc)

Please explain your activities when another company performs the PDS:

_____

_____Total km driven: ☐

b) If you made HRSW sales where you performed the buy-back yourself:

i. How much of your time does it take to perform a PDS, in hours? ☐
ii. What activities does this include? (driving, etc)

Please explain your specific activities to perform the PDS yourself:

_____

_____Total km driven: ☐

2.2.7) When looking for a buyer, how many buyers do you contact, and how many buyers do you send samples to per sale, on average?

write in the number for each crop

	HRSW	Oats	Flax	Lentils
Number of buyers that I contact when I want to sell				
Number of buyers that I send samples to per sale				

2.2.9 a) How much time does it take to prepare and send one sample to a buyer?

b) Please describe the sample preparation and sample sending process:

_____

_____

2.2.10) How much extra time per sale does it take to sell to the U.S.? (ex: time spent faxing papers to the U.S. border and/or dealing with the customs broker) (If applicable)
(hours)

2.2.11) How much extra time per sale does it take to sell to other foreign countries? (if applicable) (hours)

2.2.12 a) How much time do you spend to have a test done of your grain per sale when each of the following tests is needed?

Crop	Test	Amount of your time taken per test (preparing sample) (hours)	Km driven to send/deliver sample(s)	Number of samples that you would likely send at a time
Wheat				
Oats				
Flax				
Lentils				

c) Any other costs to perform these tests? Please describe:

_____

2.3 Challenges Associated with Marketing and Payments

2.3.1 a)From the time you began to produce organic crops(consider all organic crops) have you ever not been paid for a sale of organic grain? Yes _____ No _____
Proceed to question 2.3.2 if you answered "No"

b) If you answered "Yes" please give the following details about each non-payment situation, including the extra time and money spent dealing with the problem:

Sale number (or year)	Crop	Company type	CWB agent? (yes/no)	Extra time spent (hours)	Extra money spent	Value of sale lost

Please provide other details about the problems:

_____
_____
_____

2.3.2 a) From the time you began to produce organic crops, have you ever been paid late?
Yes _____ No _____
Proceed to question 2.3.3 if you answered "No"

If you answered "Yes" please give the following details about each late payment situation, including the extra time and money spent dealing with the problem:

Sale number (or year)	Crop	Company type	CWB agent? (yes/no)	Days after deadline	Extra time spent (hours)	Extra money spent

Please provide other details about the problems:

_____
_____
_____

a) From the time you began to produce organic crops, has the buyer ever said that your grain quality was lower than what the contract/agreement had stipulated? (This can include quality problems relating to dockage, splits, visual quality, etc.)
Yes _____ No _____

(if you answered "No", then skip the rest of this question and proceed to section 2.4)

b) If you answered "Yes" please give the following details about each quality problem situation.

Please provide the relevant details for each instance:

Trans. number (or year)	Crop	Company type	CWB agent? (yes/no)	Type of quality problem	Discount per tonne (if any)	Extra time spent (hours)	Extra money spent

Please provide other details about the problems related to the quality rejection:
_____
_____
_____

2.4 Member of a Farmer-controlled marketing agency

Were you a member of a farmer-controlled marketing agency in 2001 and/or 2002? (ex: Marysburg Organic Producers, etc.) Yes _____ No _____

If you answered "no", please skip this section and proceed to section 2.5

2.4.2 How many hours per year did you spend in the last two years in your capacity as a member? This can include any meetings that you attended, time spent finding out about how the company is doing, preparing for the meetings, driving time, etc, plus the km driven to get to the meetings.

2001 activities:_____
_____ time ____ km ____
2002 activities:_____
_____ time ____ km ____

2.4.3 Do you have any official capacity within the organization? Yes ___ No ___

If you answered yes to 2.4.3, please explain your involvement

_____

Were you a preferred member in 2001 or 2002? Yes_____ No_____

If you answered yes, please explain what extra benefits this gave you

_____

_____

2.5 Direct Marketing Questions

Skip this section and proceed to 2.6 if you do not process any of your crops yourself or you do not have someone else process on your behalf.

2.5.1 a) If you processed some of your crops in 2001 and/or 2002, or if you had processing of your crops done for you, please explain what processing you carry out.

This includes breads or other final food products, using any of your organic grains.

2002

Product	Price/unit	Value of Sales	Type(s) of grain used	Amount of own grain used	Average cost per unit to process or package

2002

Product	Price/unit	Value of Sales	Type(s) of grain used	Amount of own grain used	Average cost per unit to process or package

2) Please explain what markets you sell into, and explain how you established the markets for your processed products.

_____

_____

_____

2.6 Forward Contracting Questions

2.6.1) Your Satisfaction with Forward Contracts

Please think about the different contracts that you have had in the past.

Rate your satisfaction with the contracts that you have signed when forward contracting between 1 and 5, where 1 = very unsatisfied and 5 = very ☐ satisfied

Were there any features of those contracts that you did not like?
If so, please name the features and explain what was bad about it (ex: too constrictive)

_____
_____
_____

2.6.2) Contracting Strategy

Explain how you find buyers to contract with and establish a price:

_____
_____
_____
_____
_____

Part 3 Organic – Conventional Cost Comparison

We would like you to provide an estimate of what you think the difference in production and marketing costs are between organic and conventional grain.
Ex: if you think production for organic is 10% higher than conventional, write "+10%"

Please write the percentage difference in cost per tonne for each function, for organic compared to conventional:

Function	HRSW	Oats	Flax	Lentils
Production				
Farm Storage				
Grain Cleaning (if applicable)				
Record-Keeping				
Marketing (making sales etc.)				
Transportation from farm (if applicable)				

Comparing organic and conventional costs, what areas of your costs do you think are too high? How could you decrease these costs? _____

Part 4 Your thoughts on the creation of a price information agency

4.1) Please rate each of the following hypothetical information sources in terms of its value to you on a scale of 1 to 5, where 1 is very low value and 5 is very high value.

Also please write a dollar amount that you would be willing to pay per year in order to receive that information.
Lastly, please guess how much time that this information would save you, in hours per sale.

Information service that is provided	**Rate 1-5**	**$ you would pay**	**Time saved (hrs)**
1) Monthly prices that farmers have received plus their inventories (via mail)			
2) Monthly market outlook and future price forecasts (via mail)			
3) Daily price offers from organic grain buyers (via e-mail)			
4) Weekly price offers from organic grain buyers (via e-mail			

Part 5 Your thoughts on CWB Involvement in Organic Wheat

Think about what it would be like if you sold all of your wheat through the Canadian Wheat Board (CWB). Marketing organic wheat would be exactly the same as marketing conventional wheat.

5.1) Do you think that the CWB should begin to market organic wheat and create an organic wheat pool account? Yes ____ No ____
5.2) Please state your reason for choosing yes or no:
_____
_____

Part 6 Relationships with buyers.
6.1 What buyers want from organic producers

For each grain below, please rank the concerns of your buyers as you see them, listed on the left, in terms of their importance from 1 to 5, with 1 being the most important, 2 for the next most important, and so on, o 5, the least important.

Your Buyers' Concerns:	HRSW	Oats	Flax	Lentils
Quality of producer's commodity				
Quantity that the producer promised				
Timeliness of producer's delivery to the buyer				
To buy at a cheap price from the producer				
The farmer's audit trail is complete				
Other (specify) _____				
Other (specify) _____				

6.2 Marketing problems

Please indicate the extent to which each of the following is a problem to you when selling organic grains.

1 = Not a problem
2 = Minor problem
3 = A problem
4 = Relatively significant problem
5 = Major problem

Problems	HRSW	Oats	Flax	Lentils
Processors dispute quality upon delivery				
Grain companies dispute quality upon delivery				
Difficult to provide enough high quality grain to meet commitments				
Buyers do not honour contracts				
Buyers do not pay on time				
Prices are volatile				
Buyers have an "unfair" advantage at knowing what my grain is worth				
I do not get the best price possible when I sell.				
Not being able to find a buyer when I want to sell				
I have a poor understanding of the final market for the products resulting from my crops				
I have a poor understanding of my buyers' business situation and problems				
Having problems/disputes with buyers when I try to market "on my own."				
Other:_____				
Other:_____				

6.3 Marketer Functions/Services

Please indicate if your primary marketer provides these services, and if so, rate their performance. Also please indicate how important each function/service is to you.

Company name (or describe type) referred to in this question: _____

Tick for YES or NO to indicate if they provide each service, then rate on a scale of 1 to 5, where 1 is low performance or importance, and 5 is high performance or importance.

Functions:	Provided?		Rate Performance	Rate Importance
	YES	NO		
Providing marketing opportunities for me throughout the year				
Providing marketing opportunities shortly after harvest, when I need cash flow				
Providing me the option to contract for sale				
Provides high prices, given the realities of the market				
"Fair" marketer fees				
Provides information on marketing costs, cleaning, transportation, etc.				
Arranging for trucking from your farm				
Providing assurance of payment to you				
Provides prompt payment after delivery				
Provide information on future prices and market potential for my crops				
Advising on market and price prospects				
Providing "target pricing" opportunities				
Provides advice on "when to sell" to achieve highest price				
Provides advice on "what to plant" in new crop year				
Provides advice on "market prospects" based on the quality and quantity that I have grown				
Providing me with agronomic info.				
Other:_____				
Other:_____				

Please describe, in your own words, the marketing problems that the organic industry has. For each problem that you mention, please try to provide a possible solution to the problem.

___ Problem _____
Solution _____
_____

___ Problem _____
Solution _____
_____

___ Problem _____
Solution _____
_____

___ Problem _____
Solution _____

In the spaces provided on the left in question 6.3.1 above, please rank the importance of each problem that you mentioned.

Part 7 Certification questions

7.1) Please indicate how effective your certification body is at each of the following functions. (Please evaluate their effectiveness in these areas without considering whether it is right or wrong that they perform these functions.)
Also please indicate how important each function is to you.

Rate on a scale of 1 to 5, where 1 is not effective or not important, and 5 is very effective or very important.

Function	Rate Effectiveness	Rate Importance
Providing efficient and timely certification		
Providing objective certification		
Providing affordable certification		
Providing access to the markets that I wish to sell to		
Helping myself and buyers to connect with each other		
Providing other marketing information (discussion at meetings, pamphlets, etc.)		
Providing production/agronomic information		
Performing research in agronomy and marketing		
Distributing research knowledge to members		
Participating in the creation of a mandatory national standard		

7.2) Are you satisfied with the services you are getting from your certifying body? Please check one of the following:

Not Satisfied	Moderately Satisfied	Neutral	Moderately Satisfied	Fully Satisfied
_____	_____	_____	_____	_____

Please explain why you selected the answer in 7.2: _____
_____
_____

7.3) Please indicate how strongly you feel that certification bodies should undertake each of the following functions:

1 = Strongly disagree
2 = Somewhat disagree
3 = neutral
4 = Somewhat agree
5 = Strongly agree

Function	Rate Opinion
Helping myself and buyers to connect with each other	
Providing other marketing information (discussion at meetings, pamphlets, etc.)	
Providing production/agronomic information	
Performing research in agronomy and marketing	
Distributing research knowledge to members	
Participating in the creation of a mandatory national standard	

Part 8 Organic Regulation in Canada

We are interested in your opinion on the way that organic foods are regulated in Canada.

What do you think are the main marketing challenges for the organic grain industry?

Please rank the options in terms of their importance, with 1 being the most important:
Developing a national organic standard _____
Educating consumers about organic food _____
Promoting organic food to consumers _____

Please indicate your opinion regarding organic regulation in Canada.

1 = Strongly disagree
2 = Somewhat disagree
3 = neutral
4 = Somewhat agree
5 = Strongly agree

Statement	Rate
Canada currently has a voluntary national organic standard.	
The organic regulatory system in Canada is effective	
Canada should implement a government regulated mandatory national standard	
Canada should implement an industry regulated mandatory national standard.	
Having a mandatory national organic standard in Canada would facilitate market access to the United States.	
Having a mandatory national organic standard in Canada would facilitate market access to Europe.	
Having a mandatory national organic standard in Canada would protect domestic consumers against fraud (i.e. it would decrease the ability to sell non-organic commodities as organic).	
Having a mandatory national organic standard in Canada would increase the profitability of my operation.	
I am aware of initiatives that are being undertaken to regulate Canada's organic industry.	
Canada has a permanent advisory board made up of industry representatives that provide guidance to the government for making revisions to our national organic standard and for other policy decisions.	
Canada needs a permanent advisory board made up of industry representatives that provide guidance to the government for making revisions to our national organic standard and for other policy decisions.	

Part 10 Personal Information

10.1) Age of farm operator Please check one of the following categories

<20	21-30	31-40	41-50	51-60	61-70	>71
_____	_____	_____	_____	_____	_____	_____

10.2) Highest education achieved by farm operator. Please check one of the following:

High School	Technical College Or Equivalent	University Bachelors	University Graduate Studies	Other (Please Specify)
_____	_____	_____	_____	_____

10.3) Net Farm Income

Please select a category that represents your net income from farming operations. (i.e. gross farm income less all costs related to the farm operation) for a typical year.

$-10,000 to $0 _____
$0 to $10,000 _____
$10,001 to 20,000 _____
$20,001 to $30,000 _____
$30,001 to $50,000 _____
$50,001 to $75,000 _____
$75,001 to $100,000 _____
>$100,000 _____

10.4) a)Would you like to become a member of a farmer-owned or farmer-controlled marketer? (If you aren't a member of one already)

Yes _____ No _____

10.5) If you were to give yourself an hourly wage (i.e. value your time per hour), what would that value be, in dollars per hour? _____

10.6) Do you use the internet to market your organic grains? Yes_____ No_____

10.7) If you answered "yes' to 10.6, would you have the internet if you weren't using it for organic marketing? Yes_____ No_____

10.8) What percentage of your computer usage is devoted to selling organic grain? ___

10.9) What percentage of your fax machine usage is devoted to selling organic grain? __

Appendix B: Organic Wheat Production Costs

1999 Organic Dryland Wheat Costs and Returns

		Total $	$/Acre	$/Bushel
A Yield per acre	35.25bu/ac			
Expected market price per bushel	$7.12			
Crop Sales		17074.00	250.83	
Crop Insurance receipts		146.35	2.15	
Miscellaneous receipts		771.23	11.33	
Gross Returns		**17991.58**	**264.31**	**7.50**
B 1) Seed and seed cleaning		832.96	12.24	
2) Fertilizer 14P		333.39	4.90	
3) Chemicals		0.00	0.00	
4) Hail/Crop insurance		90.94	1.34	
5) Trucking and Marketing		86.43	1.27	
6) Fuel		720.00	10.58	
7) Irrigation fuel and electricity		0.00	0.00	
8) Repairs – machine		819.09	12.03	
9) Repairs – buildings		586.80	8.62	
10) Utilities and misc. expenses		583.63	8.57	
11) Custom work and specialized labour		43.86	0.64	
12) Operating interest paid		31.59	0.46	
13) Paid labour and benefits (19 hours)		182.55	2.68	
14) Unpaid labour (112 hours)		1117.27	16.41	
Total Variable Costs		**5428.71**	**79.75**	**2.26**
C 1) Cash/share rent and land lease		91.08	1.34	
2)Taxes, water rates, licenses and insurance		324.29	4.76	
3) Equipment and building (a) depreciation		1829.86	26.88	
(b) lease payments		0.00	0.00	
4) Paid capital interest		474.55	6.97	
Total Capital Costs		**2719.78**	**39.96**	**1.13**
D Cash costs (B+C-B14-C3)		5201.36	76.41	2.17
E Total Production Costs (B+C)		8148.49	119.71	3.40
F Gross Margin (A-D)		12790.22	187.90	5.33
Return to Unpaid Labour (A-E +B14)		10960.36	161.02	4.57
Return to Investment (A-E+C14)	3.2%	10317.64	151.57	4.30
Return to Equity (A-E)		9843.09	144.60	4.10

Source: Alberta Agriculture, Food and Rural Development (2001)

1999 Organic Dryland Wheat Costs and Returns Continued

	Total $	$/Acre	$/Bushel
Investment			
Land	55.564.29	816.28	
Buildings	7518.41	110.45	
Machinery	16369.65	240.48	
Irrigation equipment	0.00	0.00	
Total	**79452.35**	**1167.22**	

Source: Alberta Agriculture, Food and Rural Development (2001)

Appendix C: Test of Significant Difference in POF Price Within Crop Years

The result that producers selling through the POF firm attained much higher prices than producers selling through a CWB agent grain company is a significant finding, and merits extra investigation to ensure that this result is robust. This section tests for the stability of the POF premium prices over the multiple years of the sample. If the POF prices are significantly higher than the CWB agent grain company prices in each crop year in the sample, this result would lend support to the claim that the POF delivers higher prices to producers because of its inherent POF characteristics of producer control, incentives and information sharing as detailed in the theoretical framework. If, however, the POF firm only provides higher prices in some years or just one of the years from which the sample data is taken, this would suggest that the POF may not have provided higher prices because of these reasons. Instead, the POF's superior performance in the overall sample may have been due to circumstances that were present in some years and absent in others.

The price regression similar to Equation 5.1, performed for each crop year, would be the best method of testing for significant difference in prices within crop years. This method, however, is not feasible because the regression would not have enough degrees of freedom. A simpler method of testing is thus needed. A measurement of the significance of POF prices is performed by using a two-sample test (Kmenta 1997). The test is performed given two populations with means m_1 and m_2, estimated variances e_1

and e_2, and total elements n_1 and n_2. The test statistic follows a t distribution with $(n_1 + n_2 - 2)$ degrees of freedom, where

$$Z = \frac{m_1 + m_2}{s\sqrt{1/n_1 + 1/n_2}}$$

and

$$s = \sqrt{\frac{(n_1 - 1)e_1 + (n_2 - 1)e_2}{n_1 + n_2 - 2}}$$

Significance of the test statistic in each year of the sample would offer support to the claim that the characteristics of the POF allow it to attain higher prices for the producer.

There are several ways to measure price. First, the organic prices of the POF and CWB agent governance structures are tested or significant difference in each year. This tests whether or not the POF is fetching prices that are significantly higher than the alternative CWB agent grain company route. However, this measurement does not account for the fact that the POF may simply be selling at times of the year when the price is highest. A second test is performed that compares the corresponding conventional wheat prices that existed at the time of sales for the POF firm versus CWB agent grain company sales. This test allows for the measurement of the POF selling when the "general" price of wheat is significantly higher or lower.

In order to account for the "time of year" effect that is present when comparing organic prices within a crop year, the comparison is performed again by finding the "organic premium" (organic price minus conventional price) for each observation and testing for significant difference between prices of the POF and the CWB agent grain company governance structures. While the first and second approaches provide insight

into the prices of the POF, the third approach of using the organic premium is the most appropriate method of measuring the price differences of the POF within individual crop years. This method is most appropriate because it measures the ability of the POF to find higher organic premiums on a given day.

The results the tests are given in Table A.3.1. While observations were plentiful for the CWB agent governance structures in each year of the analysis, the POF observations were limited. There were four POF observations in the 2000-01 crop year, six observations in the 2001-02 crop year and 1 POF observation in the 2002-03 crop year. The test was thus possible only for the 2000-01 and 2001-02 crop years.

Table A.3.1 – Test of Significant Difference in Price in 2000-01 and 2001-02 Crop Years

Measure	Year	Governance Structure	Mean	Var.	N	t-Statistic
Organic Price	2000-01					
		POF	309.35	3100.55	4	1.07
		CWB Agent	270.19	3912.16	9	
	2001-02					
		POF	371.94	6419.99	6	3.89***
		CWB Agent	281.86	1530.03	21	
Conv. Price	2000-01					
		POF	207.19	11.49	4	-0.90
		CWB Agent	212.39	122.37	9	
	2001-02					
		POF	205.36	38.23	6	-0.76
		CWB Agent	208.81	110.11	21	
Price Premium	2000-01					
		POF	102.16	3001.14	4	1.36
		CWB Agent	57.80	2947.87	9	
	2001-02					
		POF	166.58	5959.39	6	4.27***
		CWB Agent	73.05	1309.85	21	

*** = p<0.01, ***= p<0.05, *= p<0.10
Source: Author's calculations

In the test of significant difference between POF and CWB agent organic prices, in the 2000-01 crop year, the POF prices were higher but not statistically significant. However, in the 2001-02 crop year the test finds that the POF prices were higher and significant at the 1% level. This result illustrates that the POF did not provide significantly higher prices in all years of the sample, even though POF prices were about $40/tonne higher than CWB agent prices in 2000-01. The variance of the price samples was too great to allow for statistical significance in the 2000-01 crop year.

In the test of significant difference between POF and CWB agent corresponding conventional prices, in the 2000-01 crop year, the conventional prices for POF transactions were $5/tonne lower compared to when CWB agents sold organic wheat, but were but not statistically significant. A similar result was found in the 2001-02 crop year, where the conventional price difference was only $3/tonne. This result suggests that the POF sells at times when the price of conventional wheat is lower compared to the sales timing of CWB agents. Given the assumption that the organic wheat price follows the conventional wheat price to some degree, this result suggests that the POF is not necessarily selling at time of high prices within each crop year.

In the test of significance between POF and CWB agent organic premiums, in the 2000-01 crop year, the POF prices were higher but only significant at the 20% level. However, in the 2001-02 crop year, the test finds that the POF prices were higher and significant at the 1% level. The prices provided by the POF were thus weakly significant in one year and strongly significant in another year. This result illustrates that the POF did not provide higher prices to the same degree of significance in all years of the sample, even though POF prices were about $45/tonne higher than CWB agent

prices in 2000-01. Similar to the first test using organic prices alone, the variance of the price samples is too great to allow for strong statistical significance in the 2000-01 crop year. This result lends weak support to the idea that the POF provides producers with higher prices due to its inherent characteristics as a POF.

To conclude, the objective of this analysis is to test whether or not the POF's statistically significant prices from the original price regression hold within crop years. A simple two-sample test was employed in order to test this hypothesis. The results indicated that the 2001-02 crop year allowed the POF to provide significantly higher prices to its producer members compared to CWB agent transactions, while the prices provided by the POF in the 2000-01 crop year were higher but not highly significant. The higher prices of the POF cannot be attributed to selling at times when the general market prices are higher, as measured by the conventional wheat prices corresponding to the dates when POF and CWB agent sales were made. The POF did not provide significantly higher prices than the CWB agent governance structure, but the performance of the POF was more consistent when measuring its ability to capture higher organic price premiums over conventional prices on a given day, as measured in the organic premium test.