Producers' Decision Making Process in Grain Marketing:

A Study in the Canadian Market

by

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Abstract

The purpose of this thesis is to investigate how Western Canadian wheat producers' make their marketing decisions. In Canada, wheat, durum wheat, and barley produced for human consumption and export are marketed through the Canadian Wheat Board (CWB), which offers several marketing contracts providing distinct combinations of risk, return, and cash flow. Pool pricing is the default alternative in which the CWB markets grain for producers, while Producer Payment Options (PPOs) represent instruments producers can use to price their wheat outside the pool. Results suggest that generally producers are not able to identify profit opportunities with PPOs, but active marketing strategies tend to generate better performance compared to passive strategies. Further, producers do not seem to repeat the same strategy every year and are influenced by previous performance when choosing their current marketing strategy. Finally, producers seem to follow price signals in choosing marketing contracts, indicating they track market movements and respond to the incentive of locking in higher prices.

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Chapter 1: Introduction

1.1 Problem Statement

Grain marketing studies have traditionally relied on standard economic theory in which producers make decisions that are logical and out of self-interest. However, empirical observations have shown that generally, individuals are not so rational and consistent in their decisions. For example, people tend to undervalue the future compared to the past by placing more (less) weight on short-term (long-term) outcomes, hesitate to change long-held opinions, remember successes and forget failures, and place more weight on readily available information (De Bondt and Thaler, 1995; Hirshleifer, 2001; Barberis and Thaler, 2003). These behaviours can prevent people from making decisions that lead to the highest possible payoff.

Insights from psychology suggest that economics should consider the motivations that are ignored by standard theory (such as status, fairness, greed, fear) and allow for the possibility of mistakes. Behavioural economics was developed as an alternative theory that assumes bounded rationality, as opposed to the standard notion of rationality. Bounded rationality implies that people have limited time and capacity to weigh all the costs and benefits of their choices, decisions are not fully rational, and people tend to make predictable and avoidable mistakes. Behavioural economics assumes that individuals are subject to biases and heuristics when making decisions, such as using rules of thumb, educated guesses, or even common sense, when complex variables or incomplete information are involved (Shefrin, 2002).

Studies focusing on agriculture suggest that producers' behaviour does not necessarily follow the standard rationality assumption. Studies have found evidence that producers exhibit loss aversion (impacts of losses are greater than gains), probability weighting (probabilities are not treated linearly), and tend to sometimes overestimate prices and underestimate risk (Eales et al., 1990; Collins et al., 1991; Humphrey and Verschoor, 2004; Cruz Junior, 2009; Lui, 2008; Riley and Anderson, 2009). Further, Dorfman et al. (2005) and Dorfman and Karali (2010) find evidence that habit effect in previous hedge ratios are an important factor in current marketing decisions.

Agricultural economists have long been interested in how producers make marketing decisions under conditions of uncertainty. However, understanding those decisions is challenging for economists, because obtaining data that corresponds to each producers choices and their marketing strategy is very difficult. More generally, Hagedorn et al. (2005) claim that, despite the importance of marketing for farm management, it is alarming to realize that prevalent ideas about marketing decisions and performance still do not rely on a large body of evidence.

The grain marketing system in Canada offers a unique opportunity to explore how producers make decisions. All wheat produced in Western Canada and sold for human consumption and export must be marketed through the Canadian Wheat Board (CWB), which is the largest grain marketing agency in Canada and accounts for approximately 90 percent of all wheat produced in the country. Since producers have to execute all wheat sales through a single agency, the CWB has records showing exactly how all producers chose to market their wheat and the prices they received at the end of each crop year. The presence of single-desk selling in Western Canada means producers in Manitoba, Saskatchewan, Alberta, and the Peace River area of British Columbia that produce wheat, durum wheat, and barley, must market their grain through the CWB, which offers several pricing alternatives to producers. These alternatives allow producers to choose an option that meets their own needs and preferences regarding risk, return, and cash flow. The oldest alternative is price pooling, which is the default program, meaning the CWB assumes producers will use this program unless otherwise indicated. Other pricing alternatives allow producers to price their own grain through futures markets, instead of receiving the pool price.

1.2 Objective

The objective of this research is to explore how Western Canadian wheat producers make marketing decisions. A key question addressed is whether producers have better information or analytical skills to outperform the markets or if they are overconfident in their ability to market their wheat. Other questions addressed are whether producers use the same marketing strategy every year, whether pricing performance in the previous year affects their current year's strategy, and finally how current price signals affect marketing decisions. Data for this research was provided by the CWB and is comprised of marketing instruments chosen by each producer and their final prices received at the end of the crop year from 2003/04 to 2008/09 for each pricing alternative.

Past research has investigated producers' decisions using expected utility theory. However, empirical studies have shown that producers' behaviour is not always consistent with expected utility (Eales et al., 1990; Collins et al., 1991; Cruz Junior, 2009; Riley and Anderson, 2009). Therefore, this research explores dimensions from prospect theory developed by Kahnaman and Tversky (1979) and Tversky and Kahnaman (1992). Prospect theory allows decisions to be affected differently by gains and losses, which can influence the amount of risk producers' are willing to endure to achieve their desired price. Developments from prospect theory suggest that, in a dynamic context, decisions can be affected by prior outcomes. In agricultural marketing, this notion implies that prior gains or losses can influence producers' risk-taking behaviour. Furthermore, the notion of overconfidence is possibly one of the most common reoccurring errors in the decision-making process. Overconfidence occurs when individuals believe they have superior abilities or skills to outperform their peers, even though their performance shows otherwise. In addition, Weber and Camerer (1998) suggest individuals make decisions based on reference points, with outcomes above the reference point being valued as gains and outcomes below valued as losses.

Overall, producers and the CWB can benefit from this research as its results may help improve the design and communication of marketing alternatives developed by the CWB for producers. As well, results may also be relevant for government agencies, extension programs and marketing advisory services, which might be able to gather more insight about producers' decision-making process.

1.3 Thesis Outline

The thesis is structured as follows. Chapter 2 discusses the theory and presents the foundation for decision analysis in agriculture. Expected utility is investigated to understand its limitations and how prospect theory has emerged as one of the main alternatives used to better understand the decision-making process of individuals when dealing with risk and uncertainty.[1] Chapter 3 reviews the empirical literature on how producers make decisions. It looks at how expected utility and prospect theory are

[1] Other theories have also been developed to address the violations of expected utility.

utilized and which one seems to be more consistent with producer behaviour. The chapter also reviews literature regarding overconfidence in producers' decision-making process and factors that affect their marketing decisions. Chapter 4 gives an overview of the structure of how wheat is marketed in Western Canada through the CWB. This chapter also explores the pricing alternatives offered by the CWB to producers in order to price their grain. Chapter 5 presents the data and research method used in the analysis of producers' decision-making process. Chapter 6 presents the results of the models estimated and explains their implications on producers' decision-making. Finally, chapter 7 discusses the conclusions established from the estimation of the models presented in chapter 5. This chapter also identifies some of the limitations of the research, as well as areas for future research.

Chapter 2: Theory

2.1 Introduction

This chapter presents the theory used to model decision-making under risk and uncertainty. Section two identifies some of the sources of risk involved with making financial and marketing decisions in agriculture. Section three examines expected utility, which is the standard framework in exploring decision-making in economics. The fourth section discusses limitations of expected utility and how it fails to explain many types of behaviours under risk. Section five describes the alternative to expected utility called prospect theory. The final section looks at some of the behaviours observed in empirical studies that cannot be explained by expected utility, but fit under prospect theory.

2.2 Risk in Agriculture

In agriculture, many decisions involve some degree of uncertainty and risk. Hardaker et al. (2004) define uncertainty as imperfect knowledge and risk as uncertain consequences, but mostly unfavourable consequences. Risk is inevitable for producers and every decision they make has its own degree of consequences (Hardaker et al., 2004).

Due to the nature of agriculture, several types of risks are present (Hardaker et al., 2004). One type is production risk, which refers to unpredictable weather and performance of crops and/or livestock due to pests and diseases. Another type is price or market risk, since prices of farm inputs and outputs are unknown at the time when producers make their decisions regarding the type of grain and acres to seed. Producers take huge risks during seeding because they are unaware of the final price at harvest. The third risk is institutional risk, which generally relates to governments changing rules and policies that affect production and profitability. Another risk is personal or human risk, meaning decisions are influenced by the people who are farming, the way they operate the farm, and how their choices can affect whether the farm business is profitable. Finally, the last risk is business risk, which is a combination of all the risks together. In other words, the choices individuals make involving decisions takes into considerations all the risks previously mentioned, which can influence the profitability of the farm business by impacting the net cash flow or net farm income.

Understanding risk in agriculture is extremely important, especially because most individuals dislike risk (Hardaker et al., 2004). This thesis focuses exclusively on the risk involved with marketing, and hence no other type of risk listed above will be discussed further. Empirical observations have found individuals are often risk averse and willing to forgo some amount of expected return in order to reduce their risk (Hardaker et al., 2004; Wilkinson, 2008). Consequently, many producers will buy insurance in order to transfer risk to someone else. This concept of risk aversion is very important to the method of decision analysis. Some of the marketing instruments that producers use to manage price risk include futures, options, and forward contracts. Futures contracts allow producers to lock in a price for their commodity, for a future date, using a standardized contract, which corresponds to maturity months related to spot markets. Option contracts allow producers to set floor or ceiling prices by buying or selling puts or calls. These types of contracts are similar to insurance because they give the individual the right, but not the obligation to buy or sell a certain product at a certain time. Forward contracts allow producers to remove price uncertainty for their grain, because it allows them to sign a contract at a predetermined price before delivering the grain. The risk management principles involved in these contracts are used in the development of several other instruments, such as pricing programs offered to Canadian producers. Details of these programs will be discussed later.

2.3 Expected Utility Theory

Understanding decision-making has been very important for economists. Expected utility theory (EUT) is the standard theory of individuals' choices and building block for numerous economic theories (Starmer, 2000). EUT was initially proposed by Daniel Bernoulli (1738) and was later revisited by von Neumann and Morgenstern (1944) to include four axioms on preferences. Furthermore, EUT is a normative model, showing how individuals should behave and would ideally be a descriptive model as well, showing how individuals actually behave (Starmer, 2000; Wilkinson, 2008). However, EUT fails as a descriptive model in many situations because individuals' choices are not always rational.

In general, EUT suggests that choices are made between future outcomes x, representing different incomes or wealth levels, and their corresponding probabilities p. The choices individuals make involve pairs (x, p) and are referred to as prospects or gambles. The extent of individual's goals being achieved is a measure of utility, which essentially reflects the individual's degree of satisfaction. Therefore, decision-making under risk involves choosing between different prospects that will maximize expected utility.

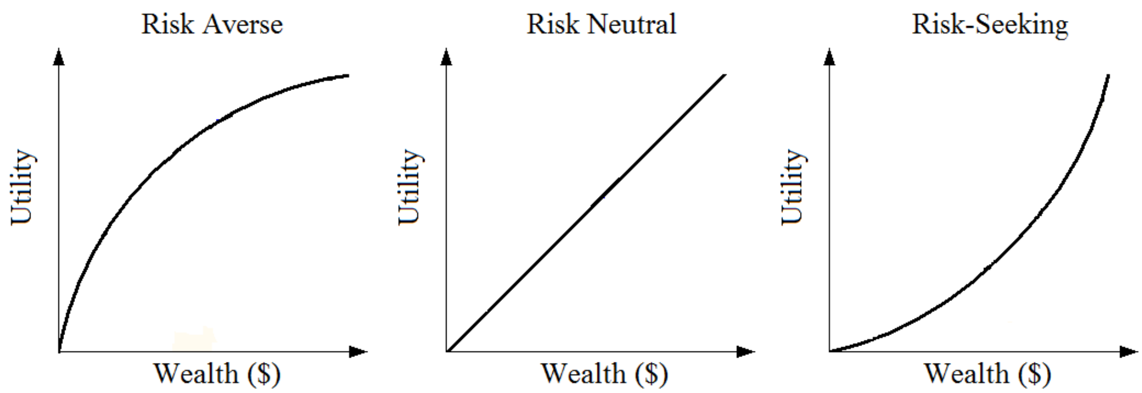
Expected utility is calculated by multiplying the probability of each outcome by its utility and summing them across the number of outcomes as shown in equation (1) (Baron, 2008; Quiggin, 1993).

$$EU(x_i) = \sum_i p_i \cdot u(x_i) \tag{1}$$

Where EU is expected utility, i represents each different outcome, p_i is the probability of the ith outcome, and $u(x_i)$ is the utility of the ith outcome. Therefore, EUT combines two components–utility and probability–that enable risky choices to be rationalized (Hardaker et al., 2004).

Choices are partially explained by how decision makers react to different levels of risk, which is commonly known as risk preferences or risk attitudes. Individual risk attitudes are explained using utility functions $u(\cdot)$, which show the levels of risk individuals are willing to accept for a gamble and its corresponding expected value. EUT framework allows individuals' to be classified as one of three types of risk attitudes: risk averse (aversion), risk neutral, and risk-seeking (Hardaker et al., 2004). Risk aversion is the central behavioural concept in EUT (Quiggin, 1993). Individuals that are risk averse prefer certain increases in wealth to risky prospects, meaning they are reluctant to accept risk with uncertain payoffs over one with a more certain but lower payoff. Risk neutral individuals are characterized as being indifferent to different levels of risk. Their decisions are not affected by certain or uncertain levels of wealth/payoffs, but rather by the magnitude of the payoffs. Risk-seeking individuals, however, prefer risk over no risk if the expected payoff has a higher return of wealth over the non-risky payoff. Or, if two prospects have the same expected value, a risk-seeking individual will choose the one with more risk. Figure 1 illustrates the shapes of the utility functions for these risk attitudes.

Figure 1. Risk Attitudes and Shapes of the Utility Functions



2.3.1 Axioms

This section presents the four axioms that von Neumann and Morgenstern (1944) used to derive EUT, indicating how rational decision makers should behave to maximize their expected utility. The first axiom, completeness, entails that individual's have preferences over certain gambles. They prefer one of two prospects, a to b (a > b), b to a (b > a), or both. The second axiom, transitivity, states individuals rank gambles in a consistent way. For example, take three prospects, a, b, and c where the individuals' choices must be placed in order of preference. If an individual prefers a to b (a > b) and b to c (b > c), then a is assumed to be preferred to c (a > c). Often these two axioms are combined together and called the ordering axiom (Wilkinson, 2008). The third axiom, continuity, indicates that a real value be attached to every prospect and that some combination of the best and worst gamble is preferred to the intermediate gamble. More specifically, prospects a, b, and c where the individual prefers a to b to c (a > b > c), there exists a probability p, such that the individual is indifferent between prospects b and (a, p; c, 1-p).[2] Finally, the fourth axiom, independence, places strong restrictions on the

[2] The notation (a, p; c, 1-p) implies prospect a has the probability p and prospect c has probability (1-p).

preferences used to derive EUT (Starmer, 2000). This is also the axiom that is relaxed by many of the alternatives to EUT. The independence axiom requires that for all prospects a, b, and c, if $a \geq b$ then $(a, p; c, 1-p) \geq (b, p; c, 1-p)$ for all p since the common component $(c, 1-p)$ can be ignored. This is also called the substitution axiom (Kahneman and Tversky, 1979). Von Neumann and Morgenstern (1944) established that these four axioms are both necessary and sufficient in representing individuals' decisions.

2.4 Anomalies in Expected Utility Theory

Decisions under risk are only partially explained using EUT since the theory does not consider fear, anxiety, and beliefs held by individuals because they are considered "irrational" factors that impact decisions (Buschena and Zilberman, 1994). Von Neumann and Morgenstern (1944) suggest that EUT is a normative model, implying it shows how individuals should behave but not necessarily how they actually behave. When descriptive behaviours such as rules of thumb and educated guesses are adopted EUT axioms are violated and deviations from expected utility emerge (Wilkinson, 2008; Baron, 2008). Some of the most common and famous violations of EUT axioms are discussed in this section.

2.4.1 Allais Paradox

Perhaps the most recognized of the axiom violations is the "Allais paradox" which dates back to 1953 and violates the independence axiom (Fox and Poldrack, 2009; Wilkinson, 2008). Kahneman and Tversky (1979) illustrate this violation in a study where subjects were given the following two decisions:

Decision 1: Choose between (a) 80 percent probability of receiving $4,000 or (b) 100 percent probability of receiving $3,000.

Decision 2: Choose between (c) 20 percent probability of receiving $4,000 or (d) 25 percent probability of receiving $3,000.

Kahneman and Tverksy (1979) found most individuals choose (b) over (a) and (c) over (d). In an expected utility framework these choices can be rewritten in terms of utility. Choosing (b) over (a) implies the utility of gaining $3,000 for sure is greater than the utility of gaining $4,000 with 80 percent probability, $U(\$3{,}000) > 0.8U(\$4{,}000)$. Similarly, choosing (c) over (d) implies $0.2U(\$4{,}000) > 0.25U(\$3{,}000)$ or $0.8U(\$4{,}000) > U(\$3{,}000)$ if both sides are multiplied by four. Choice (c) is a quarter of (a) and (d) is also a quarter of (b). Therefore, if (c) is to be preferred to (d), then (a) must be preferred to (b) under EUT. Results in Kahneman and Tversky (1979) were not consistent with choices in an expected utility framework, violating the independence axiom because under EUT (a) must be preferred to (b) for all probabilities, which is not the case. Therefore, individuals' choices are not independent since there is a common component affecting the decisions. This violation is also known as the "common ratio effect."

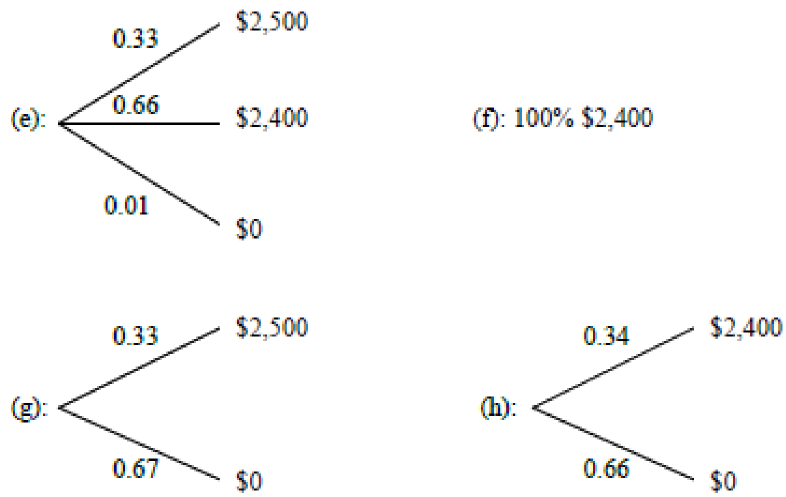
2.4.2 Common Consequence Effect

Another violation of the independence axiom occurs when individuals are given the following two decisions (Kahneman and Tversky, 1979):

Decision 3: Choose between (e) 33 percent probability of receiving $2,500, 66 percent probability of receiving $2,400, 1 percent probability of receiving nothing, or (f) 100 percent probability of receiving $2,400.

Decision 4: Choose between (g) 33 percent probability of receiving \$2,500 or (h) 34 percent probability of receiving \$2,400.

This problem can also be illustrated as follows:



For these two sets of decisions, Kahneman and Tversky (1979) found that individuals choose (f) over (e) and (g) over (h). In an expected utility framework these choices can be rewritten as follows. Choosing (f) over (e) implies $U(\$2{,}400) > 0.33U(\$2{,}500) + 0.66U(\$2{,}400)$, which can be rewritten as $0.34U(\$2{,}400) > 0.33U(\$2{,}500)$. Choosing (g) over (h) implies $0.34U(\$2{,}400) < 0.33U(\$2{,}500)$. This violates the independence axiom again because (h) should be preferred to (g) if the individual prefers (f) to (e). Preferences should not be affected by a mixture of prospects as happens from decision 3 to decision 4. This violation of the independence axiom is called the “common consequence effect.”

2.4.3 Reflection Effect

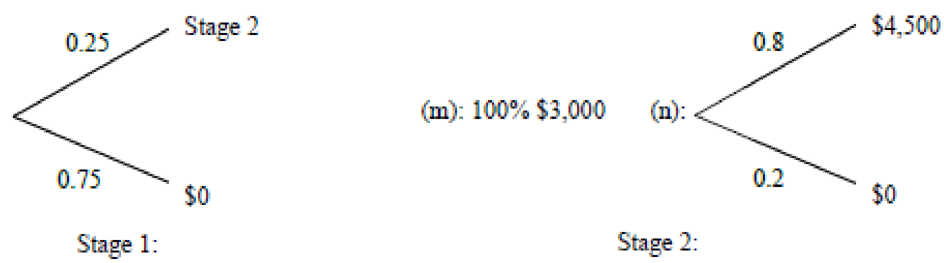
EUT assumes individuals are either risk averse, risk neutral, or risk-seeking over all levels of wealth. However, empirical evidence indicates that decisions are made in terms of changes in wealth rather than total wealth, and different combinations of risk attitudes emerge depending on whether gains or losses in wealth are experienced. This is referred to as the "reflection effect." This violation suggests that behaviours change as individuals switch from gains to losses, which can be observed in the following two decisions:

> Decision 5: Choose between (i) 80 percent probability of receiving $4,000, 20 percent probability of receiving nothing, or (j) 100 percent probability of receiving $3,000.
>
> Decision 6: Choose between (k) 20 percent probability of receiving $4,000, 80 percent probability of receiving nothing, or (l) 25 percent probability of receiving $3,000, 75 percent of receiving nothing.

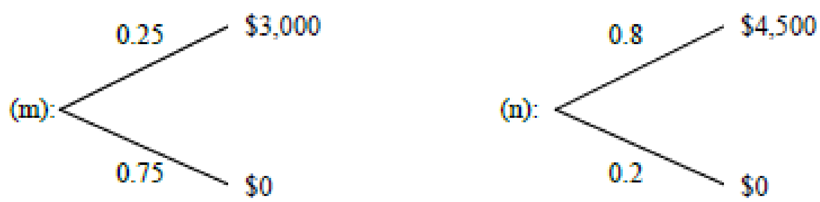
Observations have shown that individuals more often choose (j) over (i) and (k) over (l) (Wilkinson, 2008). However, when the two decision problems are stated as losses rather than gains, choices are the exact opposite with (i) preferred to (j) and (l) preferred to (k). When individuals experience gains in decision 5 and choose (j) over (i), they exhibit a risk averse behaviour. When negative values are used with the same probabilities, their preference switched to a risk-seeking behaviour, choosing (i) over (j).

2.4.4 Subcertainty Effect

If a problem is set up as a multi-stage problem, individuals have a tendency to overweigh outcomes that are considered certain compared to outcomes that are only probable. For example, in a two stage game, the decision in stage 1 involves a 75 percent probability of receiving nothing, versus a 25 percent probability of moving on to stage 2. Therefore, if in stage 1 the individual wins the right to move to stage 2, then he/she has to choose either (m) 100 percent probability of receiving $3,000 or (n) 80 percent probability of receiving $4,500, and 20 percent probability of receiving nothing. The decision problem is illustrated as the following two stage problem.



Individuals often tend to ignore the first stage that got them to stage 2 and consider the decision as a one-stage problem. The decision problem is then referred to as the following two decisions as shown below.



Individuals take the 100 percent probability of receiving $3,000 in choice (m) from stage 2 and substitute it in for the 25 percent chance of moving on to stage 2 from stage 1. This implies people place additional weight on decisions involving certainty. This is called the “subcertainty effect” (Wilkinson, 2008). The next section looks at prospect theory as an alternative to EUT. Prospect theory is used to understand the marketing choices of individual producers.

2.5 Prospect Theory

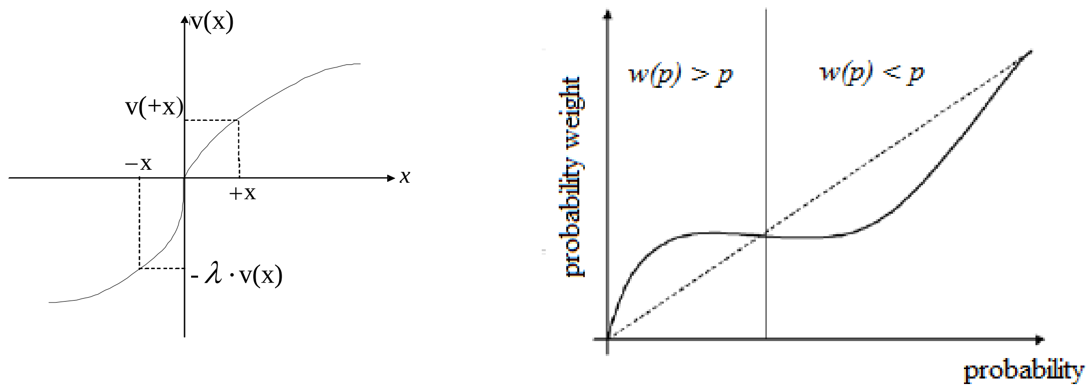
Prospect theory was developed by Kahneman and Tversky (1979) and Tversky and Kahneman (1992) as an alternative to explain behaviours that deviate from EUT such as the violations discussed previously. The decision model for prospect theory is based on the function $V(x_i)$, which has two components: the value function $v(x_i)$ and the probability weighting function $w(p_i)$, where x_i is the argument of the value function and p_i is the probability distribution of x. The function V assigns to each outcome x_i a number $v(x_i)$, which represents the value of the outcome. Each probability p_i is accompanied by a probability weight $w(p_i)$ which changes the overall value of the prospect. This can be expressed mathematically in equation (2).

$$V(x_i) = \sum_{i=1}^{n} v(x_i) \cdot w(p_i) \qquad (2)$$

The value function $v(\cdot)$ in prospect theory relies on the notion that individuals respond to changes in wealth rather than total wealth. These changes are measured with respect to a reference point, which is subjectively determined by each individual. Changes in wealth above the reference point are treated as gains and below as losses. Prospect theory claims that individuals behave asymmetrically, exhibiting risk aversion in the gain domain and risk-seeking in the loss domain. Therefore, the value function is concave over gains and convex over losses (Figure 2). Further, the value function incorporates the notion of loss aversion, which suggests that people exhibit a stronger impulse to avoid losses than to acquire gains. In Figure 2, loss aversion is represented by the parameter λ, which amplifies the impact of losses relative to gains of the same magnitude (Tversky and Kahneman, 1992).

Figure 2. Value and Probability Weighting Functions

Value Function Probability Weighting Function



The second component to prospect theory is the probability weighting function and implies that probabilities are not treated linearly. Kahneman and Tversky (1979) found that people tend not to treat probabilities as they are stated. Instead, their decisions are often based on the individuals' perceived probability, which can be either larger or smaller than in reality. The value of an outcome is not weighted by its objective probability but rather by a probability weight $w(\cdot)$. Empirical evidence reveals that individuals are not accurate at estimating the probabilities of events occurring. In fact, many studies have indicated that people have a tendency to overweigh small probabilities and underweight moderate to large probabilities when making decisions (Kahneman and Tversky, 1979). This reveals an inverse s-shaped curve as shown in Figure 2.[3] Research suggests that over/underweighting of probabilities can be related to preferences for certain gambles, overconfidence, and optimism/pessimism.

Probability weights can be expressed as a function of stated probabilities, as in the functional form proposed by Tversky and Kahneman (1992) in equation (3).

[3] Other patterns of probability weighting also emerge in empirical studies.

$$w(p) = \frac{p^{\gamma}}{[p^{\gamma} + (1-p)^{\gamma}]^{1/\gamma}} \qquad (3)$$

The parameter γ represents the curvature of the weighting function. If equal to one there is no probability weighting, meaning $w(p) = p$ as represented by the dotted line in Figure 2. In this case individuals are able to distinguish probabilities and use this information objectively. When γ is less than one the weighting function shows the inverse s-shaped curve in Figure 2 (overweighting small probabilities and underweighting large probabilities), while γ greater than one denotes a s-shaped curve (underweighting small probabilities and overweighting large probabilities). Overweighting probabilities leads to more willingness to take risk since individuals believe that probabilities of certain outcomes are larger than they really are. Underweighting probabilities lead to less willingness to take risk since individuals believe that probabilities of certain outcomes are smaller than they really are. Therefore, risk preferences indicated by the value function are not the only drivers of behaviour under prospect theory. The presence of probability weighting can also affect behaviour, as it can enhance risk attitudes. For example, an individual who is risk averse over gains (concave for gains) can behave as a risk-seeking individual if he/she overweighs all probabilities. This contrasts EUT, which assumes probability weighting does not exist and hence choices are based solely on risk preferences given by the utility function.

2.6 Applications of Prospect Theory

Prospect theory can be used to explain some of the types of risk-taking behaviours discussed in empirical studies, such as loss aversion and framing, status quo bias, overconfidence, and sequential decisions.

2.6.1 Loss Aversion and Framing Effect

One of the most common behaviours identified in empirical studies is loss aversion and framing. Research by Tversky and Kahneman (1992) found that losses have an impact of roughly twice that of a gain of the same magnitude.[4] Shefrin (2002) found evidence strongly suggesting that if individuals were given an option of taking a sure loss or a gamble with a 50 percent chance of a loss, most individuals' would opt for the gamble because they hate the idea of a sure loss. Equivalently, loss aversion can also be incorporated into the individual's notion that if they have an investment that is doing poorly, they will not sell it at a loss. Instead they would rather hold on to the investment and hope for it to rebound and make money or breakeven, although this can lead to the possibility of even more losses (Shefrin and Statman, 1985; Odean, 1998; Locke and Mann, 2005). This behaviour is called the disposition effect. Shefrin and Statman (1985), Odean (1998), and Locke and Mann (2005) define the disposition effect as the tendency by investors to sell winning positions too early and hold losing positions too long.

In this context, if the same choice is framed as a loss rather than as a gain an individual will make a different decision. Tversky and Kahneman (1981) found evidence that people would make different choices depending on how a problem was framed even though the outcomes remained the same. Moreover, standard theory–based on rational and consistent choices–suggests framing of a question should not matter, and the same decision should be chosen because they represent the same choice. Further, results from this experiment suggest individuals make risk averse choices when questions are framed

[4] The actual value found by Tversky and Kahneman (1992) was 2.25.

as gains and risk-seeking choices when framed as losses, which is consistent with the notion of loss aversion. These results also emerge in several other studies.

2.6.2 Status Quo Bias

Another behaviour that is often referred to as an implication of loss aversion is the status quo bias. When people are faced with more than one option, they tend to choose the one that ratifies or extends the existing condition, because the disadvantage of leaving the status quo looms larger than the advantages (Thaler, 1992; Samuelson and Zeckhauser, 1988). Generally, this is caused because people are predisposed to avoiding change. Additionally, if more than one option is included, people's choices may be delayed or the number of people that adopt default alternatives (status quo) may increase.

The status quo can also be referred to as the reference point (Samuelson and Zeckhauser, 1988). The reference point suggests individuals' decisions are based accordingly to a previously specified point that could be any value (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992; Thaler, 1992). Further, each outcome is measured as a gain or loss from the reference point, as illustrated in Figure 2 by the inflexion point between the gain and loss domains. The reference point can vary from one individual to another and also over time. For example, Odean (1998) explored whether investors hold losing stock positions longer than they do winning positions. The reference point is considered the purchasing price of the stock and separates gains from losses. So an investor will have a winning (losing) position if the current price of his/her stock is above (below) the price that was initially paid.[5] In a marketing context, the status quo bias can prevent producers from changing strategies they have used in previous years.

2.6.3 Overconfidence

The notion of overconfidence is perhaps one of the most common reoccurring errors found in decision-making. Overconfidence occurs when people believe they have superior abilities or skills to outperform their peers, even though their performance shows otherwise. A study regarding financial markets suggests that overconfident investors tend to trade more often than other investors (Glaser and Weber, 2007; Barber and Odean, 2001; Odean, 1999). Glaser and Weber (2007) surveyed approximately 3,000 online investment brokers that answered a questionnaire that was designed to focus on overconfidence. The study looked at 215 of the 3,000 investors trading behaviours and found that investors would trade more if they believed their skills in the past were above average. Therefore in a marketing context, overconfidence can prevent producers from effectively timing the markets and identifying profitable opportunities.

2.6.4 Sequential Decisions

Many decisions are made in a dynamic context. For example, if individuals are faced with the same choices repeatedly over time, do their choices change or remain the same? In this context several studies have investigated whether outcomes from previous decisions affect current choices, but evidence has been mixed. Some research has found evidence that individuals tend to take more risk after prior losses and less risk after prior gains, which is consistent with the notion of loss aversion. Alternatively, other studies

[5] If investors hold stocks for long periods of time, factors other than the purchasing price of the stock may also affect the reference point (Odean, 1998).

have found the opposite behaviour, which is known as house-money effect. In this case, individuals take less risk after prior losses and more risk after prior gains (Thaler and Johnson, 1990; Frino et al., 2008; Coval and Shumway, 2005; Weber and Zuchel, 2005). Thaler and Johnson (1990) suggest that integration of subsequent outcomes is not necessarily sequential or automatic. In this framework, prior gains are perceived as windfall profits and induce more risk-taking. Individuals are comfortable in taking more risks because they feel as if they are "playing with the house money." On the other hand losses smaller than previous gains are integrated into prior gains and perceived simply as deductions in profits. Until the winnings are completely gone, losses are only reductions in gains because losing someone else's money does not hurt as much as losing one's own money. In a marketing context, depending on how prior gains and losses are integrated, this might suggest that pricing performance in previous years can affect or change strategies that producers choose to adopt in the current year.

The dimensions discussed above provide the background for following sections, which present studies on producers' behaviour, their findings, and the methods adopted to address marketing decisions in this research. Prospect theory is the most promising theory to explain deviations from EUT, but it still cannot explain all deviations from EUT (Barberis and Thaler, 2003). So prospect theory is used as a basic theoretical framework, but the empirical analysis will also include other variables such as price signals, marketing activeness, and time of year when marketing contracts are signed.

Chapter 3: Empirical Literature Review

3.1 Introduction

The empirical literature on producers' decision-making process is limited. Therefore, this chapter focuses on empirical observations in both agriculture and financial markets, such as investment traders. Section two looks at behavioural dimensions in financial decisions, while the third section discusses behavioural finance as a possible framework for explaining producers' choices. Section four presents various studies showing evidence of deviations from EUT. Section five reviews producers' price expectations using futures and option contracts, while section six reviews previous research on whether individuals are overconfident in the choices they make and whether habit, price signals, or farm characteristics affect producers marketing strategies when deciding on the tools to price commodities.

3.2 Behavioural Dimensions in Financial Decisions

The types of behaviours presented in chapter 2 have been identified in several studies regarding financial decisions, particularly with investors and professional traders in financial markets. In general, these behaviours have been discussed in studies by De Bondt and Thaler (1995), Hirshleifer (2001), and Barberis and Thaler (2003). Overconfidence has been found in many studies and results suggest that overconfident investors tend to trade more often than rational investors (Glaser and Weber, 2007; Barber and Odean, 2001; Odean, 1999). Glaser and Weber (2007) investigated the presence of overconfidence in a group of 215 online investment brokers. Results suggest that investors that assessed their skills and performances in the past as above average tend to trade more. They also indicate that overconfidence is unrelated to investors trading volumes, but stress caution when interpreting the variable.

Barber and Odean (2001) performed a similar study regarding overconfidence, but instead focused on the effects that gender played on individuals trading and returns. The study used United States (U.S.) online brokers from 1991 to 1997 for over 35,000 household stock investments. Results imply that men are more overconfident and trade more stocks than women. As well, their findings revealed that men experienced lower returns than women suggesting overconfidence is linked to lower returns (mainly due to higher transaction costs caused by a larger number of trades). Odean (1999) investigated overconfidence in financial markets by exploring if the returns of investors cover the transaction costs associated with trading over 84, 252, and 504 days. Results indicated that trading more leads to lower returns.

In addition, Odean (1999) revealed that investors who trade more are prone to selling winning positions sooner than losing positions, which is consistent with the disposition effect discussed in chapter 2. Many studies in financial markets find evidence of the disposition effect, which refers to individuals' behaviours in closing investment positions (i.e. closing winning positions too quickly and keeping losing positions too long). Theory suggests that investors realize losses differently from their realization of gains (e.g., losses should be realized in the short-term and gains in the long-term) (Shefrin and Statman, 1985). Therefore to study the disposition effect, researchers examined the frequency in which investors sell winners and losers. The motivation behind this behaviour is that investors hope market conditions will change and they will be able to break-even or at least cover transaction costs (Shefrin and Statman, 1985; Odean, 1998; Locke and Mann, 2005).

Shefrin and Statman (1985) originally identified this behaviour and discussed the disposition effect by examining whether individual investors realize their gains and losses in a market setting through the use of loss aversion (as discussed in prospect theory), mental accounting, regret aversion, and self-control. Further, Weber and Camerer (1998) identify the cause of the disposition effect as when two attributes of prospect theory combine (reference point and reflection point effect). The reference point is indicated by individuals' gains and losses relative to their reference point, which could be an initial purchase price or level of wealth. The reflection point effect is the difference between gains and losses for risk attitudes, where individuals are risk averse in the gain domain and risk-seeking in the loss domain, this behaviour is called loss aversion.

Several other studies focused on investors and traders in financial markets and the existence of the disposition effect. Odean (1998) studied 10,000 securities accounts from a discount brokerage house traded from 1987 and 1993 to understand how investors perceived risks when buying and selling stocks. Results implied the disposition effect was indeed present in decisions to sell or hold stocks. In fact, Odean (1998) revealed many investors tend to realize their profitable stocks sooner than their unprofitable ones thus alluding to the notion of selling winning stocks and holding on to losers. Locke and Mann (2005) conducted a similar study but focused on 334 futures traders at the Chicago Mercantile Exchange in 1995. Results were similar to Shefrin and Statman (1985) and Odean (1998) that traders ride losers too long and sell winning positions earlier than necessary.

Loss aversion and house-money effect in dynamic decisions have also been largely explored. Overall results are not consistent over studies. Frino et al. (2008) used data on 8,762 trading accounts from the Sydney Futures Exchange in 1999. This study investigated whether the levels of risk traders took in the afternoon were influenced by gains or losses experienced in the morning. Results revealed a stronger behavioural bias towards house-money effect, where morning profits (losses) resulted in more risk-seeking (risk aversion) in the afternoon. The findings suggest traders take more (less) risk after gains (losses). The opposite conclusion was reached in a similar study by Coval and Shumway (2005). This study explored the Chicago Board of Trade proprietary day traders during 1998 and how morning gains and losses affect afternoon risk-taking. They found evidence of loss aversion, suggesting traders take more (less) risk after losses (gains).

The studies above provide some examples of studies which find evidence of deviations from EUT in financial decisions. The following sections discuss more detailed research on agricultural marketing decisions, which is the focus of this thesis.

3.3 Behavioural Finance in Agricultural Marketing

Brorsen and Anderson (2001) discussed implications of behavioural finance for agricultural marketing and indicate psychological biases can affect marketing decisions. The first is anchoring, which implies producers are reluctant to revise long-held opinions when faced with new information.[6] An example of how this can affect producers' marketing decisions is, a producer who only prices his/her grains using pool accounts just because that is what he/she has always done, even though other strategies might yield

[6] Anchoring indicated by Brorsen and Anderson (2001) is similar to the concept of status quo bias.

better results in certain years. The second is loss aversion, which suggests producers experience proportionally more anguish about losing money than from gains of the same magnitude. Producers that are loss averse often view outcomes separately than as a whole, holding on to strategies longer than economically makes sense, because they do not want to accept loss (Brorsen and Anderson, 2001). For example, if prices are low they might wait too long to sell, hoping that the price will increase. But doing so also leaves them exposed to further price drops. They might also take more risk than usual if they experienced losses in the previous year. The third is the misleading notion of small numbers, implying that producers have a tendency to place extra weight on small amounts of information that is available, even though the available data might not be representative of the entire distribution. For example, producers who make marketing decisions based solely on conversations with their neighbours might be missing important pieces of information (e.g. market reports and CWB newsletters). The fourth is overconfidence, which implies producers overestimate the accuracy of their price predictions. If a producer is overconfident, then they think they have better information or analytical skills to price their commodity, which may affect their marketing decision. For example, producers who believe they can outperform the pool will try to price grain by themselves. However, if they are overconfident (rather than actually having better information or skills) this strategy might result in a price worse than the pool. Lastly, hindsight bias implies producers tend to remember their successes and forget their failures. This affects producers' marketing decisions because they continue to make the same errors each time they try to market his/her commodity.

Brorsen and Anderson (2001) provided an overview of types of behaviours that can affect marketing decisions. The next sections present specific studies which approach different dimensions of producers' decision-making.

3.4 Expected Utility Theory versus Prospect Theory

A few studies have used experiments and/or data on marketing decisions to investigate producers' behaviour. In general, these studies show evidence of deviations from EUT. Collins et al. (1991) conducted surveys with 37 Oregon grass seed producers from 1973 to 1975 and found that their risk preferences switched from risk averse to risk-seeking and vice versa as their wealth changed in each period, which is consistent with prospect theory in that risk-taking behaviour is determined by changes in wealth rather than wealth levels. They also found evidence of the importance of producers' reference points in determining gains and losses. Unlike EUT which classifies producers as either risk averse or risk-seeking, producers can exhibit both types of risk attitudes depending on whether gains or losses are experienced.

Serrao and Coelho (2004) focused on nine wheat and cattle producers in Portugal using experimental data to form relative value functions and found that producers preferred more risk in the negative part of the value function (loss domain) and less risk in the positive part of the function (gain domain), which is consistent with the notion of loss aversion. Evidence of loss aversion was also found among Chinese producers. Lui (2008) surveyed 320 cotton producers and her results indicated 90 percent of them exhibited loss aversion.

A study by Xu et al. (2005) looked at personality types and risk attitudes to investigate their effects on production and marketing decisions. Participants included large-scale producers from the Eastern Corn Belt in the U.S. who attended the Top Farmer Crop Workshop at Purdue University in 1991, 1993, and 1994. Producers were younger and on average more educated than the general agricultural population, and were asked to indicate their agreement or disagreement with a series of risk attitude related statements. About 70 percent of producers agreed with the following statements related to their willingness to take risk "I regard myself as the kind of person who is more willing to take a few more risks than others" and "I must be willing to take a number of risks to be successful." On the other hand, the survey found that producers tended to disagree with the following statements "I am generally cautious about accepting new ideas" and "I am reluctant about adopting new ways of doing things until I see them working for the people around me." These two statements are related to the notion of status quo bias, which appears not to affect participants considering their disagreement with these statements. Results also suggest producers are loss averse as they agree with the statement "I am more concerned about large loss in my farm operation than missing a substantial gain." Xu et al. (2005) also found producers express a higher willingness to take risk in production areas and lower willingness to take risks in financial area.

A few recent studies illustrated the relevance of probability weighting when investigating how producers' make their choices. Humphrey and Verschoor (2004) conducted experiments in farming communities in Uganda, Ethiopia, and India. Although communities involved in the study were some of the poorest in their societies, they all have similar employment, education, and lifestyles. They found evidence of probability weighting as producers tended to underestimate smaller probabilities and overestimate larger probabilities. In addition, studies by Serrao and Coelho (2004) and

Lui (2008), which surveyed producers in Portugal and China, found that they tended to overweigh small probabilities and underweight large probabilities, which is also consistent with the presence of probability weighting. Mattos et al. (2008) adopted a simulation approach for exploring the impacts of probability weighting on marketing decisions. They investigated hedging decisions of soybean producers and found that probability weighting causes large deviations from expected utility hedge ratios.

3.5 Price Expectations

Other studies investigated how producers' price expectations effect the decisions they make and more specifically, how price expectations influence their ability to market their production rationally. In general these studies revealed that producers tend to overestimate prices, while underestimating volatility. Eales et al. (1990) examined a sample of 237 corn and soybean producers in Illinois that were asked to forecast prices and volatility. Participants were asked to indicate the probabilities they believed to represent the local cash price, local basis, and futures price (nearby and distant). Then they were given price intervals and asked to provide weights to each one of the intervals, such that the price interval believed to obtain the actual price would exhibit the higher weight. Producers were also asked to predict prices for the following forecast dates: November 1987, January 1988, and March 1988. Results showed that their price forecasts were close to the actual prices, but their volatility forecasts were consistently lower than actual volatility. This finding is in line with other studies which found evidence that producers underestimate risk. Riley and Anderson (2009) studied 36 corn and soybean producers and 41 cotton producers in Mississippi and results suggest that estimation of volatility was also lower than actual volatility. However, forecasted prices were higher than actual prices. Cruz Junior (2009) examined a group of 90 corn producers in Central-west and Southern Brazil. Participants indicated their expected average price from selling their grain in different futures months using the Brazilian Mercantile and Futures Exchange, as well as assigning probabilities to different price ranges for corn during the March and July futures contracts. Results were also consistent with Eales et al. (1990) and Riley and Anderson (2009) indicating that producers tend to underestimate risk.

Another study investigating price expectations was Sulewski et al. (1994), who investigated wheat and canola producers in Saskatchewan. Wheat was priced through the CWB pool, while canola was priced on the open market and Winnipeg Commodity Exchange. Sulewski et al. (1994) compared producers' price expectations with a variety of theoretical expectation models for wheat and canola. These models included naïve expectations, first-order autoregressive expectations, moving averages, Turnovsky's extrapolative expectation (price expectations equal the previous period's price plus a correction allowing for change in price during the last period), Nerlove's adaptive, and Quasi-Rational expectations. The proxy used to compare producers' expectations and the actual price producers received for wheat was the U.S. September futures price. For canola, the cash market price received when producers sold canola to the handling facilities were obtained from the Saskatchewan Wheat Pool for the November futures prices.[7] Data was collected for six years from 1987 to 1992, consisting of 770 wheat and 427 canola producers from the Top Management Workshops held at the University of Saskatchewan. Sulewski et al. (1994) results suggest producers could make better price

[7] The Saskatchewan Wheat Pool was one of the largest grain handling facilities in Canada. However, since 2000, it has merged with numerous other grain handling facilities and it is now called Viterra.

expectations by changing to a futures price formulation, which is better than the other proxy expectations for both wheat and canola.

3.6 Empirical Studies in Agricultural Marketing Decisions

Overconfidence in the decision-making process implies that individuals believe they can consistently outperform their peers. Cunningham et al.'s (2007) research of wheat producer transactions in Oklahoma from 1992 to 2001 revealed that activeness in futures and options markets were not necessarily related to successful marketing strategies.[8] Suggesting producers are overconfident, because they believe they have superior skills to time the market and obtain higher prices even though there is no evidence linking derivative usage and improved performance. In fact, Cunningham et al. (2007) found producers that actively marketed their grain in order to get higher prices were not successful.

Further, Cabrini et al. (2007) investigated whether overconfidence is present in marketing advisory services for corn and soybean crops and if there is a relationship between style characteristics (intensity of futures and options use, degree of activeness, and seasonality of sales) and pricing performance. Data on advisory services was obtained from the Agricultural Market Advisory Service project at the University of Illinois from 1995 to 2004. Results revealed that on average, more active programs exhibit higher prices, suggesting active advisors have superior information and/or analytical skills. However, the authors indicate that results could have been driven by a single advisory service, so this finding should be interpreted with some caution.

[8] The method used to determine overconfidence looked at how an active marketing style affected the price received by producers.

Meulenberg and Pennings (2002) focused on the marketing strategies of Dutch hog producers. They administered personal computer-guided interviews to 418 producers to examine how their hedging decisions were influenced by characteristics such as risk attitudes, risk perception, level of understanding of futures markets, market orientation, and demographic variables (e.g. age and farm size). They found that risk attitudes and demographic variables do not help discriminate between producers who use and those who do not use futures markets, but other factors are important to discriminate between the two groups. In particular, they found evidence that producers' perceived performance and reference price affects their marketing decisions.[9] Meulenberg and Pennings (2002) defined reference prices as a producers benchmark to judge other prices. Therefore, when futures prices surpass the reference price the futures position becomes more attractive to producers. Their findings suggest that as perceived performance of futures positions increase, producers' use of futures markets also increase. They also indicated that producers tend to use futures contracts when the difference between the futures price and producer's reference price is positive, and usage of futures markets increase as this price spread becomes larger. However, they found large variations in producers' reference prices and that a given futures price is not equally attractive to all producers.

Pricing decisions were also investigated by McNew and Musser (2002) who followed grain marketing clubs in Maryland between 1994 and 1998. Their findings suggest that producers tend to hedge less in the spring and more in the summer, adjust their pricing strategies as market conditions change, vary the amount of grain hedged across years (which they interpret as attempts to time the market), and generally respond

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[9] Reference prices were identified through Puto's question format where producers identified prices as being above (below) the point where profits (losses) are perceived.

to price signals when making marketing decisions. Response to price signals comes in the form of less hedging when the current price is above previous year's price, and more hedging when the futures price is higher than the fundamental price.[10] Therefore, producers are not willing to commit to forward contracts early in the season and since producers in the marketing clubs hedge more when prices are low, they suggest producers see falling prices as an indication of lower prices to come. However, when prices are high, producers tend to hedge less because they suspect prices to continue to increase. This implies that producers in the marketing clubs use signals to make hedging decisions.

A recent study by Dorfman and Karali (2010) investigated Georgia producers' hedging strategies from 1999 to 2002 for corn, soybeans, wheat, and cotton and the role habit plays in terms of their hedging decisions. They explored factors that could affect producers' marketing decisions–such as education levels, percent of income from farming, information sources, and commodity mix–and used lagged hedge ratios to incorporate habit in their model. Results revealed producers with more education and more diversified commodity mixes tend to hedge more, while producers whose income comes mainly from farming tend to hedge less than those who earn only a small portion of their income from farming. Furthermore, they found that coefficients on lagged hedge ratios are positive, implying that habit is important in producers' hedging decisions.

Isengildina and Hudson (2001) conducted a survey with cotton producers in the U.S. and found that farm characteristics can also have large impacts on producers' hedging decisions. They found a positive relationship between farm size and cotton producers' decisions to use indirect hedging or direct hedging compared to a base

[10] McNew and Musser (2002) estimated what they call a fundamental price based on a simple regression model with futures prices as a function of stocks-to-use ratio.

scenario of selling in cash markets.[11] They argue that larger farms have more hired labour, which provides farm managers with more time to invest in marketing. Their results also indicated that producers that agree with the statement “A marketing pool nets me a higher price than I can get myself” tended to choose indirect hedging over cash sales. This finding suggests that producers believe their marketing skills do not allow them to outperform marketing pools and therefore they would prefer to purchase marketing services from pools which suggests they are not overconfident.

Studies discussed in this chapter find evidence suggesting that reference points, past events, and overconfidence, among others, are relevant in explaining marketing decisions. Chapter 5 will discuss the research method and show how these factors are incorporated in the empirical analysis.

[11] Indirect hedging encompasses marketing through the use of pools and forward contracting, and direct hedging considers those producers who take positions in the futures and/or options markets (Isengildina and Hudson, 2001).

Chapter 4: An Overview of the Canadian Wheat Board

4.1 Introduction

Chapter 4 presents background information regarding how the CWB operates and the pricing alternatives offered to producers in order to market their grain. This chapter looks at the characteristics of each of the pricing alternatives, changes to the contracts, contract pricing dates, and eligible grains for each program. A brief introduction is given regarding how CWB deliveries are made, how producers initiate signing pricing contracts, and also the benefits and risks involved with using pricing alternatives.

4.2 Background on the Canadian Wheat Board

The CWB is the largest grain marketing agency in Canada and the sole marketer of wheat, durum wheat, and barley produced in Western Canada. All producers growing these grains must market through the CWB if the grain is to be sold for either export or human consumption. Appendix A illustrates the wheat growing area in Western Canada, highlighting the regions of Western Canada that must market grain through the CWB. The geographical area encompasses mainly three provinces, Manitoba, Saskatchewan, and Alberta, and as per Statistics Canada, represents approximately 90 percent of all wheat produced in Canada.[12]

Grains sold through the CWB are usually referred to as Board grains or CWB grains. Grains that are not marketed through the CWB are often referred to as non-Board grains and consist of specialty grains such as flax, canola, lentils, corn, soybeans, oats, and peas. Producers with feed qualities of wheat and barley have the option to market

[12] There is also a small area in British Columbia.

their grain domestically with or without the CWB called off-Board grains. Since the CWB has control over such a large proportion of grain, previous research has suggested the CWB is able to price discriminate and command higher returns compared to its competitors, because it has more negotiating leverage. [13]

In general, the CWB has three key operational functions: contracting grain for delivery, paying producers once grain is delivered, and selling and moving grain from handling facilities to foreign buyers or domestic processors.[14] To market grains through the CWB, producers must sign CWB delivery contracts, indicating they have a certain quantity and quality of Board grains to be marketed. The CWB offers different marketing contracts that allow producers to choose a program that meets their own needs and preferences regarding risk, return, and cash flow. There are two categories of pricing alternatives available to producers' and include pool pricing and Producer Payment Options.

4.3 Marketing Programs

4.3.1 Pool Pricing

The most traditional program is price pooling, which is the default program in that the CWB assumes producers will keep Board grains in the pool accounts unless otherwise indicated. Pool pricing was designed to guarantee that all producers receive the same final price for their Board grains by pooling together all pool sales during the crop year. With pool accounts, producers receive an initial payment when deliveries are

[13] Articles referencing price discrimination by the CWB can be found in Brooks and Schmitz (1999) and Alston and Gray (2000).
[14] The CWB does not physically store or handle the grain it markets. Instead it has handling agreements with private firms that control terminals across Canada.

made to the grain handling facility and additional payments (known as adjustment payments) as sales are completed throughout the crop year (August 1 to July 31). The exact dates of adjustment payments are unknown and can occur any time throughout the crop year.

Pool pricing allows producers in Western Canada to share the risk associated with prices for Board grains. Price pooling ensures that producers receive the same payments for the same grade of grain regardless of when grain is delivered by removing the risk associated with price increases and decreases in the marketplace (CWB, 2010).

During the crop year, the CWB releases a projected price, the Pool Return Outlook (PRO), which is their estimate of what the final pool price will be at the end of the crop year. The PRO can be used by producers as a price signal as it reflects the price they are expected to receive at the end of the crop year. Final pool payments are usually sent to producers around the middle of December (after the crop year has ended). This is considered one of the main concerns with pool pricing because of the lack of cash flow throughout the year and price uncertainty. However, until 2000 pool pricing was the only marketing program offered by the CWB and hence the only marketing contract available to producers in Western Canada.

4.3.2 Producer Payment Options

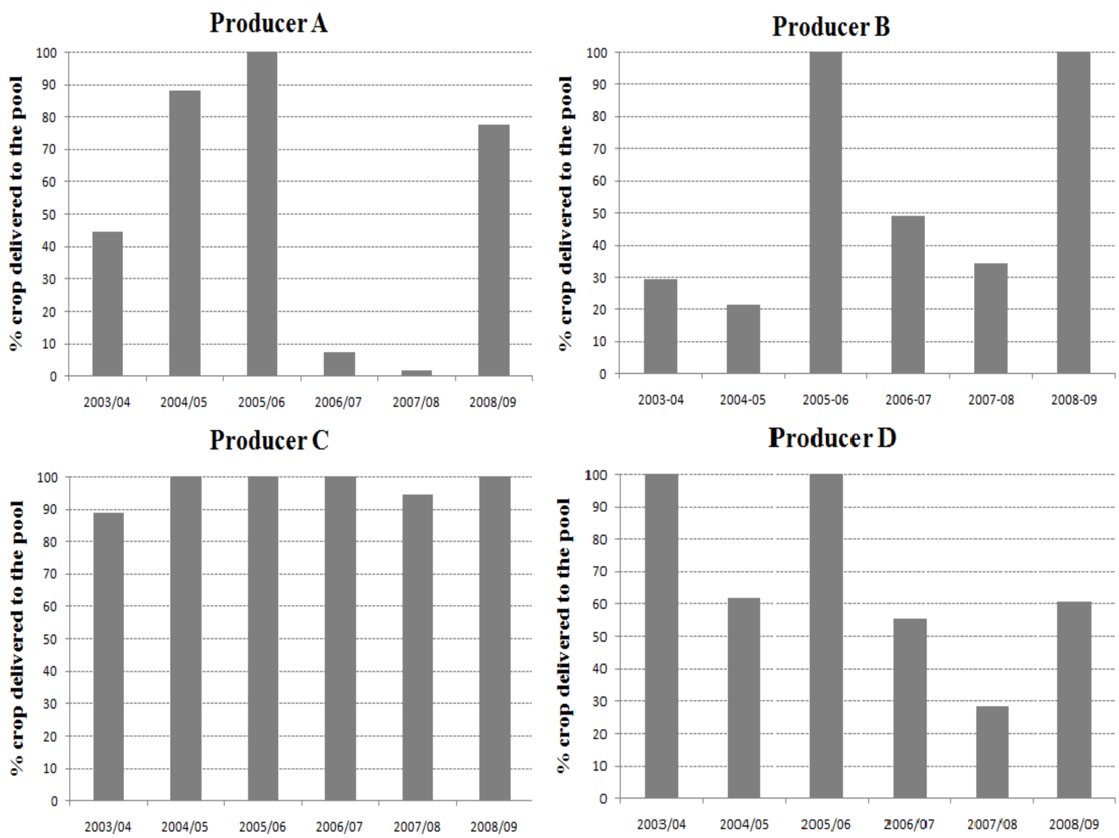
After 2000 the CWB introduced other pricing alternatives—generally known as Producer Payment Options or PPOs—that were developed to accommodate producers' demand for more flexibility to manage risk, return, and cash flow. PPOs include the Fixed Price Contract (FPC), Basis Price Contract (BPC), Daily Price Contract (DPC), Early Payment Option (EPO), and FlexPro. These contracts have distinct characteristics but essentially allow producers to use futures markets to price their Board grains. One of the key characteristics of the FPC, BPC, DPC, and FlexPro was that producers may obtain prices above the pool. Alternatively, the EPO was designed to help producers manage their cash flow and thus only allow producers to lock in a percentage of the expected pool price or PRO.[15] Another difference between pool accounts and PPOs is their payment schedule. Unlike pool pricing where producers do not receive their final payment until after the end of the crop year, producers using PPOs receive their final payment within 10 business days of delivering grain to the handling facilities.[16]

Each PPO has a different marketing window during which producers need to let the CWB know about their marketing choices. More than one alternative may be used by each producer in a given crop year, in which case they need to tell the CWB what proportion of their grain will be marketed by each instrument during the corresponding marketing window. Additionally, PPOs and pool pricing can be used simultaneously during the crop year. Although the majority of producers in Western Canada still choose to use the pool over PPOs. Those producers who use PPOs also tend to leave part of their crop in the pool. However, those that use PPOs tend to have large variability in their marketing strategies year after year. Figure 3 shows the different marketing strategies by four different producers over time, where producers A, B, and D choose to use different combinations of PPOs and pool accounts every year, while producer C chooses essentially the same marketing strategy year after year. The slow adoption of PPOs by some producers might be explained by the fact that PPOs are still relatively recent and

[15] Producers using EPOs return to the pool accounts when the contract price falls below the pool price.
[16] Final payments for PPOs are sent to producers after a cash ticket is sent by the handling facility to the CWB. However after 2001/02, futures components could be left unpriced up to the contract expiry dates, thus delaying final payments.

producers are still learning how to use them, compared to the pool accounts, which producers have been familiar with for a long time. Also, the CWB has made adjustments to PPOs over the years, which might have slowed the process of producers adopting the new marketing contracts.

Figure 3. Marketing Strategies of Producers



The choice of marketing contracts can rely on several factors. Price signals can be important variables in this process. The PRO is often seen as a benchmark and can be used by producers as a pricing signal, to remain in the pool accounts or sign a PPO contract. It is an open question regarding exactly which price signal producers use in their marketing decisions, but anecdotal evidence suggests producers only follow futures prices when making pricing decisions. Furthermore, when producers use pool pricing to price grain it can be called passive, because there is no action level to the pool. On the other hand, when producers use PPOs to price grain, it can be called an active strategy since they are pricing their own grain, thus requiring some level of action being taken.

4.4 Basis Price Contract

4.4.1 General Contract Information

The BPC was one of the first two pricing alternatives introduced during the 2000/01 crop year, the other was the FPC. The BPC is comprised of three components: futures price, basis, and late sign up adjustment factor (see Appendix B for more details regarding CWB basis). The late sign up adjustment factor reflects the cost of committing tonnage to the program after the beginning of the crop year (August 1). It offsets gains and losses of hedging by the CWB and passes it back to the program participants, the producers, in the form of a positive or negative adjustment. The BPC allows producers to lock in either the basis or futures price component first. However, producers have until the end of October to lock in the basis (since 2004/05) and the futures contract expiry month to lock in the futures price. If all components are not locked in by the specified deadlines, the CWB automatically locks in the price on the last day, regardless of the CWB daily price. A downside to signing a BPC is that the final pool price could be higher than the contract price. However the upside to signing the contract is the final pool price could end up being lower than the contracted price, suggesting the producer performed better than the pool.

Once tonnage has been signed for the program and basis locked in, producers have the option to roll tonnes that are not fully priced to another futures month, only as long as the contract has not surpassed the futures month expiry date. This option is only available after August 1 and allows producers more flexibility and time to lock in a price for their grain. The benefit to rolling the futures month is producers can take advantage of market trends to receive a higher futures price. An administration fee is charged for performing this task.

4.4.2 Changes to Contract

In 2000/01, contract signage took place within five business days following the announcement by the CWB of the April, May, June, and July futures months for the Minneapolis futures markets.[17] For most years producers signed the basis component prior to the start of the crop year. In 2004/05, the deadline to sign the BPC was extended to October 31, 2004 to allow producers an extra three months to commit and price tonnes for all contract months. The objective of an October 31 deadline was to allow producers to sign a contract once harvest finished. Allowing producers to sign exact tonnes and formulate better decisions for their farm, depending on the grade and amount produced. For example, if feed grades were delivered, producers would receive a discount using PPOs, but not under the pool accounts, since pool pricing is broken down by grades and proteins versus reference grades like PPO contracts. Specific reference grades are presented in Appendix C.

Also in 2000/01, producers were required to lock a futures price prior to making deliveries to the grain handling facilities or the CWB would lock in the futures price for them on the day grain was delivered as indicated on the cash ticket. However, in the 2001/02 crop year, producers could price their second component after deliveries were

[17] Exact dates could not be obtained.

made, but futures components still had to be priced before the futures expiry months. The benefit of extending the lock in period after delivery was to give producers more opportunity and flexibility to capture higher prices. Another option available to producers was the ability to lock in more than one price for their grain. If producers saw a good price one day but were not sure what would happen the following day, they could lock in a portion of grain and the rest at a later date.

4.4.3 Sign up Dates and Deadlines

As previously mentioned, the basis had to be locked in prior to the start of the crop year from 2000/01 through 2003/04. However, once the program matured, the deadline to lock in the basis was extended to the end of October, while futures prices still needed to be priced by the futures expiry month. In the 2005/06 crop year, producers signing BPCs could either sign the futures price or the basis component first, as long as the basis was locked in by October 31. The exact signing dates and deadlines for the BPC basis are presented in Appendix D for each crop year. As for the futures months expiry dates, Table 1 indicates the last day to lock in the futures price as the last business day prior to the contracted month.

Table 1. BPC Futures Months Expiry Dates

Crop Year	December Futures	March Futures	May Futures	July Futures
2000/01	November 29, 2000*	February 27, 2001**	---	---
2001/02	November 29, 2001*	February 28, 2002**	---	---
2002/03	November 28, 2002	February 27, 2003	April 29, 2003	June 27, 2003
2003/04	November 27, 2003	February 26, 2004	April 29, 2004	June 29, 2004
2004/05	November 29, 2004	February 25, 2005	April 28, 2005	June 29, 2005
2005/06	November 29, 2005	February 27, 2006	April 27, 2006	June 29, 2006
2006/07	November 29, 2006	February 27, 2007	April 27, 2007	June 28, 2007
2007/08	November 29, 2007	February 28, 2008	April 29, 2008	June 27, 2008
2008/09	November 27, 2008	February 26, 2009	April 29, 2009	June 29, 2009

*Contracts signed in April and May were based off December Futures.
**Contracts signed in June and July were based off March Futures.

4.4.4 Eligible Board Grains

In 2000/01, producers could only allocate tonnage under the BPC for Canada Western Red Spring (CWRS) wheat, excluding feed. The next crop year, the CWB added all seven classes of wheat, except for durum, sample grades, and mixed grains, with feed being added at a discounted price. Appendix C gives a list of the seven classes of wheat eligible for delivery under the BPC. In the 2006/07 crop year, selected barley contracts were available and the following year feed barley was added. However, in the 2008/09 crop year, the BPC no longer offered feed and selected barley contracts.

4.5 Fixed Price Contract

4.5.1 General Contract Information

The FPC is very similar to the BPC, except for being one flat price. This type of contract is based on three components: futures price, basis, and late sign up adjustment factor. However, unlike the BPC, producers have to lock these components and their tonnage in all at once. Therefore, the pricing component of this contract is called the fixed price. And similar to the BPC, the upside to signing a FPC is that the producers' contract price could be higher than the pool price, while the downside is the contract price could be lower than the pool price.

4.5.2 Changes to Contract

Starting 2004/05, the deadline for producers to lock the fixed price was extended to October 31, just like the BPC. Most changes that occurred for the FPC were consistent with those changes for the BPC.

4.5.3 Sign up Dates and Deadlines

When the FPC was introduced as a pricing alternative, signing took place before the beginning of the crop year. Then in 2004/05, the deadline to sign a contract was extended to the end of October. For sign up dates and deadlines see Appendix D.

4.5.4 Eligible Board Grains

Board grains eligible for delivery under the FPC have changed throughout the crop years. In 2000/01, only CWRS wheat could be delivered. The following crop year, producers could sign contracts for all seven classes of wheat, including feed wheat. A separate feed barley FPC was added during the 2001/02 crop year. Then in 2002/03, a durum wheat contract was added, which had specific guidelines for producers that kept the contract separate from the other grains.[18] Selected barley was added in 2004/05, however, barley was removed from the FPC program in the 2008/09 crop year.

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[18] Tonnage limits were placed on durum contracts and producers were encouraged to only sign a portion of their durum to the program. The reason for this was the relatively small market for durum. Therefore, the CWB worried there would not be enough buyers if producers signed 100 percent of their tonnage. By only signing a portion of their durum the CWB could ensure full delivery against PPO contract. This procedure is called guaranteed acceptance level.

4.6 Early Payment Option

4.6.1 General Contract Information

Introduced as a pilot program in 2001/02, the EPO gives producers the opportunity to lock in a contract for a portion of the PRO, discounted for risk, and time value of money. The benefit of signing a contract that gives producers the ability to lock in either 80, 90, or 100 percent of the PRO is to increase cash flow by making a percentage of the pool payment available within 10 business days of delivery. EPO contracts can be used by producers to set floor prices for Board grains in case the PRO and final pool prices fall below price expectations. In addition, the EPO is set up similar to an option since there is a cost associated with signing the contract that is equal to a discount and if the pool price goes above the contract price, producers go back into the pool. EPO contracts also provide producers with the opportunity of locking in prices better than the pool price.[19] However, the most common reason for producers to use EPO contracts is to increase their cash flow by receiving a portion of the PRO, while remaining in the pool.

Three components to EPO contracts are: Early Payment Value (EPV), discount, and incremental payment. The EPV is equal to 80, 90, or 100 percent of the reference grade of the PRO signed by the producers.[20] The discount factor takes into account the time value of money, risk, and administration costs, which are deducted from the EPV locked in at signing. The discount factor increases with the percentage of the PRO

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[19] This only happens if the PRO drops during the crop year after the producer has signed an EPO.
[20] The EPV is calculated as follows:

80 percent EPV = reference grade PRO x 0.80

90 percent EPV = reference grade PRO x 0.90

100 percent EPV = reference grade PRO x 1.00

because the CWB must undertake larger risks and costs to guarantee the EPV. Some of the factors that influence the daily EPO discount include the PRO, U.S. futures price, foreign exchanges, initial payment values, and percentage of pool sold.

Unlike other PPO programs, the EPO allows producers to remain in the pool accounts. Payments for producers using EPOs are a combination of both pool pricing and PPOs. Producers receive an initial payment when deliveries are made to the grain handling facility and the remaining percentage of the PRO price within 10 business days. Once the pool price becomes larger than the EPV, producers are eligible for adjustment and final payments. The major advantage of the EPO is that producers are still guaranteed their EPO price if the final pool price falls below the EPV, and they can go back into the pool if the pool price increases above the EPV.

4.6.2 Changes to Contract

All grains were not originally eligible for 80, 90, and 100 percent of the PRO. Only in 2006/07 were all grains eligible under each percentage, including feed wheat, which was given its own EPO contract. Allowing feed wheat to have its own contract, meant additional feed discounts could be eliminated from the EPO contract values, thus improving contract prices. Table 2 indicates when each grade became eligible for 80, 90, and 100 percent EPV.

Table 2. Types of Grains Eligible for EPVs

(a) EPO Contracts for 2001/02

	EPO Level "EPV"		
	80 percent	90 percent	100 percent
Wheat		√	
Durum Wheat			
Selected Barley			
Feed Barley			

(b) EPO Contracts for 2002/03

	EPO Level "EPV"		
	80 percent	90 percent	100 percent
Wheat		√	
Durum Wheat			
Selected Barley			
Feed Barley			

(c) EPO Contracts for 2003/04

	EPO Level "EPV"		
	80 percent	90 percent	100 percent
Wheat		√	
Durum Wheat			
Selected Barley		√	
Feed Barley			

(d) EPO Contracts for 2004/05

	EPO Level "EPV"		
	80 percent	90 percent	100 percent
Wheat	√	√	√
Durum Wheat	√	√	
Selected Barley	√	√	
Feed Barley	√	√	√

(e) EPO Contracts for 2005/06

	EPO Level "EPV"		
	80 percent	90 percent	100 percent
Wheat	√	√	√
Durum Wheat	√	√	
Selected Barley	√	√	
Feed Barley	√	√	√
Feed Wheat	√	√	√

(f) EPO Contracts for 2006/07

	EPO Level "EPV"		
	80 percent	90 percent	100 percent
Wheat	√	√	√
Durum Wheat	√	√	√
Selected Barley	√	√	√
Feed Barley	√	√	√
Feed Wheat	√	√	√

(g) EPO Contracts for 2007/08

	EPO Level "EPV"		
	80 percent	90 percent	100 percent
Wheat	√	√	√
Durum Wheat	√	√	√
Selected Barley	√	√	√
Feed Barley	√	√	√
Feed Wheat	√	√	√

(h) EPO Contracts for 2008/09

	EPO Level "EPV"		
	80 percent	90 percent	100 percent
Wheat	√	√	√
Durum Wheat	√	√	√
Selected Barley	√	√	√
Feed Barley	√	√	√
Feed Wheat	√	√	√

4.6.3 Sign up Dates and Deadlines

The process for signing an EPO contract is different from the other contracts. Producers can only sign EPO contracts once the crop year has commenced (August 1) and are recommended to sign shortly before expected deliveries, to prevent the EPV from losing value (however, this does not always occur). Producers that wait too long to deliver grain against EPO contracts run the risk of the initial payment being higher in value than the contract price, thus rendering the EPO contract valueless (this problem can also happen with all other PPO contracts).[21] When the EPO has no value it means that the percentage of the PRO signed is below the pool price. Meaning that when a producer delivers his/her grain to the handling facility, the initial payment price received is a higher price than the contract.

Table 3 shows a list of all the pricing periods for EPO contracts from 2001/02 to 2008/09. The contracts were initially available August 1 to the end of November. However, once the program developed, the deadlines were extended to span the entire crop year.

Table 3. EPO Sign up and End Dates

Crop Year	Sign up Begins	Sign up Ends*
2001/02	August 1, 2001	November 30, 2001
2002/03	August 1, 2002	November 30, 2002
2003/04	August 1, 2003	May 28, 2004
2004/05	August 1, 2004	July 31, 2005
2005/06	August 1, 2005	July 31, 2006
2006/07	August 1, 2006	July 31, 2007
2007/08	August 1, 2007	July 31, 2008
2008/09	August 1, 2008	July 31, 2009

*****Programs can be terminated before July 31 if the initial payment is near or exceeds the EPV level.

4.6.4 Eligible Board Grains

Eligible Board grains delivered against EPO contracts in 2001/02 were only Canada Western Red Winter wheat and Canada Western Soft White Spring wheat. The

[21] Producers still have to pay the discount factor if their EPO contract losses its value.

following year the CWB opened the program to all seven classes of wheat (excluding durum). In 2003/04 feed and selected barley were added. In addition to signing feed barley contracts, producers could sign a Guaranteed Delivery Contract meaning they were guaranteed 100 percent delivery opportunity for their feed barley. Durum was added in 2004/05.

4.7 Daily Price Contract

4.7.1 General Contract Information

The DPC was added as a pricing alternative in the 2005/06 crop year and uses U.S. cash elevator prices from locations in Montana and North Dakota, since Western Canadian producers commonly refer to these two states because of their geographical closeness. Therefore, daily U.S. elevator prices from these primary locations were used to calculate the DPC basis, while the nearby futures months were still used (Appendix C). The two components for the DPC include: a flat price based on the reference grade (DPC basis + nearby futures price) and cash spreads that adjust the prices to reflect the grade that producers actually delivered.[22] The upside to using the DPC is the contract price could go above the pool price. However the downside is the early signing period, which could result in the pool price being higher than the contracted price.

The daily price for the DPC combined the nearby futures price of the relevant wheat futures markets with a daily basis determined by the CWB (DPC price locked in = spot basis + nearby futures price +/- cash spread). The spot basis is calculated based on average daily U.S. elevator prices from Montana and North Dakota. While cash spreads adjusted the DPC price to reflect market values of the actual grade delivered. Cash

[22] All PPOs are signed based on reference grades.

spreads are determined and locked in on the settlement date on the cash tickets. If cash spreads are higher (lower) than the initial payment received at the grain handling facility, producers received additional DPC premiums (discounts). For example, assume a producer delivers No. 1 CWRS 14.5 against a contract with a price of $295.00/ton and a reference grade of No. 1 CWRS 13.5. On the day of delivery the spread is $29.55/ton, which is added to the DPC price, increasing the value of the contract to $324.55/ton.

The DPC is different compared to the FPC and BPC programs because it uses spot prices rather than a pooled basis when calculating the daily price.[23] Additionally, the spot basis experienced more volatility since it reacts to daily markets, as opposed to the pooled basis which tends to remain stable for longer periods of time because it is an expected average value of pooled sales made over the entire crop year.

4.7.2 Changes to Contract

The DPC was terminated after the 2007/08 crop year because of large amounts of risk the CWB endured since the program had more unhedgeable basis risk than any other PPO program.

4.7.3 Sign up Dates and Deadlines

In order for producers to be able to use the DPC, they had to sign tonnes before the beginning of the crop year. Table 4 provides further details regarding the dates for the signing and pricing periods. Once producers signed tonnes to the program, they had the entire crop year to price the tonnes, which allowed for the opportunity to capture market highs throughout the crop year. A tonnage limit was applied to the program,

[23] The pooled basis is the difference between the PRO and the futures prices, less a discount. It represents the expected average value of the pooled sales over the entire crop year.

which started at 500,000 tonnes in 2005/06 and 2006/07 and increased to 650,000 tonnes in 2007/08. Tonnage caps only influenced signing during the 2007/08 crop year when program caps were reached within 90 minutes of the first signing day (Pawlyk, 2010). Since tonnage caps were reached before the signing deadline, producers were no longer able to sign a contract for this program. Further, a per-farm limit of 5,000 tonnes was also implemented in the 2007/08 crop year.

Table 4. DPC Sign up and Pricing Deadlines

	Sign up Period		Pricing Period	
Crop Year	Start Date	End Date*	Start Date	End Date
2005/06	June 1, 2005	July 22, 2005	August 1, 2005	July 31, 2006
2006/07	June 1, 2006	July 21, 2006	August 1, 2006	July 31, 2007
2007/08	June 18, 2007	July 20, 2007	August 1, 2007	July 31, 2008

*****The end date can be terminated as soon as the tonnage limit is reached.

4.7.4 Eligible Board Grains

Producers wanting a DPC could only sign a contract for the seven reference grades of wheat during the programs existence (presented in Appendix C).

4.8 FlexPro

4.8.1 General Contract Information

The FlexPro was introduced by the CWB for the 2008/09 crop year. Signing a contract for this program is similar to the DPC since producers commit tonnes before the start of the crop year and have the entire crop year to lock in a flat price for their wheat. The flat price incorporates a basis similar to the BPC and FPC programs. But, as opposed to the BPC and FPC, it does not include a late sign up adjustment factor and the flat price takes into account all futures months. Therefore, producers do not sign a specific futures month contract for December, March, May, or July, but instead the CWB incorporates the months over the entire period into one daily price. The FlexPro basis is based on the PRO and deducts average futures values for the crop year and a discount for risk, time value of money, and administration costs in order to determine the average projected pooled basis. Again, the downside to using this contract is the early signing period like the DPC, which could result in contract prices being lower than the pool price.

4.8.2 Changes to Contract

The FlexPro has only been available since the 2008/09 crop year. Therefore, no changes have occurred to the program that are relevant to the years considered for this research.

4.8.3 Sign up Dates and Deadlines

Tonnes for the FlexPro are committed to the program before the beginning of the crop year. In 2008/09, producers signed tonnage between June 23, 2008 and July 28, 2008. Allowing the CWB to hedge at the start of the crop year and give producers the chance to price grain over the entire crop year (August 1, 2008 to July 31, 2009).

4.8.4 Eligible Board Grains

Eligible Board grains for FlexPro contracts include the seven classes of wheat, excluding durum (Appendix C).

4.9 Changing Contract Commitments

Producers unable to deliver 100 percent of grain to their PPO contracts, have three options for changing contract commitments. Option one is to complete an assignment to transfer the remaining tonnes to another producer that has the same grain. Option two is buyout the remaining tonnes. Option three is do nothing and face pricing damages at the end of the crop year. Pricing damages are calculated the same way as buyout costs, but at the price posted on the last day of the crop year (July 31). Producers can also use any combination of these three options. However, transaction/administrative costs are associated with each option.

The best option for producers would be to transfer the contract to another producer since only an administration cost of $15 would be incurred. However, this option is not always possible because the producer may not be able to find another individual with the grain, or the contract has such a poor price that no one is willing to take over the contract. Producers that do not fulfill contract obligations and do not exercise any of the previously mentioned options available to them automatically incur pricing damages on undelivered tonnes at the end of the crop year.

However, if producers watch the markets daily, it is possible to buyout of the contract for only the administrative cost.[24] When the buyout has no cost, it suggests there is still some value left to the contract, so the producer only needs to pay the administration fee (this holds for all PPO buyouts even if the value is negative). The CWB does not pay producers for basis or futures gains if the contracts still has some value. For a detailed breakdown of the buyout calculations see the CWB website.

[24] The administrative cost can range from a flat rate of $15 to $1.25/ton depending on the crop year and program.

4.10 Delivery of Board Grains Using Marketing Programs

Producers wanting to deliver grain to the CWB need to sign a CWB delivery contract. This notifies the CWB about how much grain has been produced in Western Canada and how much they need to market. Deliveries by producers to grain handling facilities cannot be made until the CWB has called for the grain. Delivery contracts must be signed by producers planning to use the pool accounts or PPO contracts. Producers can only deliver up to the amount that has been accepted.

Signing PPOs does not allow producers to deliver their grain whenever they want. Producers using PPOs must wait for delivery calls just like those in the pool. Once a call has been announced, all producers using pool accounts and PPOs have the same delivery opportunities.

Delivery obligations for producers using marketing programs offered by the CWB are different. Producers signing delivery contracts must be careful with the type of pricing alternative they use because delivery contracts do not guarantee 100 percent delivery. However, producers using PPOs are required to deliver 100 percent of their contract versus those that remain in the pool. Therefore, producers must make sure not to over commit to PPO contracts in case they are not able to deliver 100 percent of their grain, or not all their grain is accepted.

4.11 The Benefits and Risks of Producer Payment Options

Producers generally sign PPOs because they believe they can obtain prices higher than the pool or because of cash flow needs. By locking in a price, producers are essentially reducing pricing uncertainty and improving their ability to budget for their farm. PPO contracts provide producers enhanced cash flow capabilities since payments and prices are known earlier than the pool.

There are also risks associated with PPO contracts in terms of overpayments. Since markets can be extremely volatile, producers may end up with worse prices than pool accounts, which could put them into an initial overpayment situation. Initial overpayments usually happen when the initial payment producers receive at time of delivery is greater than the producers PPO contract, which occurred on a large-scale in 2007/08. Producers with overpayments are required to repay the money to the CWB.

Chapter 5: Methodology

5.1 Introduction

Chapter 5 explains the methodology used in this thesis. Section two identifies the data used in the models. Section three explains the two models used to investigate producers' marketing decisions. In general, these models look at whether producers are overconfident in their ability to market grain and whether current decisions are being affected by previous year's marketing choices, performance, and price signals. Section four looks at the use of panel data to estimate both models in this research.

5.2 Data

Data for this research was provided by the CWB and includes 225,692 observations for 67,798 producers that grew CWRS wheat from 2003/04 through 2008/09 in Western Canada. The data set for the first model contains 7,388 producers that grew CWRS wheat in at least two of the six crop years and marketed their wheat using PPO contracts (DPC, FPC, and BPC), while the data set for the second model contains 8,387 producers who used PPOs between 2003/04 and 2008/09.[25]

Even though PPO contracts were first available in 2000/01, the data set starts in 2003/04 because the initial three crop years had minimal PPO usage. The more current crop years (2009/10 and 2010/11) are not included because the final pool price had not yet been finalized when the data was obtained.

Data contains transactions made by each producer that indicates (i) what contracts they used to market their wheat, (ii) how many tonnes of wheat were delivered to each

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[25] The total number of producers is based on the number of CWB producer permit books. Since producers can hold permit books as an individual, partnership, and corporation, it is possible that some producers have more than one book.

contract, (iii) exact dates when producers signed PPO contracts, (iv) final price received by each producer for each marketing contract used to sell wheat, (v) PRO, PPO and futures prices, and (vi) province. The final price received by each producer is calculated as a weighted average of all prices received under each contract. The weights are the amount of tonnes priced under each contract. Therefore, their final price received represents the average dollar per tonne received for their wheat. The contracts included in this sample are pool accounts and five PPO contracts (FPC, BPC, DPC, EPO, and FlexPro).[26]

Choices of marketing programs and prices received are used to identify strategies adopted by producers and their results in terms of price. PRO, PPO and futures prices are used to understand market conditions during the signing period when producers are making marketing decisions. The dates when producers signed and/or priced PPO contracts are used to understand what was happening in the markets to signal to producers whether to sign a PPO contract or stay in the pool accounts.

Data on harvest progress was obtained from the CWB but was only available provincially, excluding British Columbia. Harvest progress shows the weekly average of the proportion of total crop already harvested in a given week for each province. With harvest usually beginning around mid-August and completing around mid- to late October or November, depending on the year and/or province.

Data on historical futures prices were obtained from the Commodity Research Bureau for the Minneapolis Grain Exchange futures price on Hard Red Spring wheat.

[26] The DPC was terminated after the 2006/07 crop year and the FlexPro was created in the 2007/08 crop year. Both contracts are very similar in their purpose and specifications. For the purpose of this research the DPC and FlexPro are combined into one contract due to their similarities and generally referred to as "DPC".

The futures prices were converted to Canadian dollars using the Bank of Canada noon exchange rate.

5.3 The Models

5.3.1 Model 1: Are Canadian Producers Overconfident?

It is first investigated whether producers have better information or analytical skills to outperform certain benchmarks, or whether they just believe they have superior skills but cannot actually outperform the benchmark. This would indicate whether producers are overconfident in their ability to market their own wheat outside of the pool accounts. A regression model based on Cabrini et al. (2007) and Cunningham et al. (2007) is estimated following equation (4).

$$\begin{aligned} Performance_{i,t} = \alpha + \beta_D (\%DPC)_{i,t} + \beta_F (\%FPC)_{i,t} + \beta_B (\%BPC)_{i,t} + \\ \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (4)$$

Where performance ($Performance_{i,t}$) is the difference between the price received by producer i and the benchmark price in year t, $(\%DPC)_{i,t}$, $(\%FPC)_{i,t}$, $(\%BPC)_{i,t}$ are the percentages of wheat delivered against each PPO contract by producer i in year t, $Month_{i,t}$ is used to indicate the month in which producer i priced a PPO contract in year t, and $Activeness_{i,t}$ is a measure of marketing activeness for producer i in year t.

5.3.1.1 Performance Measure

To calculate the performance measure, a final price received must be determined. Price received is the final price received by each producer for their wheat at the end of the crop year using either a DPC, FPC, BPC or any combination of these three contracts. Producers that chose to put 100 percent of their wheat in the pool or EPO during a crop year were omitted from this model. Pool deliveries and their corresponding prices were not taken into consideration for this calculation because the model explores producers' performances when using specific PPOs that enable them to obtain higher prices for their wheat compared to what they could receive if the CWB marketed the grain. EPO deliveries are also not considered because they are used more for cash flow purposes and not as a means to get higher prices compared to the pool like the other PPOs.

Producers can have multiple final prices that correspond to each PPO contract. Therefore, a single final price is calculated by averaging all prices weighted by the quantity of wheat delivered against each program.

$\text{Performance}_{i,t}$ is calculated as the difference between the actual price producers received and a benchmark price as shown by equation (5). So if the final price received by producer i in year t is above (below) the benchmark price, $\text{Performance}_{i,t}$ is positive (negative).

$$\text{Performance}_{i,t} = (\text{price received}_{i,t} - \text{benchmark}_{t}) \tag{5}$$

Performance is measured with respect to two types of benchmarks, as in previous studies on marketing performance (e.g., Hagedorn et al., 2005; Cabrini et al., 2007; Dietz et al., 2009). This is due to the uncertainty regarding the relevant marketing windows and benchmarks used by Western Canadian wheat producers. One is the final CWB pool price, which is a farmer benchmark. Producers can simply choose to stay in the pool and let the CWB market their wheat for them. One of the reasons to use PPO contracts would be to obtain higher prices compared to the pool.

Other benchmarks are based on historical averages of futures prices, which are market benchmarks. Many producers track futures prices and use them as a reference to evaluate their marketing performance. Market benchmarks follow a 24-, 20-, and 12-month window based off Minneapolis Grain Exchange for Hard Red Spring wheat converted to Canadian dollars using the Bank of Canada noon exchange rate. The 24-month market benchmark is calculated by taking the average of the futures price over a 24-month marketing window that begins August of the previous crop year and ends July of the current crop year (so it encompasses the entire current and previous crop years). The other two market benchmarks are only shorter versions of the 24-month benchmark. The 20-month benchmark removes the first four months of the 24-month benchmark, while the 12-month benchmark is only the current crop year (August to July).

5.3.1.2 Percentage of Grain Delivered to PPO Contracts

The percentage of grain delivered against each PPO contract ($(\%DPC)_{i,t}$, $(\%FPC)_{i,t}$, $(\%BPC)_{i,t}$) indicates how much wheat producers try to market by themselves outside the pool account. It is calculated as the proportion of tonnes delivered against each PPO divided by total tonnes delivered to the CWB (including both pool accounts and all PPOs). High values for the PPO variables ($(\%DPC)_{i,t}$, $(\%FPC)_{i,t}$, $(\%BPC)_{i,t}$) indicate more tonnes priced with PPOs and less in the pool, suggesting producers might perceive opportunities to profit from pricing their wheat using futures contracts. A positive relationship ($\beta > 0$) between these variables and performance indicates that producers who use more PPOs can actually receive a price above the benchmark. Conversely, a negative relationship ($\beta < 0$) indicates that producers who use more PPO contracts perform worse than the benchmark, suggesting they are not able to detect and take advantage of profit opportunities in futures markets.

5.3.1.3 Month Producers Make Marketing Decisions

The variable $Month_{i,t}$ is used to indicate the month which producer i priced a PPO contract in year t. A single marketing window is adopted for all PPOs during the crop year (Appendix E). The marketing window is assumed to start when the first PPO contract is available (BPC) and go until the deadline of the last PPO contract (DPC/FlexPro since 2005/06). For example, in 2006/07 the BPC and FPC were first available in February 2006 and the DPC was last available July 2007. Therefore, producers had a 17-month window to make their marketing decision (Appendix E). Months will be indicated in relative terms, starting at zero for the first month producer i can price his/her PPO contract and ending at one for the last month producer i can sign and/or price his/her PPO contract. For example, February 2006 was the first month of the signing period for the 2006/07 crop year, so $Month_{i,t}$ is equal to zero if producer i signed the contract in that month, 0.06 if he/she signed in March, 0.12 if he/she signed in April, and so on. Therefore $Month_{i,t}$ is calculated by dividing the number of months from the beginning of the marketing window by total number of months of the marketing period. This procedure is adopted because marketing windows have different lengths across crop years.

The FPC and DPC only have one important component in order to price a contract. Therefore $Month_{i,t}$ can easily be determined for each by looking at the date the price was locked in. However, the BPC has two components to complete a contract. Producers must first price either the futures price or basis component of their contract and then lock in the remaining component at a later date. So the value of $Month_{i,t}$ for the BPC is determined by an average between the months when each component is priced.

For example, if one component is priced in July 2006 (0.29) and the other component in January 2007 (0.65), $\text{Month}_{i,t}$ will be 0.47.

If more than one PPO contract is signed and/or priced for each program, weighted averages are used to determine one $\text{Month}_{i,t}$ value for each program. The weights are given by the quantity of tonnes allocated to each specific date. For example, in 2006/07 a producer prices 300 tonnes of wheat by signing PPO contracts on August 16, 2006 and September 6, 2006 (100 tonnes in August and 200 tonnes in September). August and September are respectively the sixth and seventh months of the marketing window in the 2006/07 crop year, so August is 0.35 and September is 0.41 in our scale. Therefore the value of $\text{Month}_{i,t}$ for this producer is 0.39.

If the relationship between performance and $\text{Month}_{i,t}$ is positive $(\delta > 0)$, then larger (smaller) values for the month leads to better (worse) performance. This suggests that the later (earlier) producers sign and/or price their grain the better (worse) their price. On the other hand, a negative relationship $(\delta < 0)$ indicates that larger (smaller) values for the month leads to worse (better) performance, suggesting the earlier (later) producers sign and/or price their grain the better (worse) their price.

5.3.1.4 Marketing Activeness Index

The measure of marketing activeness $(\text{Activeness}_{i,t})$ comes from performance models used in Cabrini et al. (2007) and Cunningham et al. (2007). Cabrini et al. (2007) identified four measures of activeness in their research since they suggest there is no one measure that can be used to describe the differences in degrees of activeness. However, some of these measures required data that is not available in the context of this research and hence only two measures are used to compute activeness here. The first measure starts by creating a series with the amount of wheat marketed in each week of the crop year during the marketing window as a percentage of total production.[27] The amount of wheat marketed in each week is based on the amount of wheat committed to delivery when the producer signed and/or priced a PPO contract. Marketing activeness is computed by calculating the standard deviation of the weekly series of marketing activity for each producer. To calculate activeness, the formula given by Cunningham et al. (2007) is used. First the tonne-weighted average week marketed $(awk_{i,t})$ is calculated for each producer i in year t as in equation (6).

$$awk_{i,t} = \sum_{w=1} \frac{wvol_{i,t,w} \cdot wk_{i,t,w}}{tvol_{i,t}} \tag{6}$$

Where $wk_{i,t,w}$ is the week grain is marketed[28], $wvol_{i,t,w}$ is the tonnes marketed in week w, and $tvol_{i,t}$ is the total tonnes marketed in the crop year.

Then the measure of marketing activeness for each producer is given by the standard deviation of $awk_{i,t}$ series calculated as in equation (7).

$$Activeness_i = \sqrt{\frac{\sum_{t=1} (awk_{i,t} - \overline{awk}_i)^2}{n-1}} \tag{7}$$

Where n is the number of years in which producer i marketed wheat, and $\overline{awk_i}$ is the mean of $awk_{i,t}$ for each producer across crop years.

[27] If more than one transaction occurred in a specific week, the transactions were combined together into one for that specific week.
[28] The total number of weeks producers have to market grain in a crop year in Western Canada depends on the specific year. The same marketing window is used for each PPO contract as given in Appendix E.

An example illustrating this calculation is given in Table 5, where the marketing strategies of two producers for a three-year period with five marketing weeks in each year are given. To calculate $awk_{i,t}$ first multiply the total volume of tonnes marketed by producer i in each week of the year $(wvol_{i,t,w})$ by the week $(wk_{i,t,w})$, then divide by the total volume of tonnes marketed in the year $(tvol_{i,t})$. For example, producer 1 (i=1) has $awk_{1,1}$ = 0.31 + 0.38 + 1.31 + 0.00 + 0.31 = 2.31 in year 1, $awk_{1,2}$ = 0.06 + 0.00 + 0.75 + 1.00 + 2.19 = 4 in year 2, and $awk_{1,3}$ = 0.00 + 0.86 + 0.71 + 1.33 + 0.00 = 2.90 in year 3. Next, the arithmetic average for the three years for producer 1 is calculated ($\overline{awk_1} = 3.07$). The final step consists of calculating squared deviations of each year from the average $\left(awk_{1,t} - \overline{awk_1}\right)^2$, and obtain the standard deviation which is the measure of activeness. Following this procedure, producer 1's measure of activeness is

$$\text{Activeness}_1 = \sqrt{\frac{(2.31-3.07)^2+(4-3.07)^2+(2.90-3.07)^2}{3-1}} = \sqrt{\frac{0.58+0.86+0.03}{2}} = 0.74 .$$

Following the same procedure, producer 2 has a measure of activeness equal to zero, since he/she markets the same quantities of grain in the same weeks every year (Table 5). So producer 1 changes his/her strategy every year and hence his/her activeness measure is greater than zero. On the other hand, producer 2 adopts the same strategy every year and therefore his/her activeness measure is equal to zero.

Table 5. Example of Marketing Activeness Calculation

(a) Producer 1

Year 1

Week (wk)	Quantity (tvol)	Week x Quantity (tvol x wk)	(tvol x wk)/tvol
1	50	50	0.31
2	30	60	0.38
3	70	210	1.31
4	0	0	0.00
5	10	50	0.31

total vol = 160 awk =2.31

Year 2

Week (wk)	Quantity (tvol)	Week x Quantity (tvol x wk)	(tvol x wk)/tvol
1	10	10	0.06
2	0	0	0.00
3	40	120	0.75
4	40	160	1.00
5	70	350	2.19

total vol = 160 awk = 4

Year 3

Week (wk)	Quantity (tvol)	Week x Quantity (tvol x wk)	(tvol x wk)/tvol
1	0	0	0.00
2	90	180	0.86
3	50	150	0.71
4	70	280	1.33
5	0	0	0.00

total vol = 210 awk = 2.90

Average awk =	3.07	
Squared deviations	Year 1	0.58
	Year 2	0.86
	Year 3	0.03
activeness		0.74

(b) Producer 2

Year 1

Week (wk)	Quantity (tvol)	Week x Quantity (tvol x wk)	(tvol x wk)/tvol
1	50	50	0.31
2	30	60	0.38
3	70	210	1.31
4	0	0	0.00
5	10	50	0.31

total vol = 160 awk = 2.31

Year 2

Week (wk)	Quantity (tvol)	Week x Quantity (tvol x wk)	(tvol x wk)/tvol
1	50	50	0.31
2	30	60	0.38
3	70	210	1.31
4	0	0	0.00
5	10	50	0.31

total vol = 160 awk = 2.31

Year 3

Week (wk)	Quantity (tvol)	Week x Quantity (tvol x wk)	(tvol x wk)/tvol
1	50	50	0.31
2	30	60	0.38
3	70	210	1.31
4	0	0	0.00
5	10	50	0.31

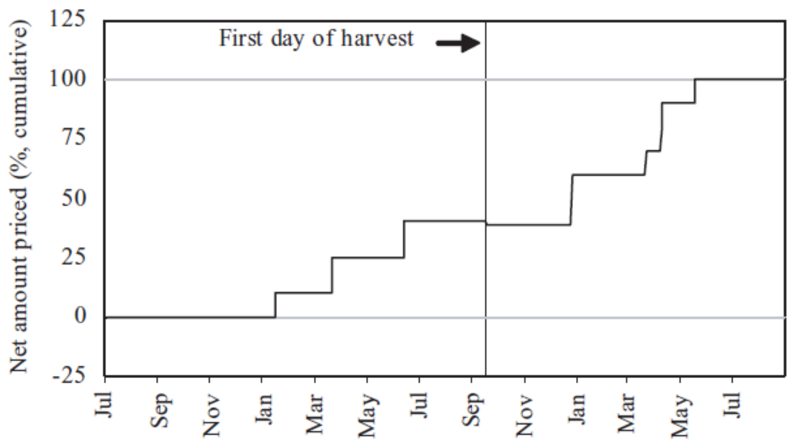
total vol = 160 awk = 2.31

Average awk =	2.31	
Squared deviations	Year 1	0.00
	Year 2	0.00
	Year 3	0.00
activeness		0.00

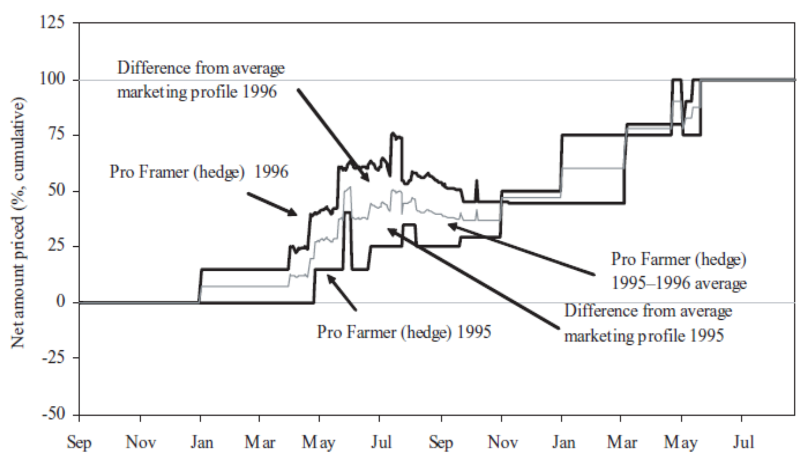
Cabrini et al. (2007) illustrated the notion of marketing activeness for corn by graphing marketing profiles. Figure 4(a) shows the marketing profile of a producer for one crop year. Each step on the graph indicates a point when the producer marketed his/her grain. Assuming this producer would adopt the exact profile every year, there would be no deviations from the profile in Figure 4(a) and thus he/she would have a marketing activeness equal to zero. Figure 4(b) illustrates a marketing profile of a producer who chose different marketing strategies in two different years. Cabrini et al. (2007) calculate the average marketing profile for these two years and then measured marketing activeness using the deviations of each year's profile with respect to the average, which is greater than zero in this case.

Figure 4. Graphical Example of Activeness Measures

a) Marketing Profile for One Crop Year



b) Marketing Profile for Two Crop



Source: Cabrini et al. (2007)

The second measure of activeness involves examining how producer's decisions differ from a naïve strategy of equally spreading recommended sales along a marketing window.[29,30] To compute this measure add the absolute differences between the percentage of grain that would be priced according to the naïve strategy and the percentage of grain actually priced by the producers during the marketing window for each business day. Therefore, if a producer were to follow the naïve strategy, their measure of activeness would be zero.

Both activeness measures are standardized, so they can be expressed in terms of standard deviation relative to the marketing activeness of the average producer in the whole sample. Therefore, a standardized index is given by equation (8).

$$\text{Activness Index} = \frac{\text{Activeness} - \mu}{\sigma} \tag{8}$$

Where μ and σ are the average and standard deviation of marketing activeness across all producers respectively. Finally, the activeness index for each producer is calculated as the average of the two standardized variables. Therefore, as mentioned previously, activeness index is expressed as the number of standard deviations from the average producer.

The higher the activeness index the more active the producer is compared to the average producer's strategy, meaning each year the producer prices his/her wheat in different weeks. Therefore, a positive relationship $(\gamma > 0)$ between marketing activeness and performance indicates that greater activeness leads to better performance, while a negative relationship $(\gamma < 0)$ indicates that greater activeness leads to worse

[29] Marketing window ranges from 16 to 22 months between 2003/04 and 2008/09.
[30] The idea of this measure is similar to Cabrini et al. (2007) except that their research used a cumulative pricing strategy.

performance. These relationships can be used to explore overconfidence. Producers who believe they have better information or analytical skills to outperform the benchmark tend to be more active in their marketing strategies. If greater activeness leads to poor performance $(\gamma < 0)$ it suggests producers are actually overconfident in their abilities to outperform the benchmark.

Note that a positive relationship between marketing activeness and performance does not necessarily follow a positive relationship between PPO transactions ($(\%DPC)_{i,t}$, $(\%FPC)_{i,t}$, $(\%BPC)_{i,t}$) and performance. The fact that producers use more PPO contracts does not automatically indicate they have a more active marketing strategy. A producer who markets all his/her grain using PPOs can do so in the same weeks every year, indicating zero activeness (such as producer 2 in Table 5). Another issue is that a producer can try to actively use PPOs to time the market every year, but commits only a small fraction of his/her crop to these contracts (leaving most of the crop in the pool). In this case, it is possible the producer shows a positive relationship between activeness and performance but not necessarily a positive relationship between PPO usage and performance. For producers to be considered in the calculation of activeness for this statistical model, they had to use PPO contracts (DPC, FPC, or BPC) for at least two crop years.

5.3.2 Model 2: How Canadian Wheat Producers' Make Marketing Decisions?

The second model explores whether the previous year's marketing strategy and performance, and current price signals affect producers' current marketing strategy. This method is adapted from similar models used by Coval and Shumway (2005) and Frino et al. (2008), who investigated trading decisions of professional traders. Equations (9a)-(9d) present the models for this estimation, where the marketing decisions are investigated for each PPO contract individually, so one equation is estimated for each contract. The dependent variables in each equation correspond to each PPO, while explanatory variables are essentially the same across equations.

$$\begin{aligned}(\%FPC)_{i,t} = \alpha + \beta_1(\%FPC)_{i,t-1} + \chi_E(\%EPO)_{i,t} + \chi_D(\%DPC)_{i,t} + \chi_B(\%BPC)_{i,t} + \\ \gamma_P \text{Performance}_{i,t-1} + \rho_S \text{Harvest Progress at Signing}_{i,t} + \theta_1 \text{Price Spread}_{i,t} + \\ \theta_2 \text{Price Trend}_{i,t} + \varepsilon_t\end{aligned} \tag{9a}$$

$$\begin{aligned}(\%BPC)_{i,t} = \alpha + \beta_1(\%BPC)_{i,t-1} + \chi_E(\%EPO)_{i,t} + \chi_D(\%DPC)_{i,t} + \chi_F(\%FPC)_{i,t} + \\ \gamma_P \text{Performance}_{i,t-1} + \rho_S \text{Harvest Progress at Signing}_{i,t} + \theta_1 \text{Price Spread}_{i,t} + \\ \theta_2 \text{Price Trend}_{i,t} + \varepsilon_t\end{aligned} \tag{9b}$$

$$\begin{aligned}(\%DPC)_{i,t} = \alpha + \beta_1(\%DPC)_{i,t-1} + \chi_E(\%EPO)_{i,t} + \chi_F(\%FPC)_{i,t} + \chi_B(\%BPC)_{i,t} + \\ \gamma_P \text{Performance}_{i,t-1} + \rho_S \text{Harvest Progress at Signing}_{i,t} + \theta_1 \text{Price Spread}_{i,t} + \\ \theta_2 \text{Price Trend}_{i,t} + \varepsilon_t\end{aligned} \tag{9c}$$

$$\begin{aligned}(\%EPO)_{i,t} = \alpha + \beta_1(\%EPO)_{i,t-1} + \chi_D(\%DPO)_{i,t} + \chi_F(\%FPC)_{i,t} + \chi_B(\%BPC)_{i,t} + \\ \gamma_P \text{Performance}_{i,t-1} + \rho_S \text{Harvest Progress at Signing}_{i,t} + \theta_1 \text{Price Spread}_{i,t} + \\ \theta_2 \text{Price Trend}_{i,t} + \varepsilon_t\end{aligned} \tag{9d}$$

The variables $(\%FPC)_{i,t}$, $(\%BPC)_{i,t}$, $(\%DPC)_{i,t}$, $(\%EPO)_{i,t}$, $(\%FPC_i)_{i,t-1}$, $(\%BPC)_{i,t-1}$, $(\%DPC_i)_{i,t-1}$, and $(\%EPO_i)_{i,t-1}$ are percentages of wheat delivered against each PPO contract by producer i in years t and t-1, $\text{Performance}_{i,t\text{-}1}$ is the pricing performance of producer i in year t-1, $\text{Harvest Progress at Signing}_{i,t}$ is a measure of harvest progress for producer i on the day he/she priced a PPO contract in year t, $\text{Price Spread}_{i,t}$ is an average price spread for producer i observed on the day he/she priced a PPO contract in year t, and $\text{Price Trend}_{i,t}$ is a measure of average price trends of nearby futures price observed when producer i priced a PPO in year t. These variables will be discussed in more detail in the following sections.

5.3.2.1 Performance Measure in Previous Time Period

The relationship between the dependent variables $(\%FPC)_{i,t}$, $(\%BPC)_{i,t}$, $(\%EPO)_{i,t}$, $(\%DPC)_{i,t}$ and $Performance_{i,t-1}$ is used to discuss how performance in the previous year affects marketing decisions in the current year. As discussed before, performance is measured against benchmarks, so gains and losses refer to prices above and below the benchmarks, respectively. This relationship can be used to investigate the presence of house-money effect and loss aversion in producers' decisions. For instance, with the FPC (or any other PPO contract), a high value of $(\%FPC)_{i,t}$ indicates larger portions of wheat priced during the crop year using PPOs, suggesting the producer is reducing his/her pricing risk as he/she locks in a price when the FPC is signed. Low values of $(\%FPC)_{i,t}$ indicate small portions of wheat priced during the crop year using PPOs and hence a larger portion remains unpriced until the announcement of the final pool price at the end of the crop year. Therefore producers who price just small portions of their wheat with FPCs are exposed to larger amounts of price risk. So less (more) risk refers to more (less) wheat delivered to PPO contracts.

A positive relationship ($\gamma > 0$) between $(\%FPC)_{i,t}$, $(\%BPC)_{i,t}$, $(\%DPC)_{i,t}$ $(\%EPO)_{i,t}$, and $Performance_{i,t-1}$ in equations (9a)-(9d), suggests the presence of loss aversion. Producers would take less risk after gains $(perf > 0)$ (i.e. positive performance in the previous year leads to more PPO usage in the current year) and more risk after losses $(perf < 0)$ (i.e. negative performance in the previous year leads to less PPO usage in the current year). One implication of this is that producers are taking less risk because they are locking in prices earlier than the pool.

On the other hand, if this relationship is negative ($\gamma < 0$), it suggests the presence of house-money effect. Producers would take more risk after gains (i.e. positive performance in the previous year leads to less PPO usage in the current year) and less risk after losses (i.e. negative performance in the previous year leads to more PPO usage in the current year). Implying producers are taking more risk by locking in prices earlier than the pool.

The data for $\text{Performance}_{i,t-1}$ was created in the same way as in the first model, but also includes the EPO price, in addition to the DPC, FPC, and BPC and is lagged one crop year. As a result, the sample is reduced to five crop years. Also, since our dependent variable is percentage of grain delivered to specific PPO contracts, producers that delivered 100 percent of their wheat to the pool are excluded.

5.3.2.2 Price Signals

It is uncertain exactly which price signals producers' use when making decisions regarding staying in the pool or signing PPOs during a marketing window. Some possible reference prices producers may use include the PRO, CWB fixed price (for FPCs), CWB futures prices, U.S. futures prices, or historical prices (pool or futures prices).[31] However, anecdotal evidence reveals that producers might only look at futures prices when making pricing decisions. As well, it is still open to debate whether producers pay attention to the PRO or other reference prices released by the CWB. Therefore, two price signals are used in the estimation of equations (9a)-(9d). These

[31] Those possible reference prices emerged from discussions with the industry, CWB analysts, and producers.

price signals are identified as possible triggers for producers to decide whether they should sign a PPO contract or remain in the pool accounts. One is a price spread and is calculated using moving averages. The other one signals price trends of nearby futures prices.

5.3.2.2.1 Price Spreads

Price spreads represent the difference between the price that can be obtained with PPOs and the price that can be obtained in the pool. For the FPC, BPC, and EPO take the CWB futures price minus the PRO, which represents how much futures prices are above or below the expected pool price and is assumed to provide an indication of whether producers can price their grain above or below the pool. The CWB futures price is based on the nearby contract, since it is unknown what futures month producers used. It is also the futures price component for the BPC and FPC. The DPC/FlexPro uses the DPC/FlexPro price minus the PRO and represents how much the DPC/FlexPro price is above or below the expected pool price (equation 10).

$$\text{Price Spread} = (\text{CWB futures price} - \text{PRO}) \text{ for the FPC, BPC, EPO} \qquad (10)$$

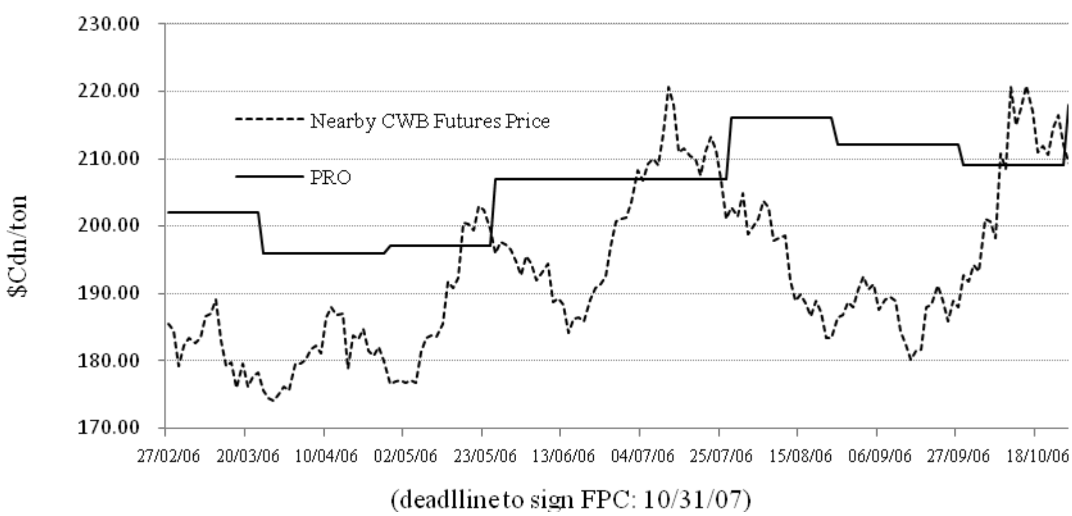
$$\text{Price Spread} = (\text{DPC/FlexPro price} - \text{PRO}) \text{ for the DPC/FlexPro}$$

For those PPO programs that have more than one component to the contracts, the following assumptions have been made. For the BPC price spread, since futures prices are being used, only the dates when the futures price component of the contract was priced will be considered, thus ignoring the basis component. The BPC basis component has not been included because of the difficulty in determining a good price indicator. Additionally, during the 2007/08 and 2008/09 crop years, producers could price a December futures contract for the BPC as early as September of the previous crop year.

However, since there was no data available for the PRO in order to calculate spreads for that period, observations from September to February were omitted.

The PRO in equation (10) is being used as a farmers' benchmark price to measure if producers gain or lose by signing a PPO contract. When a futures price exceeds the benchmark, producers will be more keen to use PPOs. However, if the benchmark is above the CWB futures price (or DPC/FlexPro price) producers most likely remain in the pool accounts. Figure 5 shows the CWB's nearby futures price and the PRO in 2006/07 and provides an illustration of how this price signal can affect marketing decisions. Therefore the futures price was below the PRO during most of the marketing window for the FPC (ignoring basis component and late sign up adjustment factor), so the price signal was mainly negative. This situation would signal to producers not to sign a FPC because the pool was expected to be higher than the nearby futures price (final pool price was $212.89/ton).

Figure 5. Marketing Window for FPC for the 2006/07 Crop Year



A positive relationship ($\theta_1 > 0$) between price spreads and the dependent variables in equation (9a)-(9d), which is expected, suggests that producers will use more PPOs when the difference between the CWB futures price and the PRO becomes positive or increases, and less PPOs when this difference becomes negative or decreases. If the relationship is negative ($\theta_1 < 0$), producers will use more PPOs when the difference between the CWB futures price and the PRO becomes negative or decreases, and use less PPOs when the difference becomes positive or increases. It is not expected that price spreads for the EPO will affect the decision to use the contract, since producers mostly use this contract for cash flow purposes.

Four values of the variable price spread are calculated for each producer. One is a simple average of the differences between CWB futures price (or DPC/FlexPro price) and the PRO price in the 10-days preceding the date when the producer priced a PPO contract (including the day when contract priced). The other is very similar, differing only in that it considers a 30-day period. Additionally, 10- and 30-day price spreads are also calculated with weighted averages. The weights for the 10- and 30-day periods are fixed, ranging from 1 to 10 and 1 to 30, respectively. For example, using the 10-day period, the window when producers priced a PPO will always have the fixed weights of 1 to 10, with the largest weight being applied to the most recent date and the smallest weight applied to the furthest date. Weighted averages are used to take into account the possibility that producers pay more attention to recent prices and less attention to past prices. Therefore, price spreads are calculated as 10- and 30-day simple averages, and 10- and 30-day weighted averages. If there is more than one PPO contract, the price signal for that producer is calculated as a weighted average based on tonnage on each day he/she priced a contract. If producers signed a contract before the 10- and 30-day simple average and weighted average, a simple cumulative average is used.

5.3.2.2.2 Price Trend

The second price signal is $\text{Price Trend}_{i,t}$, which indicates whether the current price is above or below the recent price trend. This variable is defined as the difference between the CWB futures price on the day the producer signed a PPO contract and the average CWB futures price for the 10-days before the contract was priced (including the day when contract was priced). If there were more than one pricing date, then weighted averages were used based on tonnage. Again the same pricing dates used for the price spread are used again for each producer, meaning only the futures price component for BPC and pricing dates for DPC are used.

If the current CWB futures price is above (below) the 10- or 30-day averages, then the variable has a positive (negative) value. A positive relationship $(\theta_2 > 0)$ between the price trend and the dependent variable suggests producers tend to market more (less) grain with PPOs when the futures price is above (below) the trend. A negative relationship $(\theta_2 < 0)$ suggests producers would market more (less) grain with PPOs when the futures price is below (above) the trend.

5.3.2.3 PPO Contract Usage in the Previous Crop Year

The relationship between current contract usage and previous year’s contract usage is also explored, and can shed light on whether habit plays a role in marketing decision. A positive relationship $(\beta_1 > 0)$ between the dependent variable and the same PPO contract in the previous year suggests that the more (less) a producer used the contract in the previous year the more (less) he/she will use that same contract in their current strategy. However, a negative relationship $(\beta_1 < 0)$ suggests that the more (less) producers use the same contract in the previous year, the less (more) they will use that same contract in their current marketing strategy.

In addition, variables on current usage of other PPO contracts are also included in the model. Since there is a limited quantity of wheat that can be marketed by each producer, usage of one contract should be reduced if other contracts are used. Therefore a negative relationship is expected between current use of one contract and current use of other contracts.

5.3.2.4 Harvest Progress at Signing

The measure for $\text{Harvest Progress at Signing}_{i,t}$ shows how much crop has already been harvested in the producers' province in the week that he/she priced a PPO contract. Data for harvest progress was obtained from the CWB and includes a weekly breakdown of the percentage of wheat harvested in each province (excluding British Columbia). A simple smoothing effect was adopted if the percentage of harvest progress dropped in value from one week to the next. This variable is calculated by matching the weekly percentage of harvest progress with the date the producer priced his/her PPO contract. For the FPC and EPO there is only one pricing date associated with each contract. However, for the BPC and DPC, the dates when the futures price and pricing components were locked in were used, respectively.

It is important to control for this variable since it is an indicator of how certain the producer is about the quantity and quality of grain that would be available to market. Therefore, the more wheat the producer has harvested the more certain about the amount of grain to price. So the more (less) advanced harvest is the more (less) certain the producer is about the amount of grain that needs to be priced. If this variable is significant to explain PPO usage, it would suggest that producers pay attention to the progress of their harvest before pricing their grain. Therefore a positive relationship $(\rho > 0)$ between $\text{Harvest Progress at Signing}_{i,t}$ and the dependent variable suggests that as harvest progress increases (decreases) (i.e. how close harvest is to being completed), producers will increase (decrease) PPO usage. A negative relationship $(\rho < 0)$ suggests that as harvest progress increases (decreases), PPO usage will decrease (increase).

5.4 Estimation of the Models

Previous research by Coval and Shumway (2005) identified possible ways to estimate models using pooled ordinary least squares (OLS), Fama and MacBeth, or panel regressions. Pooled OLS regression compiles all data together for each producer and year, while Fama and MacBeth estimates models by compiling data either by producer or by year. For the purpose of this research, a pooled OLS regression model is not adopted because it would not account for differences in producers' individual behaviour. While a Fama and MacBeth model compiling data by year is not adopted for the same reason. Finally, a Fama and MacBeth model compiling data by producer is not adopted because of the limited number of observations for each producer, since not all of them participated in the PPO programs each crop year. Furthermore, since only six crop years are used in this sample, the maximum number of observations for one producer is six.

Therefore, due to the nature of this research and limitations in the data, panel regression is the best method to estimate both models. Panel data considers both cross-sectional and time series dimensions of the data and allows the models to follow (or at least attempt to follow) the same individual across time (Wooldridge, 2002; Hsiao, 2003;

Pindyck and Rubinfeld, 1998; Kennedy, 2008). Panel regression allows our estimates to be more precise and accurate since a larger sample size can be used in the regressions.

5.4.1 Advantages of Panel Data Models

The major advantages of using panel data over other cross-sectional or time-series data sets are more data and accountability for unobserved effects. The unobserved effect will be discussed in more detail later. Panel data models allow researchers to estimate larger numbers of data points since there are two dimensions: a cross-sectional dimension and a time-series dimension (Hsiao, 2003; Baltagi, 2005). By pooling both cross-sectional and time-series data sets together, researchers are able to increase degrees of freedom and reduce collinearity between independent variables, thus improving the overall efficiency of the estimates in the model (Hsiao, 2003; Kennedy, 2008).

In addition, panel models allow researchers to attempt to resolve or at least reduce the magnitude of the unobserved variables that are correlated with the independent variables (Wooldridge, 2002; Hsiao, 2003; Pindyck and Rubinfeld, 1998). One of the simplest (but not always the best) methods of removing this influence is by taking the first differences of the individual observations.[32] Panel data sets also allow researchers to identify all the time-series observations for a specific individual by allowing for different intercepts (Kennedy, 2008).

By using panel models, more insight is given to how individuals behave because there is more quality in the estimates and increased precision (Cameron and Trivedi, 2005). As well, panel data enables more complicated behavioural models to be constructed and tested than just cross-sectional, time-series, or pooled data.

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[32] Later in the section we will discuss other methods of dealing with the unobserved effect that are better suited for panel data.

5.4.2 Issues with Using Panel Data Models

There are two major issues involving parameter estimates that arise when using panel data models. The first issue is that since most panel data comes from real life events, factors may influence different individuals. However, it is impossible to include all these factors for each individual. Therefore, individual effects in cross-sectional data or time-specific effects in time-series data that cannot be captured in the independent variables can cause parameter heterogeneity in the models (Hsiao, 2003). Ignoring heterogeneity may lead to inconsistent and biased estimates of the parameters if the unobserved effect is correlated with the independent variables (Hsiao, 2003). To deal with this, Hsiao (2003) suggests using a variable-intercept model, where all effects of omitted variables are driven by three types of variables, individual time-variant, period individual-invariant, and individual time-varying. Variable-intercept models absorb these effects and assume the variables are uncorrelated with the explanatory variables.

Another possible bias is that the given sample may not be randomly selected from the population (Hsiao, 2003). This can create selection bias that is caused when the specific group sampled is not a fair representation of the population. Non-random sampling can bias the least squared estimates resulting in them no longer being the best linear unbiased estimates, which can give unreliable coefficients, standard errors, and t-statistics.

5.5 Panel Data Procedure

Before identifying the procedure for estimating panel data sets, it is important to emphasize that panel models consider both an individual (cross-section) dimension and a time (time-series) dimension. Also, panel data allows the intercept and slope coefficients to vary for both individual and time (Cameron and Trivedi, 2005). Further, the models can be estimated by either a one-way error component that focuses on either the individual or time effect, or a two-way effect that focuses on both the individual and time effects together. Consider a simple linear regression model using panel data with n individuals and T time periods.

$$y_{i,t} = \alpha + X_{i,t}^{'}\beta + \varepsilon_{i,t} \qquad i = 1,...,n; t = 1,...,T \tag{11}$$

Where $y_{i,t}$ is the dependent variable for individual i at time t and $X_{i,t}^{'}$ is the independent variable for individual i at time t. If the panel data is balanced, there is the same number of observations each year, such that n is greater than one, T is greater than one, and the total number of observations is n·T (Wooldridge, 2002; Johnston and DiNardo, 1997). Therefore the data can be organized by decision units, where

$$y_i = \begin{bmatrix} y_{i,1} \\ y_{i,2} \\ \vdots \\ y_{i,T} \end{bmatrix} X_i = \begin{bmatrix} X_{i,1}^{1} & X_{i,1}^{2} & \cdots & X_{i,1}^{k} \\ X_{i,2}^{1} & X_{i,2}^{2} & \cdots & X_{i,2}^{k} \\ \vdots & \vdots & \ddots & \\ X_{i,T}^{1} & X_{i,T}^{2} & \cdots & X_{i,T}^{k} \end{bmatrix} \beta = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_k \end{bmatrix} \varepsilon_{i,t} = \begin{bmatrix} \varepsilon_{i,1} \\ \varepsilon_{i,2} \\ \vdots \\ \varepsilon_{i,T} \end{bmatrix}$$

and $\varepsilon_{i,t}$ is the random disturbance (error) term.

Baltagi (2005) and Frees (2004) indicate that in panel data for equation (11), i denotes the individuals and t denotes time. Therefore, a one-way individual error component model for equation (11) has a disturbance term indicated by equation (12).

$$\varepsilon_{i,t} = \mu_i + v_{i,t} \tag{12}$$

Where μ_i is the unobserved individual-specific effect and $v_{i,t}$ is the remainder disturbance term. The unobserved effect is included in the disturbance term since it is difficult and often impossible to measure, but it needs to be considered in the models because variables such as tastes and preferences or even peer pressure can influence individual's decisions. The unobserved effect is constant across time and considers individuals unobserved ability, being either independent or correlated with the independent variable $X_{i,t}^{'}$. On the other hand, the remainder disturbance varies across individual and time, and is assumed to be well-behaved and uncorrelated with the independent variables $X_{i,t}^{'}$ (Baltagi, 2005; Wooldridge, 2002; Croissant and Millo, 2008).

In the case of a two-way error component model, Baltagi (2005) and Frees (2004) indicate that the disturbance term for equation (11) is shown by equation (13).

$$\varepsilon_{i,t}=\mu_i+\lambda_t+v_{i,t} \tag{13}$$

Where once again μ_i is the unobserved individual effect and $v_{i,t}$ is the remainder disturbance term. The new term λ_t denotes the unobserved time effect. This term considers all time-specific effects not included in the regression (Baltagi, 2005). Ignoring time-specific effects can lead to biased estimators. Therefore, it is important to account for events which could affect behaviour, such as strike years, changes in government policies, and events that affect production supplies and prices.

Since the unobserved effects μ_i and λ_t can vary across individuals and time, it is possible that they could be correlated with the independent variables. Panel data uses two methods to deal with the unobserved effects, fixed effects and random effects methods. The fixed effects method suggests the unobserved effects are correlated with independent variables $X_{i,t}^{'}$, while the random effects method suggests the unobserved effects are uncorrelated with independent variables $X_{i,t}^{'}$. The following explanations of the fixed effects and random effects methods deal with one-way individual effects, but the same principles apply to time effects.

5.5.1 Fixed Effects Method

Wooldridge (2002) and Johnston and DiNardo (1997) identified that the objective of the fixed effects method is to eliminate the unobserved effect from the model because it is correlated with the independent variables. The fixed effects model allocates a dummy variable to each individual and allows for the possibility that each individual can have different intercepts, which in turn prevents biased results (Kennedy, 2008; Cameron and Trivedi, 2005). To apply the fixed effects method to the estimation procedure, consider the simple linear regression model from equation (11), including the two error components, unobserved effect, and remainder disturbance.

$$y_{i,t} = \alpha + X_{i,t}^{'}\beta + \mu_i + v_{i,t} \qquad i = 1,...,n; t = 1,...,T \qquad (14)$$

To transform equation (14) using fixed effects, the equation is averaged over time for each individual i.

$$\bar{y}_i = \alpha + \bar{X}_i^{'}\beta + \bar{\mu}_i + \bar{v}_i \qquad i = 1,...,n \qquad (15)$$

Since the unobserved effect μ_i is constant over time $\mu_i = \bar{\mu}_i$, by subtracting equation (15) from (14) for each t, equation (16) is obtained, where there is no individual effect because $\mu_i - \bar{\mu}_i = 0$.

$$y_{i,t} - \bar{y}_i = (X_{i,t}^{'} - \bar{X}_i^{'})\beta + (v_{i,t} - \bar{v}_i) \qquad i = 1,...,n; t = 1,...,T \qquad (16)$$

Equation (16) uses time-demeaned data and can be rewritten as equation (17).

$$\ddot{y}_{i,t} = \ddot{X}_{i,t}^{i}\beta + \ddot{v}_{i,t} \qquad i = 1,...,n; t = 1,...,T \qquad (17)$$

Where $\ddot{y}_{i,t} = y_{i,t} - \bar{y}_i$, $\ddot{X}_{i,t}^{'} = X_{i,t}^{'} - \bar{X}_i^{'}$ and $\ddot{v}_{i,t} = v_{i,t} - \bar{v}_i$ (Croissant and Millo, 2008). If an independent variable is constant over time for all i (time-invariant regressors), it is also removed by the fixed effect transformation since $X_{i,t} - \bar{X}_i = 0$ (Kennedy, 2008).

5.5.2 Random Effects Method

The random effects method is only appropriate to use when the unobserved effect μ_i is uncorrelated with the independent variables $X_{i,t}^{'}$. Unlike the fixed effects method, the random effects method does not eliminate the unobserved effect since it would lead to inefficient estimates because it is believed the unobserved effect is uncorrelated with each independent variable across all time periods (Wooldridge, 2002). Therefore, feasible generalized least squares (GLS) was applied to equation (18), which required the estimation of the variances of the two error components.

$$y_{i,t} = \alpha + X_{i,t}^{'}\beta + \mu_i + v_{i,t} \quad (18)$$

The disturbance term expressed as $\varepsilon_{i,t} = \mu_i + v_{i,t}$ can be used to rewrite equation (18).

$$y_{i,t} = \alpha + X_{i,t}^{'}\beta + \varepsilon_{i,t} \quad (19)$$

Since the disturbance term includes an unobserved effect μ_i, $\varepsilon_{i,t}$ is said to be serially correlated across time. Further, the major assumption regarding random effects is that the unobserved effect μ_i is uncorrelated with the independent variables $X_{i,t}^{'}$, the correlation between μ_i and $v_{i,t}$ is expressed in equation (20), where σ_μ^2 is the variance of μ_i and σ_v^2 is the variance of $v_{i,t}$.

$$\text{corr}(\varepsilon_{i,t}, \varepsilon_{i,s}) = \frac{\sigma_\mu^2}{(\sigma_\mu^2 + \sigma_v^2)}, t \neq s \quad (20)$$

Pooled OLS standard errors ignore the correlation, so the issue of serial correlation can be addressed with feasible GLS by defining $\theta = 1 - \left[\frac{\sigma_v^2}{(T\sigma_\mu^2 + \sigma_v^2}\right]^{1/2}$, which is between zero and one (Wooldridge, 2002). Then, equation (19) transforms into equation (21).

$$y_{i,t} - \theta\overline{y}_i = \alpha(1-\theta) + (X_{i,t}' - \theta\overline{X}_i)\beta + (\varepsilon_{i,t} - \theta\varepsilon_i) \tag{21}$$

Where $\overline{y}$ and $\overline{X}$ are time averages of y and X and the disturbance term is homeskedastic and serially uncorrelated (Croissant and Millo, 2008). In addition, θ is between zero and one.

Feasible GLS can then be used to estimate the model by estimating $\hat{\theta}$ since θ is unknown. Therefore, $\hat{\theta}$ takes the form of equation (22).

$$\hat{\theta} = 1 - \left\{1 \Big/ \left[1 + T\left(\frac{\hat{\sigma}_\alpha^2}{\hat{\sigma}_\eta^2}\right)\right]\right\}^{1/2} \tag{22}$$

Where $\hat{\sigma}_\alpha$ and $\hat{\sigma}_\eta$ are consistent estimators based on either pooled OLS or fixed effects (Wooldridge, 2002). Therefore if $\hat{\theta}$ equals zero it is appropriate to use pooled OLS and if $\hat{\theta}$ equals one, fixed effects method should be used (Wooldridge, 2002; Croissant and Millo, 2008). However in practice θ is never equal to zero or one. But, if $\hat{\theta}$ is relatively close to zero, random effects is close to pooled OLS and if $\hat{\theta}$ is relatively close to one, then random effects and fixed effects are essentially the same.

5.5.3 Fixed Effects or Random Effects

Choosing between fixed effects or random effects methods to estimate a panel model can be challenging. Wooldridge (2002) and Johnston and DiNardo (1997) both suggest that the best way to determine which method to use for estimating the model is to consider whether the unobserved effects μ_i are correlated with the independent variables $X_{i,t}^{'}$ or not. Therefore, if μ_i is correlated with the independent variables $X_{i,t}^{'}$ then the fixed effects method is appropriate. But if μ_i is uncorrelated with the independent variable $X_{i,t}^{'}$ then the random effects method should be used. While some researchers rely on the assumption that if the unobserved effects μ_i are parameters to be estimated then fixed effects should be used because the unobserved effects are related to the independent variables, but if they are outcomes of a random variable then random effects should be used because the variables are unrelated. However, there is no simple rule to follow, therefore a test can be used to evaluate whether there is correlation between μ_i and $X_{i,t}^{'}$.

5.5.4 Hausman's Test for Fixed Effects or Random Effects

The two methods to estimate panel models rely on the relationship between μ_i and $X_{i,t}^{'}$. If μ_i is uncorrelated with $X_{i,t}^{'}$, the use of random effects method would yield consistent and efficient estimates, while the fixed effects method would still generate consistent but no longer efficient estimates. Now, if μ_i is correlated with $X_{i,t}^{'}$, the fixed effects method would yield estimates that are both consistent and efficient, while the random effects method would generate inconsistent estimates. In order to identify which method to follow a Hausman test can be used (Johnston and DiNardo, 1997; Woolridge, 2002; Greene, 1997).

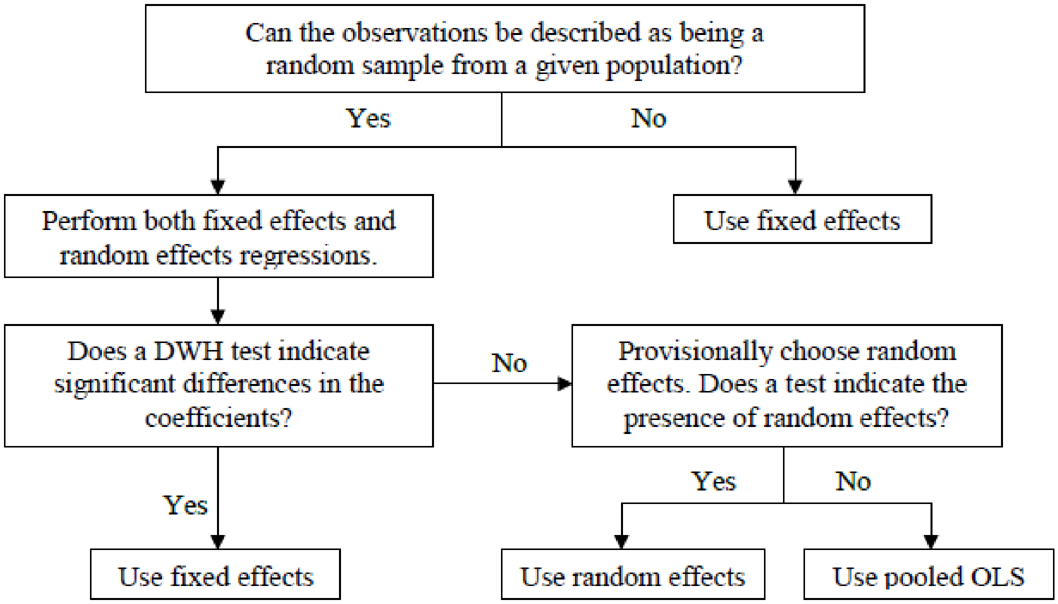
The null hypothesis for the Hausman test states μ_i and $X_{i,t}^{'}$ are uncorrelated, versus the alternative hypothesis that they are correlated. The test is based on differences between the two methods (Johnston and DiNardo, 1997; Greene, 1997). Further, Johnston and DiNardo (1997) indicate that the intuition of the test is whether leaving out the fixed effects in the random effects model has any effect on the consistency of the random effects estimates. Therefore, if the null hypothesis is not rejected, it would suggest that the appropriate method to use is random effects. The statistic for the Hausman test is defined by equation (23).

$$H = (\hat{\beta}_{RE} - \hat{\beta}_{FE})'(\Sigma_{FE} - \Sigma_{RE})^{-1}(\hat{\beta}_{RE} - \hat{\beta}_{FE}) \tag{23}$$

Where $\hat{\beta}_{RE}$ and $\hat{\beta}_{FE}$ are the estimates for the random effects and fixed effects estimates, and Σ_{FE} and Σ_{RE} are the covariance matrix for the fixed effects and random effects estimates, respectively. The Hausman test statistics is distributed as chi-squared χ^2 with k degrees of freedom. The parameter k for degrees of freedom indicates the number of random variables squared and summed to form H in equation (23) (Kennedy, 2008).

In addition, Dougherty (2007) indicated a similar way to deciding on which model to use for the panel data model (Figure 6). Where DWH stands for Durbin-Wu-Hausman test, which is the same as the Hausman test and the test used to evaluate the presence of random effects is the Breusch-Pagan Lagrange Multiplier test.

Figure 6. Choice of Regression Model for Panel Data



Source: Dougherty (2007)

Chapter 6: Results

6.1 Introduction

Chapter 6 presents the results from the estimation of the models indicated in the methodology section. Each model is discussed separately, hence the chapter is divided into two sections.

6.2 Model 1: Are Canadian Producers Overconfident?

6.2.1 Descriptive Statistics

Descriptive statistics are provided in Table 6 for producer's pricing performance with respect to the pool (farmer benchmark).[33] Average performance varies substantially but is positive in five out of six crop years, indicating that on average producers who used PPOs were able to outperform the pool in those years (Table 6). For example, average performance was $10.68/ton in 2006/07, meaning producers who used PPOs were able to receive, on average, $10.68/ton above the pool price.[34] Since the pool price was $212.89/ton in 2006/07, the average performance implies approximately a five percent gain over the pool. On the other hand, 2007/08 was the only year with negative average performance, indicating producers on average made $90.87/ton less than the pool price. Considering the pool price was $372.06/ton in that year, this performance means a 24 percent loss compared to the pool. Focusing on each province, Manitoba has the highest average performance for the most crop years, followed by Saskatchewan and Alberta. The null hypothesis that average performance is equal to zero was tested for each year, against the alternative hypothesis that it is greater than zero (or less than zero in 2007/08).

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[33] See Appendix F for histograms of performance measures.

[34] Producers would have received the pool price if they had not used PPOs.

Calculated t-statistics indicate the null hypothesis should be rejected. Although, most producers were able to obtain prices above the pool in five out of six years (2007/08 is again the exception), the proportion of them outperforming the pool varies across years. The variability in performance can also be seen by looking at the standard deviations and maximum and minimum values. The same quantitative findings hold when performance is measured against the market benchmarks (Appendix F and G).

Table 6. Descriptive Statistics-Performance with Respect to the Pool*

	Crop Year					
Location/Statistic	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Western Canada─Performance** ($/ton)						
Average	3.77	20.47	6.57	10.68	-90.87	31.50
Standard deviation	8.78	16.82	11.04	9.99	39.79	64.20
t-statistic***	6.98	58.64	22.82	80.75	-177.49	28.40
Minimum	-15.72	-50.94	-21.54	-25.03	-186.68	-105.50
Maximum	30.72	44.43	43.48	43.66	308.58	155.60
Number of Producers	264	2,322	1,470	5,705	6,040	3,351
Number w/ Positive Performance	158	2,073	1,148	4,905	200	2,135
Number w/ Negative Performance	106	249	322	798	5,840	1,216
Alberta─Performance** ($/ton)						
Average	1.82	22.24	6.18	9.88	-94.07	37.14
Standard deviation	6.05	13.30	10.54	10.00	34.33	64.90
t-statistic***	1.83	43.22	12.30	43.97	-125.33	20.32
Minimum	-7.81	-48.07	-15.19	-23.74	-180.42	-105.50
Maximum	12.67	32.60	43.48	38.08	188.97	150.92
Number of Producers	37	668	440	1,981	2,092	1,261
Number w/ Positive Performance	17	618	351	1,659	46	853
Number w/ Negative Performance	20	50	89	322	2,046	408
Saskatchewan─Performance** ($/ton)						
Average	3.32	23.68	6.25	10.19	-91.69	39.04
Standard deviation	9.14	14.30	10.64	9.55	44.78	66.02
t-statistic***	4.17	46.90	14.87	50.98	-94.70	18.17
Minimum	-14.58	-50.94	-18.53	-25.03	-186.69	-98.25
Maximum	30.72	39.11	42.58	41.93	308.58	155.60
Number of Producers	132	802	641	2,287	2,139	944
Number w/ Positive Performance	79	750	498	1,941	83	637
Number w/ Negative Performance	53	52	143	345	2,056	307
Manitoba─Performance** ($/ton)						
Average	5.12	16.03	7.54	12.63	-86.57	18.69
Standard deviation	9.08	20.28	12.17	10.42	39.07	59.98
t-statistic***	5.44	23.00	12.20	45.79	-94.11	10.51
Minimum	-15.72	-50.94	-21.54	-24.95	-158.64	-104.39
Maximum	27.87	44.43	42.58	43.66	305.19	155.18
Number of Producers	93	847	388	1,427	1,804	1,138
Number w/ Positive Performance	60	700	298	1,297	71	637
Number w/ Negative Performance	33	147	90	129	1,733	501

*Pool prices were $211.14/ton in 2003/04, $205.10/ton in 2004/05, $195.14/ton in 2005/06, $212.89/ton in 2006/07, $372.06/ton in 2007/08, and $311.03/ton in 2008/09

** $\text{Performance}_{i,t} = (\text{price received}_{i,t} - \text{benchmark}_t)$

***Ho: average performance = 0, Ha: average performance > 0 (or < 0)

With respect to PPO usage, producers had been generally increasing the use of the DPC, FPC, or BPC over time until 2007/08, both in terms of number of producers using these contracts and portion of crop priced with them (Table 6 and 7). However, both indicators dropped dramatically in 2008/09. The number of producers using PPOs in this research reached 6,040 in 2007/08 and then dropped to 3,351 in 2008/09 (Table 6).[35] The portion of producers total wheat crop priced with PPOs decreased from around 51 percent to 35 percent in 2008/09. This is probably related to the poor pricing performance of PPOs in 2007/08 (Table 6). In that crop year producers who used PPOs received, on average, $90.87/ton below the pool price, while some received prices that were almost $187/ton below the pool price. In addition, 2007/08 was an unusual year also because a very large number of producers who used PPOs performed below the pool (Table 6).

Table 7. Percentage of Crop Priced with PPO Contracts (DPC, FPC, BPC)

Crop Year	Average	Standard deviation	Minimum	Maximum
2003/04	41.71	30.70	1.31	100.00
2004/05	47.63	31.20	1.27	100.00
2005/06	49.52	30.69	1.05	100.00
2006/07	52.16	29.86	2.10	100.00
2007/08	62.38	29.25	0.43	100.00
2008/09	35.63	26.23	0.27	100.00

6.2.2 Regression Results

As indicated by the Hausman test, a panel regression model with fixed effects was used to estimate the first model for Western Canada (all producers), Alberta,

[35] These numbers reflect the sample used in this model, not the whole population of wheat producers in Western Canada.

Saskatchewan, and Manitoba.[36] The method used by Dougherty (2007) in Figure 6 also resulted in the same conclusion to use the fixed effects method. The regressions contain unbalanced data since the number of producer observations varies across years. Results of the estimated model with individual specific effects are presented in Tables 8 to 11, which show point estimates and standard errors of all parameters in equation (4). Table 8 shows results when performance (dependent variable) is measured with respect to the farmer benchmark (pool price), while the other tables show results when performance is measured with respect to market benchmarks (24-, 20-, and 12-month average futures prices). The model was also tested for the presence of heteroskedasticity and serial correlation in the residuals with a modified Wald test and the Wooldridge test, respectively. Both null hypotheses that heteroskedasticity and serial correlation were not present were rejected. Therefore robust covariance estimators were used.

[36] Western Canada includes producers who did not indicate the province in which they farm. Therefore the total number of producers for Western Canada will be greater than the sum of producers in the three provinces.

Table 8. Estimated Panel Regression Models-Performance Measured with Respect to Farmer Benchmark (pool price) ($/ton)

$$Performance_{i,t} = \alpha + \beta_D (\%DPC)_{i,t} + \beta_F (\%FPC)_{i,t} + \beta_B (\%BPC)_{i,t} + \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t}$$

	All Producers (2003/04-2008/09)		Alberta (2003/04-2008/09)		Saskatchewan (2003/04-2008/09)		Manitoba (2003/04-2008/09)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	131.32	2.00***	142.84	3.47***	123.15	3.83***	116.93	3.08***
$\%DPC_t$	-0.46	0.04***	-0.21	0.09**	-0.30	0.07***	-0.74	0.06***
$\%FPC_t$	-1.59	0.03***	-1.77	0.06***	-1.29	0.06***	-1.67	0.05***
$\%BPC_t$	-1.17	0.06***	-1.45	0.11***	-0.93	0.10***	-1.03	0.08***
$Month_t$	-188.01	2.52***	-206.28	4.03***	-204.86	4.63***	-146.20	4.45***
$Activeness_t$	61.67	2.86***	84.64	5.48***	45.13	5.22***	49.69	4.06***
R^2 within	0.41		0.44		0.35		0.48	
between	0.00		0.00		0.00		0.02	
overall	0.16		0.14		0.14		0.26	
Number of observations	19,152		6,479		6,945		5,697	
Number of producers	7,388		2,444		2,828		2,102	

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

Table 9. Estimated Panel Regression Models-Performance Measured with Respect to 24-Month Market Benchmark ($/ton)

$$Performance_{i,t} = \alpha + \beta_D (\%DPC)_{i,t} + \beta_F (\%FPC)_{i,t} + \beta_B (\%BPC)_{i,t} + \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t}$$

	All Producers (2003/04-2008/09)		Alberta (2003/04-2008/09)		Saskatchewan (2003/04-2008/09)		Manitoba (2003/04-2008/09)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	85.68	1.41***	96.96	2.12***	80.60	2.65***	76.46	2.58***
$\%DPC_t$	0.40	0.03***	0.54	0.06***	0.43	0.05***	0.26	0.06***
$\%FPC_t$	-0.38	0.02***	-0.44	0.04***	-0.30	0.04***	-0.40	0.04***
$\%BPC_t$	-0.15	0.04***	-0.26	0.07***	-0.06	0.07	-0.13	0.08
$Month_t$	-147.02	2.07***	-169.78	3.04***	-143.63	3.55***	-124.07	4.18***
$Activeness_t$	10.70	2.00***	15.62	3.36***	2.04	3.52	12.82	3.46***
R^2 within	0.32		0.43		0.27		0.26	
between	0.06		0.09		0.04		0.07	
overall	0.21		0.30		0.16		0.18	
Number of observations	19,152		6,479		6,945		5,697	
Number of producers	7,388		2,444		2,828		2,102	

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

Table 10. Estimated Panel Regression Models-Performance Measured with Respect to 20-Month Market Benchmark ($/ton)

$$Performance_{i,t} = \alpha + \beta_D (\%DPC)_{i,t} + \beta_F (\%FPC)_{i,t} + \beta_B (\%BPC)_{i,t} + \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t}$$

	All Producers (2003/04-2008/09)		Alberta (2003/04-2008/09)		Saskatchewan (2003/04-2008/09)		Manitoba (2003/04-2008/09)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	93.68	1.51***	104.87	2.26***	86.57	2.90***	85.72	2.73***
$\%DPC_t$	0.29	0.04***	0.48	0.07***	0.36	0.06***	0.10	0.06
$\%FPC_t$	-0.55	0.02***	-0.62	0.04***	-0.40	0.05***	-0.59	0.04***
$\%BPC_t$	-0.25	0.05***	-0.42	0.08***	-0.08	0.08	-0.24	0.08***
$Month_t$	-172.41	2.17***	-194.54	3.19***	-171.45	3.79***	-147.70	4.40***
$Activeness_t$	16.72	2.13***	24.71	3.57***	4.65	3.85	18.30	3.63***
R^2 within	0.36		0.46		0.31		0.32	
between	0.07		0.07		0.04		0.08	
overall	0.23		0.30		0.19		0.22	
Number of observations	19,152		6,479		6,945		5,697	
Number of producers	7,388		2,444		2,828		2,102	

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

Table 11. Estimated Panel Regression Models-Performance Measured with Respect to 12-Month Market Benchmark ($/ton)

$$Performance_{i,t} = \alpha + \beta_D(\%DPC)_{i,t} + \beta_F(\%FPC)_{i,t} + \beta_B(\%BPC)_{i,t} + \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t}$$

	All Producers (2003/04-2008/09)		Alberta (2003/04-2008/09)		Saskatchewan (2003/04-2008/09)		Manitoba (2003/04-2008/09)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	184.55	2.39****	197.76	4.18***	169.37	4.60***	176.79	3.63***
$\%DPC_t$	-0.88	0.05***	-0.59	0.11***	-0.63	0.08***	-1.25	0.07***
$\%FPC_t$	-2.11	0.04***	-2.37	0.07***	-1.65	0.08***	-2.21	0.06***
$\%BPC_t$	-1.65	0.07***	-2.07	0.14***	-1.24	0.13***	-1.43	0.10***
$Month_t$	-241.35	3.14***	-249.46	5.05***	-262.45	5.81***	-207.21	5.47***
$Activeness_t$	85.70	3.54***	117.14	6.83***	62.66	6.49***	69.20	4.86***
R^2 within	0.45		0.47		0.38		0.56	
between	0.00		0.00		0.00		0.04	
overall	0.18		0.14		0.15		0.32	
Number of observations	19,152		6,479		6,945		5,697	
Number of producers	7,388		2,444		2,828		2,102	

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

Almost all estimated coefficients are statistically distinguishable from zero at the one percent significance level. The percentage of wheat priced using DPCs have negative coefficients that are statistically distinguishable from zero, except for the 24- and 20-month benchmarks, which are positive. The percentage of wheat priced with FPCs and BPCs all have negative coefficients and are distinguishable from zero, with the exception of the 24-month benchmark for Saskatchewan and Manitoba and 20-month benchmark for Saskatchewan, which are not distinguishable from zero. Since the estimated coefficients, for $\%DPC_t$, $\%FPC_t$, and $\%BPC_t$ are mostly negative, it suggests there is a negative relationship between performance and PPO usage. On average, pricing larger portions of the crop with PPOs tends to decrease performance. For example, if a producer increases the proportion of wheat priced with a FPC by 10 percentage points his/her performance decreases by $15.90/ton (Table 8, all producers). Similarly, an increase of 10 percentage points of wheat priced by a producer with a BPC decreases his/her performance by $11.70/ton.

The estimated coefficients for $Month_t$ all have negative signs, indicating that larger (smaller) values for the month variable leads to worse (better) performance. This finding implies that, on average, producers who sign PPO contracts earlier in the marketing window perform better compared to those who sign and/or price PPO contracts later in the marketing window. For example, producers who sign and/or price a PPO in the first month of the marketing window can expect on average to make $188.01/ton more than those who price at the end of the marketing window (Table 8, all producers).[37]

[37] Month is calculated based on the date the producer prices a PPO contract during the marketing window. The marketing window ranges from zero to one, with zero being the first month of the window and one being the last month. Therefore the value is calculated by dividing the months from the start of the window by the total number of months in the entire marketing window.

The estimated coefficients for activeness index have positive signs in all models. Positive coefficients imply that, on average, producers with more active pricing strategies tend to perform better than those with less active strategies. For example, the most active, average, and least active producers in the sample have activeness indexes of 3.02, 0.00, and -2.07, respectively (Table 12). Based on these figures and the estimated coefficients for the activeness index for all producers for performance with respect to the farmer benchmark (Table 8), the most active producer has an expected performance of $186.11/ton higher than the average producer and $314.30/ton higher than the least active producer. This is consistent with the notion that producers have better information or skills to time the market, since the ones who actively use PPOs tend to receive higher prices compared to those who adopt more passive strategies.

Table 12. Activeness Index–Summary Statistics

	Average	Standard deviation	Min.	Max.	Number of Observations
All Producers					
6 Crop Years: (2003/04 to 2008/09)	0.00	0.63	-2.07	3.02	19,152
4 Crop Years: (2003/04 to 2006/07)	0.00	0.70	-1.31	3.01	6,081

Table 13 shows the elasticities of performance with respect to each variable from the 2003/04 to 2008/09 crop years.[38] The results for all producers reveal that, on average, if a producer increases his/her use of a DPC by one percent his/her performance would increase by 0.17 percent, while if he/she were to increase their FPC usage by one percent, performance would increase by 3.07 percent. As well, on average, if a producer increases his/her BPC usage by one percent his/her performance would only increase by 0.90

[38] Elasticity values are calculated at the means of the variables. Descriptive statistics of those variables are in Appendix H.

percent. These results suggest that producers' performance would improve relatively more by using FPCs over the other PPO contracts. On the other hand, if a producer prices his/her wheat one percent sooner in the marketing window ($Month_t$) their performance increases by 4.65 percent, on average. Additionally, if a producer increases his/her activeness by one percent, their performance would decrease by 0.02 percent, on average.

Table 13. Mean Values and Elasticity-Performance with Respect to Each Variable

	All Producers	Alberta	Saskatchewan	Manitoba
Mean values				
Performance ($/ton)*	-16.92	-17.40	-16.11	-17.54
$\%DPC_t$	6.06	5.10	6.09	7.15
$\%FPC_t$	32.61	35.00	33.09	29.26
$\%BPC_t$	12.93	8.48	12.92	17.98
$Month_t$	0.42	0.42	0.40	0.44
$Activeness_t$	0.01	-0.03	0.00	0.04
Elasticities at means*				
$\%DPC_t$	0.17	0.06	0.11	0.30
$\%FPC_t$	3.07	3.56	2.66	2.78
$\%BPC_t$	0.90	0.71	0.74	1.05
$Month_t$	4.65	4.93	5.14	3.66
$Activeness_t$	-0.02	0.13	-0.01	-0.13

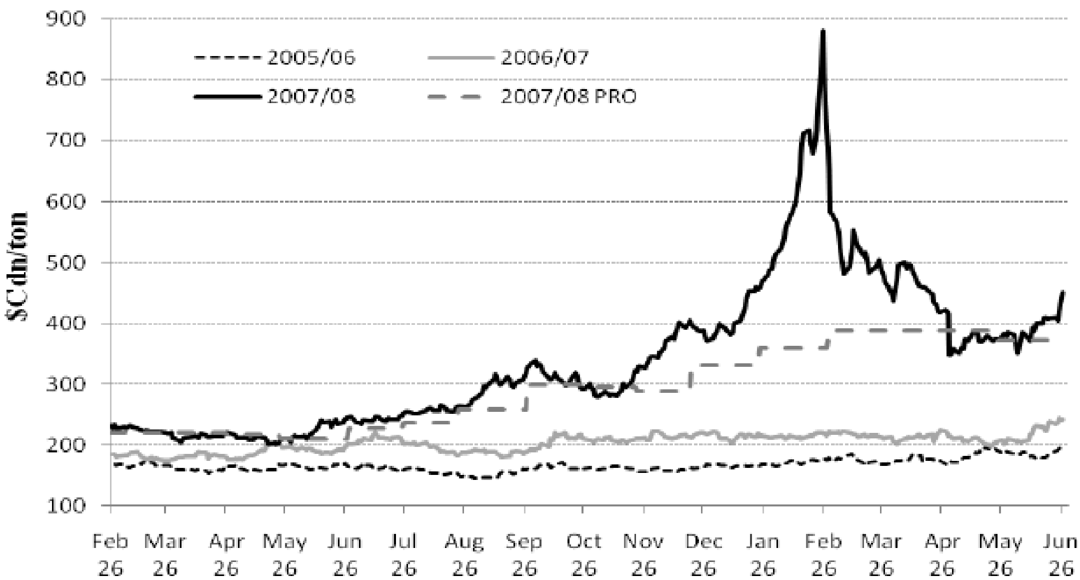
*Dependent variable for performance is measured against a farmer benchmark (pool price)

Therefore, it can be concluded that the elasticities calculated at the mean values show that the percentage of FPC usage and the month that a producer signs and/or prices PPO contracts have relatively large impacts on performance (Table 13). Additionally, the same conclusions can be made for each province since the results for each individual province are essentially the same as with all producers. On the other hand, even though activeness has a positive coefficient, the magnitude of the impact on performance is relatively small.

At first sight general results presented in Tables 8 through 11 could appear inconsistent with the descriptive analysis, which indicates that most producers who use PPOs outperform the pool in five of six crop years. However, Table 6 also shows that in 2007/08, 97 percent of producers using PPOs performed worse than the pool (5,840 producers out of a total of 6,040). This was the largest proportion of producers performing worse than the pool in all six crop years included in the sample, as well as the largest difference from the pool price on average.

Therefore, it is worth exploring whether regression results show a negative relationship between PPO usage and performance, which might be driven by the unique crop year that occurred in 2007/08. Figure 7 shows the nearby futures prices over three crop years (2005/06, 2006/07, and 2007/08) as well as the 2007/08 PRO. It is clear that during the 2007/08 crop year the nearby futures prices were above the 2007/08 PRO, as well as the 2005/06 and 2006/07 futures prices. These large futures prices might have led many producers to sign and lock in prices early in the 2007/08 marketing window. For instance, if a producer wanted to sign a FPC they had to do so by October 31, 2007, when futures prices were slowly increasing in value, but after the FPC marketing window closed, prices spiked to record highs. Therefore those who signed and/or priced a DPC, FPC, and BPC early in the marketing window missed these higher prices. These higher prices that occurred after the marketing window closed for each contract, may have distorted the performance measure used in this research substantially more than other years, since the final pool price was much higher than most producers PPO contract prices (final pool price in 2007/08 was $372.06/ton).

Figure 7. The CWB Nearby Futures Prices and PRO ($/ton)



Since the model might be highly influenced by the 2007/08 crop year, it was re-estimated without the 2007/08 and 2008/09 crop years. The results with only the first four crop years (2003/04 to 2006/07) are presented in Appendix I. The signs of the coefficients for most of the variables remain the same, with slight changes occurring for the percentage of wheat priced with the DPC and FPC. For the DPC, there are negative coefficients when using the farmer (Alberta), 24- (all producers, Saskatchewan, and Alberta), 20-, and 12-month benchmarks. However, the farmer and 24-month benchmarks are not always distinguishable from zero. The farmer (all producers, Saskatchewan, and Manitoba) and 24-month (Manitoba) benchmarks have positive coefficients. As for the FPC, all have the same sign as with the six crop years, except for the farmer benchmark for Manitoba which has a positive coefficient, but is not statistically distinguishable from zero. Major changes occur in the magnitudes of the values for each of the coefficients with large changes occurring for $Month_t$ and activeness index, where values decreased. For example, looking at performance with respect to the farmer benchmark for all producers, the estimated coefficient for month went from -188.01 using all six years to -13.20 using only four crop years, while for activeness index, it went from 61.67 to 11.36. Therefore the new month coefficient suggests that producers who sign and/or price PPO contracts in the first month of the marketing window can expect on average to make $13.20/ton more than those who price at the end of the marketing window. As for activeness, the most active producer has an expected performance of $34.20/ton higher than the average producer, since the most active and average producer in the sample have activeness indexes of 3.01 and 0.00, respectively (Table 12).

Additionally, the elasticities calculated at the mean values for the four years (2003/04 to 2006/07) show that all variables have relatively small impacts on performance (Table 14) compared to when all six crop years are estimated.

Table 14. Mean Values and Elasticity-Performance with Respect to Each Variable, 2003/04 to 2006/07 Crop Years

	All Producers	Alberta	Saskatchewan	Manitoba
Mean values				
Performance ($/ton)*	12.03	12.20	11.91	12.00
$\%DPC_t$	4.80	5.14	4.77	4.54
$\%FPC_t$	30.56	33.39	32.28	25.30
$\%BPC_t$	16.23	10.69	16.09	21.95
$Month_t$	0.34	0.32	0.33	0.36
$Activeness_t$	0.00	-0.09	0.01	0.09
Elasticities at means*				
$\%DPC_t$	0.02	0.01	0.01	0.05
$\%FPC_t$	-0.23	-0.52	-0.21	0.01
$\%BPC_t$	-0.41	-0.35	-0.45	-0.28
$Month_t$	-0.37	-0.42	-0.30	-0.37
$Activeness_t$	0.00	-0.10	0.01	0.04

*Dependent variable for performance is measured against a farmer benchmark (pool price)

6.3 Model 2: How Canadian Wheat Producers' Make Marketing Decisions?

6.3.1 Descriptive Statistics

Descriptive statistics for the second model focus on PPO usage and price signals provided in Table 15. The descriptive statistics for each variable vary substantially for the averages for each type of PPO contract. For the same PPO contract used in period $t-1$, the EPO has the largest average, while the DPC has the smallest. The averages for the dependent variables for each PPO contract are included in the summary statistics and they have the highest averages when compared to the same contract usage for the other regressions and the highest averages when compared to the other PPO contracts used in the same regression. It is also worthwhile mentioning that for these dependent variables the minimums are never zero since producers had to have used the specific PPO contract to be included in the regression. Not considering the dependent variable statistics for the percentage of wheat delivered to PPOs, the BPC has the highest average when compared to the other contracts for two of the four regressions (the one time when it does not have the highest average is when the EPO is the dependent variable). As well, the EPO has the lowest average percentage of wheat delivered for three of the four regressions, again the one time it does not is when it is the dependent variable. The average price spread and price trend are substantially higher for the FPC for both price signals when compared to the other contracts and lowest for the EPO for both as well. The other PPOs also have very small averages when compared to the FPC. See Appendix J for the remaining descriptive statistics.

Table 15. Descriptive Statistics for PPO Usage in Period t and t-1 and Price Signals

Variable/Statistic	Producer Payment Option (PPO) Fixed Price Contract (FPC)	Basis Price Contract (BPC)	Daily Price Contract (DPC)	Early Payment Option (EPO)
Same PPO_{t-1}				
Average	26.96	21.80	18.15	50.44
Standard deviation	30.16	31.29	28.54	36.56
Minimum	0.00	0.00	0.00	0.00
Maximum	100.00	100.00	100.00	100.00
Percentage of wheat delivered to FPC_t				
Average	43.97	14.55	14.02	8.11
Standard deviation	28.63	20.90	19.22	17.07
Minimum	0.40	0.00	0.00	0.00
Maximum	100.00	96.50	91.95	95.56
Percentage of wheat delivered to BPC_t				
Average	6.06	42.77	9.40	2.76
Standard deviation	14.99	28.59	16.67	10.33
Minimum	0.00	1.42	0.00	0.00
Maximum	95.49	100.00	94.79	92.18
Percentage of wheat delivered to DPC_t				
Average	4.11	5.77	40.12	1.56
Standard deviation	13.74	15.36	29.30	8.21
Minimum	0.00	0.00	0.49	0.00
Maximum	94.27	94.15	100.00	94.44
Percentage of wheat delivered to EPO_t				
Average	5.46	4.86	3.09	54.85
Standard deviation	15.54	14.08	10.48	29.73
Minimum	0.00	0.00	0.00	1.27
Maximum	96.77	96.43	92.81	100.00
10-Day Price $Spread_t$ ($/ton)*				
Average	15.15	0.56	5.60	-2.92
Standard deviation	22.24	37.70	53.01	65.41
Minimum	-52.89	-55.04	-71.48	-56.82
Maximum	69.56	371.12	331.76	371.12
10-Day Price $Trend_t$ ($/ton)				
Average	11.20	0.90	0.93	-3.79
Standard deviation	12.18	15.09	18.41	17.22
Minimum	-18.14	-63.60	-63.60	-63.60
Maximum	25.63	35.81	26.11	35.81

*Price Spread is based on summary statistics for simple averages

6.3.2 Regression Results

As indicated by the Hausman test, the fixed effects method was used for the estimation of the second model for equations (9a)-(9d) for the FPC, BPC, DPC, and EPO. Again, only individual effects are considered for the panel regression. Furthermore, the null hypotheses that heteroskedasticity and serial correlation were not present were rejected, therefore robust covariance estimators were used. The regressions contain unbalanced data for five crop years with one lagged variable. Results are presented in Table 16, which show point estimates and standard errors of all parameters in the four equations explaining usage of FPCs, BPCs, DPCs, and EPOs.

Table 16. Estimated Panel Regress Model Using 10-Day Price Signals and Performance with Respect to Farmer Benchmark

	Fixed Price Contract (FPC) (2004/05-2008/09) (a)		Basis Price Contract (BPC) (2004/05-2008/09) (a)		Daily Price Contract (DPC) (2005/06-2008/09) (a)		Early Payment Option (EPO) (2004/05-2008/09) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	46.19	0.64***	60.14	1.86***	57.90	3.82***	64.83	2.51***
Same PPO_{t-1}	-0.20	0.02***	-0.11	0.02***	-0.12	0.03***	-0.18	0.02***
$\%EPO_t$	-0.43	0.02***	-0.48	0.05***	-0.49	0.08***		
$\%DPC_t$	-0.41	0.03***	-0.41	0.04***			-0.50	0.06***
$\%FPC_t$			-0.63	0.04***	-0.47	0.06***	-0.52	0.04***
$\%BPC_t$	-0.49	0.03***			-0.49	0.06***	-0.63	0.06***
$Performance_{t-1}$ (b)	0.06	0.01***	0.15	0.02***	0.01	0.02	0.02	0.02
Harvest Progress at $Signing_t$	0.08	0.01***	-0.01	0.02	-0.05	0.04	0.07	0.03***
10-Day Price $Spread_t$	0.01	0.02	0.10	0.02***	0.22	0.02***	-0.03	0.01***
10-Day Price $Trend_t$	0.71	0.04***	0.12	0.05***	0.54	0.07***	0.00	0.05
R^2 within	0.44		0.34		0.53		0.19	
between	0.08		0.13		0.28		0.07	
overall	0.15		0.17		0.31		0.08	
Number of observations	8,547		2,591		2,000		5,112	
Number of producers	5,982		1,865		1,543		3,557	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, DPC, and EPO)

(b) Marketing performance is measured against a farmer benchmark (pool price)

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

In all equations the estimated coefficients for the variable related to usage of the same marketing contract in the previous year have negative signs and are all statistically distinguishable from zero (Table 16). For example, in the FPC equation, the estimated coefficient for the percentage of wheat priced with a FPC in the previous year is -0.20 (Table 16). This result shows a negative relationship between FPC usage in the current year and FPC usage in the previous year, suggesting the more producers on average use a FPC in period t-1 the less they will use it in period t. The same results are found for all other marketing contracts. A possible explanation for this finding is that the contracts are still relatively new instruments and in general no producer has consistently used them over the six crop years.

As for the other marketing contracts used in the current year, all coefficients are negative and statistically significant. This result is expected since there is a given quantity of wheat to be priced each year. If more wheat is priced using one contract, less wheat is left to be priced using the other contracts. For example, if the proportion of wheat priced under the DPC increases by 10 percentage points, the proportion of wheat priced with the FPC decreases by 4.10 percentage points (Table 16).

In Table 16 marketing performance is measured against the pool price. The estimated coefficients related to Performance_{t-1} are all positive and statistically distinguishable from zero, except for the DPC and EPO in terms of statistical significance (Table 16). This result indicates that producers who achieved positive marketing performance in the previous year tend to use more PPOs in the current year and the better the previous performance the more they will use PPOs. Since performance is measured against the pool price, positive performance means the producer received a price above the pool price. The more positive the performance, the higher the price received by the producer is relative to the pool price. Therefore this result is showing that producers who obtained prices above the pool price in the previous year (which can only happen through the use of PPOs) are likely to price their crop with PPOs in the current year. For example, if a producers' performance in the previous year is $10/ton above the average, then his/her current proportion of wheat priced with a FPC will be 0.60 percentage points above the average (Table 16).

The estimated coefficients for $\text{Harvest Progress at Signing}_t$ on the day marketing contracts were priced show positive signs in the FPC and EPO equations, which are statistically significant, and negative signs in the BPC and DPC equations, but are not statistically distinguishable from zero (Table 16). This positive relationship between harvest progress and FPC and EPO usage indicates producers on average tend to wait until a portion of their harvest is complete before committing to a marketing contract. This suggests that if producers on average have 100 percent of their wheat harvested, the percentage of their crop priced with EPOs and FPCs will be seven and eight percentage points higher compared with a producer who has not harvested anything (Table 16). It was expected that this variable would be significant for the EPO model because of the characteristics of the contract. The price producers receive when they sign an EPO is based on the PRO price, which is updated regularly by the CWB. Therefore, when producers chose to use EPOs they should only be signing the contract close to the time they plan to deliver the grain. In this context they need to be sure they will have grain to deliver, hence it is important for EPO users to follow their harvest pace to make marketing decisions.

Looking at the price signals, coefficients for the 10-day price spread (futures price minus PRO price)[39] are all statistically distinguishable from zero, except for the FPC. Coefficients are positive in the BPC and DPC equations, and negative in the EPO equation (Table 16). These findings suggest producers on average tend to use more BPCs and DPCs, and less EPOs as the futures price rises above the PRO price. This finding is consistent with the characteristics of the marketing contracts. BPCs and DPCs are based on futures prices and are mainly used by producers who want to obtain higher prices than the pool. Therefore they are expected to be used more heavily as producers see futures price above the PRO price, which represents the expected pool price. As for the EPO, it is based on the PRO price and is essentially used for cash flow management. Thus higher futures prices would be unlikely to drive producers to use EPOs. For the other pricing signal (10-day PriceTrend_t), coefficients are positive and statistically distinguishable from zero for the FPC, BPC, and DPC, but not statistically significant for the EPO (Table 16). That is expected for the EPO because of its contract characteristics as discussed previously. Results for the market benchmarks are essentially the same (see Appendix K).

Table 17 shows the elasticities of PPO usage at the means for each variable across each PPO contract for the 2004/05 to 2008/09 crop years.[40] Although the affects of each variable are essentially the same as for the FPC, the variables that have the largest impact of the dependent variable (contract usage in current year) are very different for each contract. For the FPC, the 10-day price trend has the largest impact on FPC usage followed by FPC usage in the previous year, while the percentage of FPC usage in the

[39] Or the CWB DPC/FlexPro price minus the PRO price.
[40] DPC/FlexPro includes only the 2006/07 to 2008/09 crop years.

current year has the largest impact on the BPC and DPC equations. The EPO is greatly influenced by EPO usage in the previous year, followed closely by harvest progress.

Table 17.Mean Values and Elasticity-Contract Usage with Respect to Each Variable

	Producer Payment Option (PPO)			
	Fixed Price Contract (FPC)	Basis Price Contract (BPC)	Daily Price Contract (DPC)	Early Payment Option (EPO)
Mean values				
Same PPO_{t-1}	26.96	21.80	18.15	50.44
$\%EPO_t$	5.46	4.86	3.09	54.85
$\%DPC_t$	4.11	5.77	40.12	1.56
$\%FPC_t$	43.97	14.55	14.02	8.11
$\%BPC_t$	6.06	42.77	9.40	2.76
$Performance_{t-1}$ ($/ton)*	-4.73	-2.79	-10.77	2.36
Harvest Progress at $Signing_t$	29.69	73.65	83.70	84.52
10-Day Price $Spread_t$**	15.15	0.56	5.60	-2.92
10-Day Price $Trend_t$	11.20	0.90	0.93	-3.79
Elasticities at means				
Same PPO_{t-1}	-0.13	-0.06	-0.05	-0.17
$\%EPO_t$	-0.05	-0.05	-0.04	
$\%DPC_t$	-0.04	-0.06		-0.01
$\%FPC_t$		-0.21	-0.17	-0.08
$\%BPC_t$	-0.07		-0.12	-0.03
$Performance_{t-1}$ ($/ton)*	-0.01	-0.01	0.00	0.00
Harvest Progress at $Signing_t$	0.05	-0.02	-0.11	0.11
10-Day Price $Spread_t$**	0.01	0.00	0.03	0.00
10-Day Price $Trend_t$	0.18	0.00	0.01	0.00

*Marketing performance is measured against a farmer benchmark (pool price)
**Price Spread is based on summary statistics for simple averages

It is also important to explore the robustness of the results and investigate the second model without considering the last two crop years, when prices showed more variability and reached all time highs. Results with four crop years (2003/04 to 2006/07) are presented in Appendix L. Since the DPC only began in 2005/06, there are not enough crop years to estimate the model for this contract given the time period. After comparing the results from Appendix L with the results from Table 16, the tables still have major points in common. The estimated coefficients for the percentage of wheat delivered to each specific PPO contract in t and the same PPO contract used in t-1 for all contracts still have negative coefficients that are statistically distinguishable from zero. Estimated coefficients for $\text{Harvest Progress at Signing}_t$ essentially are the same. Additionally, estimated coefficients for the price spreads have almost the same sign and significance levels. However, the variables have different magnitudes, which will be discussed when looking at elasticities.

Some differences also emerge. For Price Trend_t, the coefficients and significance levels exhibit larger changes compared to when all five years were included in the model. Most of the programs coefficients switch signs and significance levels. In the FPC and BPC equations coefficients are now negative and not statistically distinguishable from zero. In the EPO equation it remains positive but is no longer statistically distinguishable from zero. One reason for this dramatic change in the estimated coefficients for the price trend may be due to the fact that there were no large price movements in the three-year period between 2004/05 and 2006/07, as opposed to the large price changes that occurred during the 2007/08 and 2008/09 crop years.

Table 18 shows the elasticities of PPO usage at the means for the 2004/05 to 2006/07 crop years. Although in relative terms the impacts of the variables are still relatively small for percentage of PPO usage, the magnitudes of the impacts did increase for many of the variables compared to Table 17.

Table 18. Mean Values and Elasticity-Contract Usage with Respect to Each Variable, 2004/05 to 2006/07 Crop Years

	Producer Payment Option (PPO)		
	Fixed Price Contract (FPC)	Basis Price Contract (BPC)	Early Payment Option (EPO)
Mean values			
Same PPO_{t-1}	10.54	18.35	58.68
$\%EPO_t$	9.70	7.14	58.34
$\%DPC_t$	3.46	5.42	1.14
$\%FPC_t$	42.33	11.60	5.40
$\%BPC_t$	6.76	44.67	2.55
$Performance_{t-1}$ ($/ton)*	6.96	8.58	4.32
Harvest Progress at $Signing_t$	21.80	71.75	86.67
10-Day Price $Spread_t$**	-8.41	-18.53	-29.77
10-Day Price $Trend_t$	2.12	1.94	-1.49
Elasticities at means			
Same PPO_{t-1}	-0.07	-0.11	-0.31
$\%EPO_t$	-0.10	-0.08	
$\%DPC_t$	-0.03	-0.05	-0.01
$\%FPC_t$		-0.15	-0.03
$\%BPC_t$	-0.09		-0.02
$Performance_{t-1}$ ($/ton)*	0.02	-0.01	-0.01
Harvest Progress at $Signing_t$	0.00	-0.02	0.15
10-Day Price $Spread_t$**	-0.04	-0.16	0.13
10-Day Price $Trend_t$	-0.03	0.00	-0.03

*Marketing performance is measured against a farmer benchmark (pool price)
**Price Spread is based on summary statistics for simple averages

Finally, each PPO equation was re-estimated using 10- and 30-day simple averages and weighted averages for the price signals. Appendix M shows the results using 30-day price signals (simple averages) and performance with respect to farmer and market benchmarks. Results were essentially the same with the exception of the price spread and Performance_{t-1} for the FPC, and Performance_{t-1} for the DPC. In total there were 64 equations estimated for the second model for each time period.

Chapter 7: Discussion and Conclusions

7.1 Introduction

This chapter concentrates on the conclusions drawn from this research that explored whether Western Canadian wheat producers are overconfident in their marketing choices and investigated how they make their marketing decisions. Section three discusses the implications of these results for wheat producers and the CWB, as well as other relevant groups such as government agencies, extension programs, and marketing advisory services. The last two sections of this chapter focus on the limitations of this research and recommendations for futures research.

7.2 Conclusions

This research used data from the CWB to investigate the marketing decisions of Western Canadian wheat producers. The sub group of this study focused on producers that grew CWRS wheat and used PPO contracts between the 2003/04 and 2008/09 crop years. In particular, this research investigated two issues, whether Canadian producers are overconfident and what factors influence producers' marketing decisions.

The first model explored in this research investigated the marketing strategies of 7,388 producers that used PPOs in at least two years between 2003/04 and 2008/09. Results suggest that there is much heterogeneity in individuals marketing behaviours. Specifically, this model considered producers' abilities to identify profitable opportunities with PPO contracts, their skills to outperform the pool accounts (and other benchmarks) while using PPO contracts, and the degree of activeness in their marketing strategies. Regression results for performance with respect to farmer benchmarks (pool price) suggest that producers that price large portions of their grain with DPCs, FPCs, and BPCs are not able to detect or take advantage of profitable opportunities when using these marketing contracts. Overall, the negative relationship between PPO usage and performance suggests producers that price larger (smaller) portions of wheat with PPO contracts tend to show a poorer performance compared to those who price smaller portions of their crop with PPOs. The findings from the panel regression also indicate a positive relationship between marketing activeness and performance, suggesting that, on average, producers can time the market and obtain higher prices. This implies that producers are not overconfident in their ability to market their grain. However, the impact of activeness on performance is relatively small.

Note that a positive relationship between activeness and performance is not necessarily inconsistent with a negative relationship between PPO usage and performance. For example, some producers may actively use PPOs to time the market every year but commit only a small fraction of their crop to these contracts (leaving most of the crop in the pool). Others may price their grain in the same way every year and commit large portions of their crop to PPO contracts. If the first group performs better than the second group, it would be expected that activeness is positively related to performance while PPO usage is negatively related to performance. Therefore, it is possible producers show a positive relationship between activeness and performance but not necessarily a positive relationship between PPO usage and performance. Additionally, the time of year when producers sign and/or price PPO contracts have larger impacts on performance than other variables. Findings are essentially the same across the different benchmarks adopted to measure performance.

The first model was then estimated only for the first four crop years (2003/04 to 2006/07) to investigate whether very large price movements that occurred in 2007/08 affected the regression results. In general, findings for the four-year period remain qualitatively the same. Negative relationships between pricing performance and percentage of crop priced with PPO contracts and positive relationships between pricing performance and activeness continue to be the main findings. However, the estimated coefficient for $(\%DPC)_t$ changed signs in some cases. In addition, the magnitudes of the coefficients generally decrease, indicating that larger price movements in 2007/08 have a strong influence on estimated coefficients.

It must be noted that results related to activeness and performance should be taken with caution. This study focuses on 7,388 wheat producers who used PPOs in at least two crop years between 2003/04 and 2008/09. This number corresponds to 11 percent of all producers who grew wheat in that period. Therefore, it is possible that our sample represents a selected group of producers with a good understanding of marketing contracts and who follow futures markets frequently.

The second model explored factors that influence producers' marketing decisions using a sample of 8,387 producers that used a PPO contract at least twice between 2003/04 and 2008/09. Results do not support the notion that producers use the same pricing strategy every year, or that habit plays a role in their decisions. In fact, the findings indicate that previous use of a certain marketing contract leads to smaller use of the same contract in the current year. A reason for this may be that these programs are still relatively new instruments and are still undergoing change.

Performance with respect to the farmer benchmark suggests that, on average, positive performance in the previous year leads to more PPO usage. If producers outperform the benchmark they are more willing to use PPOs again in current marketing strategies, thus exposing themselves to less price uncertainty because they are locking in a price before the pool.

Finally, results also find that price signals are positively related to PPO usage (with the exception of price spread in the EPO equation). This finding indicates producers track current market movements and respond to the possibility of locking in higher prices. Also, there is more evidence suggesting that producers focus more on price trends than they do on spreads between current prices and the PRO.

7.3 Implications for Producers and Canadian Wheat Board

The results from the first model have implications for those producers in Western Canada that do not use PPO contracts to price their grain, specifically wheat. Results reveal producers that have more active marketing strategies may be able to increase their performance by approximately 85 percent in Alberta, 45 percent in Saskatchewan, and 50 percent in Manitoba (Table 8).[41] On average, it seems that producers that choose a more active approach to marketing their wheat, instead of leaving it in the pool, actually have superior skills to market their wheat relative to the benchmarks.[42] However, pricing earlier may reduce price uncertainty compared to the pool but a more active strategy does not necessarily mean producers can reduce their risk. In fact, it might be riskier to be "active." It is important to mention again that this study only considers producers who

[41] The magnitudes of activeness decrease when considering only the 2003/04 to 2006/07 crop years. Therefore, on average, a more active strategy for a producer in Alberta results in performance increasing by approximately 14 percent, Saskatchewan 13 percent, and Manitoba 6 percent (Appendix I (a)).
[42] The note about the possibility of sample bias from the previous section also holds here.

used marketing contracts, representing about 11 percent of all wheat producers in Western Canada. This group is likely composed of producers with more interest and/or knowledge of different pricing mechanisms. Therefore results could be reflecting the marketing behaviour of a selected group of producers rather than the whole population of wheat producers.

Furthermore, the month in which producers sign a PPO contract is also relevant to their performance. Producers may be able to considerably improve their performance by pricing earlier during the marketing window. One reason for this is that producers may be following the markets more closely therefore they are able to identify a profitable opportunity sooner compared to a producer who is not watching the markets and just waits until the end of the marketing window because they forgot or did not have time to watch the futures markets, which could mean they missed all the high prices. A point worth mentioning is that approximately 19 percent of all transactions (or roughly one in five transactions) took place during the last five business days of the marketing windows over the six crop years. An example of an extreme case for a producer that could price in the first month or the last month of the marketing window suggests that producers who do not price in the first month and wait to price in the last month of the window can expect a "loss" of $188.01/ton (Table 8).[43]

As for the second model, results reveal that producers that use a specific contract in their previous marketing strategies tend not to use the same contract in their current strategy. This indicates that producers do not use the same contracts every year out of

[43] When only the 2003/04 to 2006/07 crop years are used producers can expect a" loss" of $13.20/ton if they wait until the last month of the marketing window to price a contract (Appendix I (a)).

habit. They are actually changing the marketing tools they use and trying different marketing strategies.

This research also finds that price signals influence producers' use of PPO contracts. As futures prices exceed the PRO or daily contract price, producers tend to sign PPO contracts. This means that producers track current market movements and respond to the possibility of locking in higher prices. There is also evidence that producers pay attention to price trends and tend to sign more PPO contracts when prices are trending upwards. Since results suggest producers pay attention to price signals and make marketing decisions based off price signals, the CWB may find it beneficial to consider helping producers understand the meanings of all the different signals that can be used to help producers with their marketing decisions. This may be done by administering workshops or forums to show producers all the different sources of price information available to them. The CWB could also help producers by facilitating disseminate price information by collecting information from different sources and releasing the information through daily news letters or posting them on the CWB website.

Therefore, it might be beneficial for the CWB and/or marketing advisory services to invest more into educational programs for producers. Such programs could explore possible methods to use in order to time the markets, such as pricing earlier in the marketing window instead of waiting until the deadline, which could help improve producers understanding of the price signals previously mentioned. And discuss how producers' previous use of PPOs may affect their decisions to use PPO contracts in the following year, which could depend on their experience and performance with each contract. For instance, the CWB and/or marketing advisory services could organize workshops or publish handouts showing how producers have historically benefited from pricing their grain earlier.

They could also try to reach more producers with their existing educational programs. In general, both could expand and/or improve on their educational efforts, including more explanations about the different contracts, more examples of how to use them, and comparisons between them (e.g. when it is "better" to use one, when it is "better" to use another), but also try to reach more producers (even with the current educational programs). And since these contracts are still relatively new instruments and undergoing changes, producers might not be very familiar with their details, so this kind of educational strategy might be worthwhile. However, it might just take producers more time experimenting with each contract to learn how to use each pricing contract to their full potential.

7.4 Limitations

The use of PPO contracts by Western Canadian wheat producers is limited, with the majority of producers still using the pool accounts to price their grain. Therefore the proportion of producers in our sample with respect to the total number of producers was approximately 14 percent.[44] One reason for this is that producers may feel more comfortable using the pool since it has been around for decades and they may not feel comfortable in their abilities to time the markets. As well, some producers may view the pool as less risky compared to PPOs, which has created data limitations for this research. Therefore, the total number of producers that have used PPO contracts is not as substantial compared to the total number of producers that used the pool to market their

[44] The entire data set contained 67,798 producers that used either PPOs or the pool accounts to market their CWRS wheat between 2003/04 and 2008/09. The combined sample for both studies has 9,709 producers.

grain. As indicated earlier, the relatively small number of producers used in this research (compared to the total number of producers in Western Canada) and the sample selection based on PPO usage could mean that our sample is not necessarily representative of all Canadian wheat producers.

Producers' decision-making process may also be influenced by numerous factors that could not be captured in this research. Such factors that may affect their marketing strategies include use of advisory services, cost of production, cash flow needs, and performance of other crops among others. In addition, producers may also consider different reference prices (benchmarks) when measuring their performance, which may include local elevator prices or other futures markets such as Chicago or Kansas City.

Another limitation for both of the models regarding this research is limited number of years, since PPO contracts are relatively recent. In one of those years there were huge price movements resulting in producers underperforming the pool, which may have discouraged them from using the pool the following crop year. Even though this event provides interesting information about marketing decisions, it also limits the sample size to some extent.

There are also other variables indicated in previous studies that could have been beneficial to incorporate in the models. Such variables include off-farm income, land ownership, age, gender, education-level, and farm size.

7.5 Recommendations for Future Research

This thesis contributes to the ongoing research regarding how producers' make their marketing decisions. Further studies might look at including producers that used the pool accounts to price their grain, how their strategies might have changed over the six crop years with respect to pool and PPOs, and the factors that caused them to choose specific marketing tools each year. Also, since results are influenced by the 2007/08 crop year, which experienced extreme price movements and resulted in almost all producers who used PPO contracts to underperform the pool (Table 6) it might be worthwhile to do further research with more crop years to see how producers performed and how their marketing strategies may have changed since the 2007/08 crop year.

Another dimension for further research is to explore whether producers' decision-making might vary depending on the magnitude of PPO usage. In other words, the influence of relevant variables affecting the decision to use marketing contracts might differ between producers who price large portions of their grain with PPO contracts and producers who price only small amounts with them. The same idea applies to marketing activeness and overconfidence. On average, activeness is positively related to marketing performance and it remains to be explored whether this positive relationship also holds for groups of top- and bottom-performing producers. So quantile regression could be used to explore these points.

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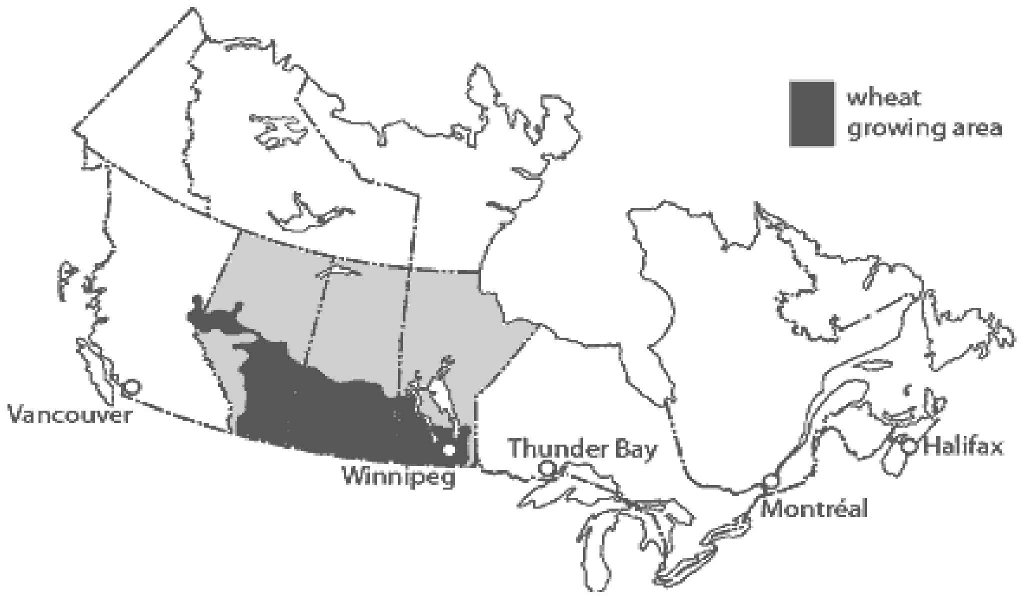
Appendix A: Wheat Growing Areas of Western Canada



Source: Canadian Grain Commission

Appendix B: Canadian Wheat Board Basis

The CWB basis is used on all non-pooling contracts and is calculated using an average expected basis relative to CWB pooled sales. The formula for the basis is (CWB PRO) - (CWB forecasted futures price) - discount), where discount reflects the risk, time value of money, and administration costs.

The CWB basis used for the FPC, BPC, and FlexPro is often referred to as the pooled basis since its value is determined from an estimate of all the CWB pooled sales. This basis is not the same as the day-to-day cash basis like other non-Board grains. Instead the CWB uses the December basis in the calculation of the basis for the other futures months. This is done because the CWB does not want the basis to attract deliveries or encourage producers to store grain. To calculate the December, March, May, and July basis, the CWB subtracts the futures price for the specific month (March) from the sum of the December basis plus the December futures price ((December basis + December futures price) – March futures price = March basis). For example, if Minneapolis posted a Hard Red Spring wheat March futures price of $200/ton, a December futures of $195/ton, and a December basis of $15/ton, the March basis would be $10/ton (($15 + $195) - $200 = $10/ton).

The CWB basis is released daily and can fluctuate each day due to changes in markets and new information coming into the markets from around the world. Some key factors that can influence the CWB basis are world supply-demand balance, movement in Canadian dollar, ocean freight rates, world crop quality, amount of pool sold, volatility in the U.S. futures market, and non-U.S. market values relative to U.S. futures markets. These factors can result in a CWB basis being either positive or negative.

Appendix C: Reference Grades and Markets

		Reference Grade	Futures Contract
Wheat:	CWRS	No. 1 CWRS 13.5	Minneapolis Hard Red Spring
	CWHWS	No. 1 CWHWS 13.5	Minneapolis Hard Red Spring
	CWES	No. 1 CWES	Minneapolis Hard Red Spring
	CPSP	No. 1 CPSP	Kansas Hard Red Winter
	CPSW	No. 1 CPSW	Kansas Hard Red Winter
	CWRW	No. 1 CWRW Select 11.5*	Kansas Hard Red Winter
	CWSWS	No. 1 CWSWS	Chicago Soft Red Winter
Durum:	CWAD	No. 1 CWAD 13.0	No associated futures market

*The reference grade for CWRW prior to 2007/08 was No. 1 CWRW.
Source: Canadian Wheat Board

Appendix D: BPC Basis and FPC Pricing Periods

Crop Year	BPC Program			FPC Program		
	Component	Type of Grain	Signing Period	Component	Type of Grain	Signing Period
2000-2001	basis	wheat	Before August 1, 2000	futures price and basis	wheat	Before August 1, 2000
2001-2002	basis	wheat	March 22, 2001 to July 31, 2001	futures price and basis	wheat and feed barley	March 22, 2001 to July 31, 2001
2002-2003	basis	wheat	March 28, 2002 to July 31, 2002	futures price and basis	wheat and feed barley	March 28, 2002 to July 31, 2002
					durum	March 23, 2002 to July 31, 2002
2003-2004	basis	wheat	February 24, 2003 to July 31, 2003	futures price and basis	wheat and feed barley	February 24, 2003 to July 31, 2003
					durum	April 24, 2003 to July 31, 2003
2004-2005	basis	wheat	February 27, 2004 to October 31, 2004	futures price and basis	wheat and feed barley	February 27, 2004 to October 31, 2004
					durum	April 22, 2004 to October 31, 2004
					selected barley	May 27, 2004 to October 31, 2004
2005-2006	basis	wheat	February 28, 2005 to October 31, 2005	futures price and basis	all Board grains	February 28, 2005 to October 31, 2005
2006-2007	basis	wheat and selected barley	February 27, 2006 to October 31, 2006	futures price and basis	all Board grains	February 27, 2006 to October 31, 2006

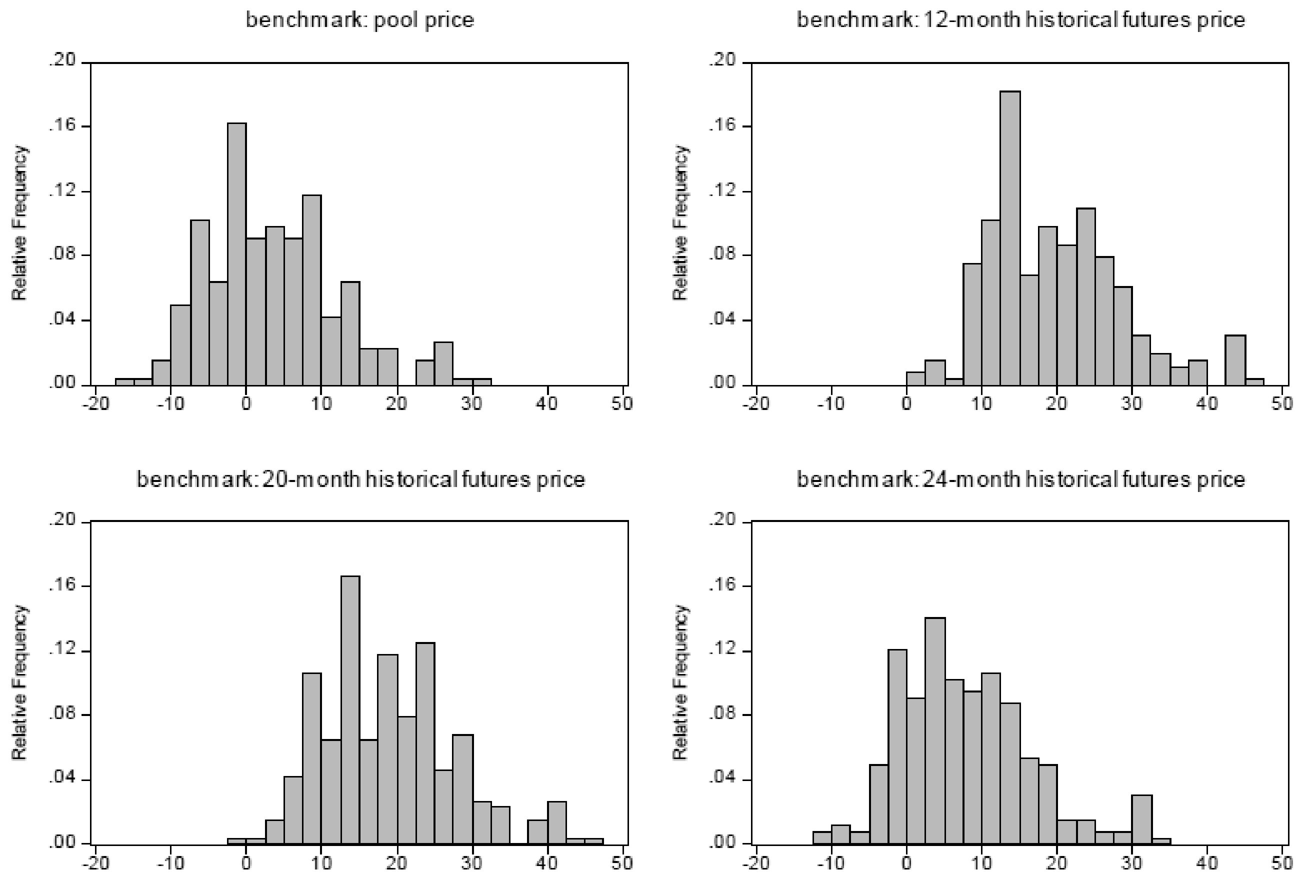
Crop Year	BPC Program			FPC Program		
	Component	Type of Grain	Signing Period	Component	Type of Grain	Signing Period
2007-2008	December futures only	wheat	September 1, 2006 to October 31, 2007	futures price and basis	Wheat, durum, and selected barley	February 26, 2007 to October 31, 2007
	December and March basis and futures	wheat	February 26, 2007 to October 31, 2007		feed barley pool A	February 26, 2007 to October 31, 2007
	May and July basis and futures	wheat	August 1, 2007 to October 31, 2007		feed barley pool B	November 1, 2007 to February 29, 2008
	December futures only	selected barley	February 26, 2007 to October 31, 2007			
	March, May, and July basis and futures	selected barley	August 1, 2007 to October 31, 2007			
	December basis and futures price	feed barley pool A	February 26, 2007 to October 31, 2007			
	March basis and futures	feed barley pool A	August 1, 2007 to October 31, 2007			
	March, May, and July basis and futures	feed barley pool B	November 1, 2007 to February 29, 2008			
2008-2009	December futures only	wheat	September 4, 2007 to October 31, 2008	futures price and basis	wheat and durum	February 25, 2008 to October 31, 2008
	December basis and futures	wheat	February 25, 2008 to October 31, 2008			
	March basis and futures	wheat	June 4, 2008 to October 31, 2008			
	May basis and futures	wheat	August 1, 2008 to October 31, 2008			
	July basis and futures	wheat	September 17, 2008 to October 31, 2008			

Appendix E: Marketing Window for Month Variable

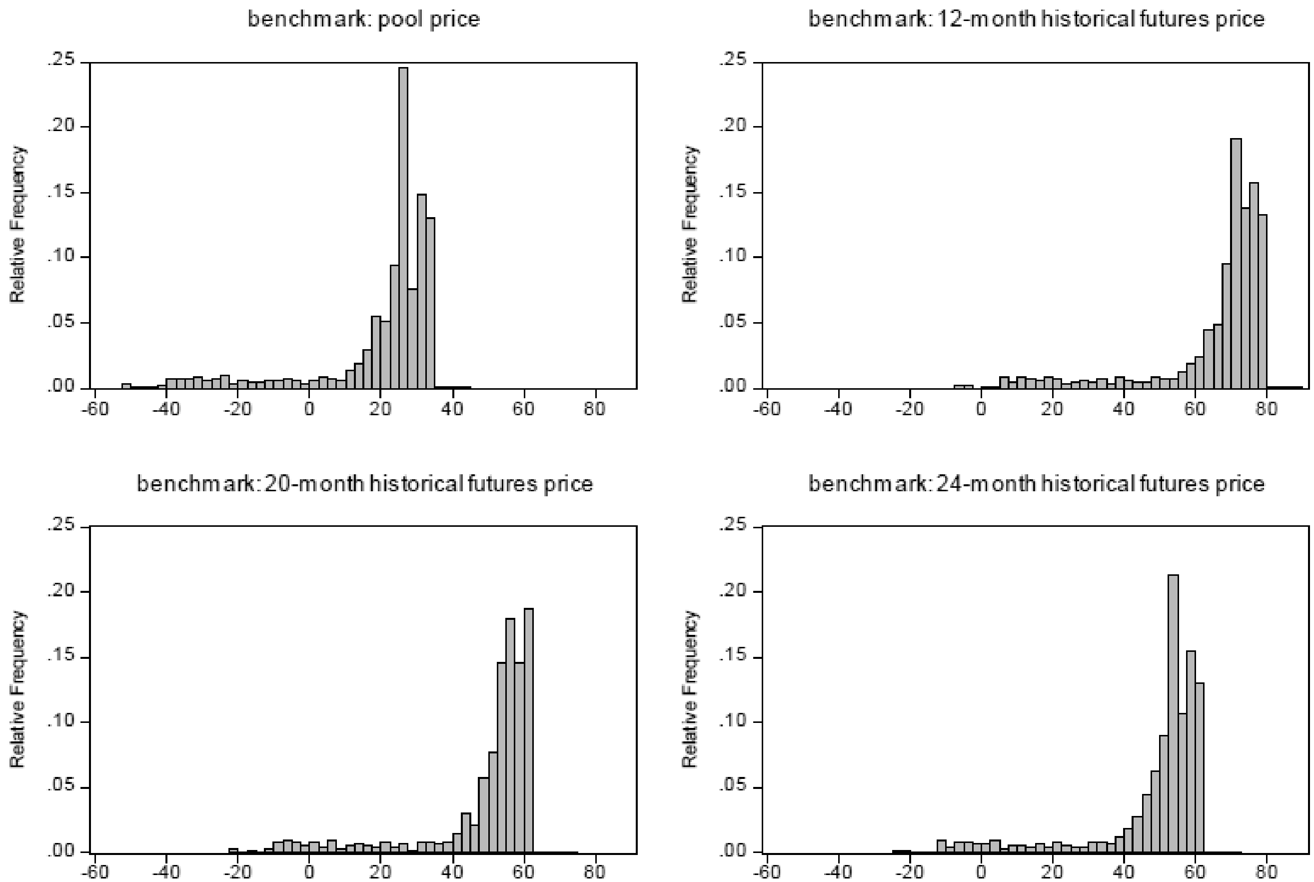
Crop Year	Start Date	End Date	Total Number of Months
2003/04	February 24, 2003	June 29, 2004	16
2004/05	February 27, 2004	June 29, 2005	16
2005/06	February 28, 2005	July 31, 2006	17
2006/07	February 27, 2006	July 31, 2007	17
2007/08	September 1, 2006	July 31, 2008	22
2008/09	September 4, 2007	July 31, 2009	22

Appendix F: Histograms for Market Performance for Producers in Western Canada

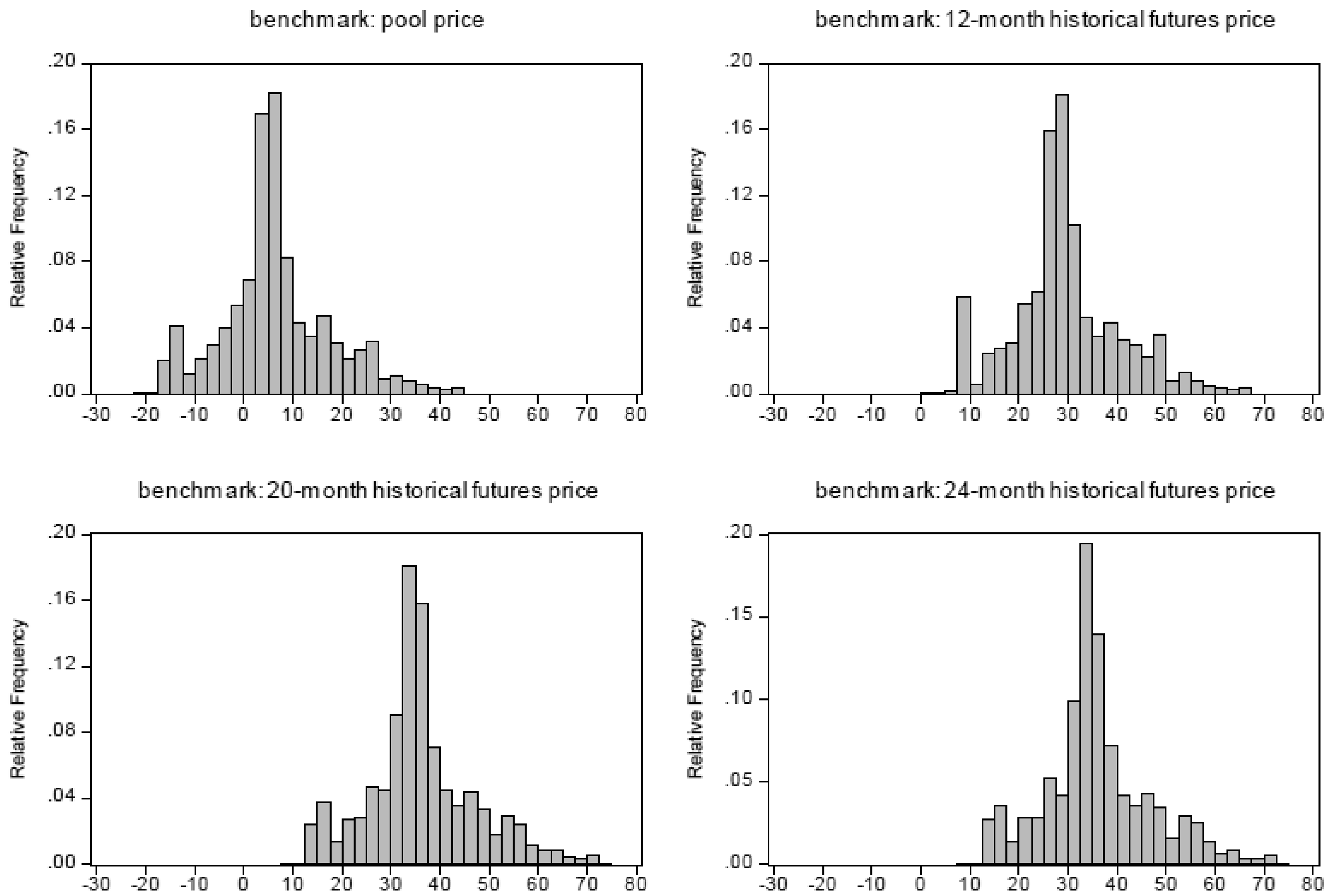
a) 2003/04 crop year



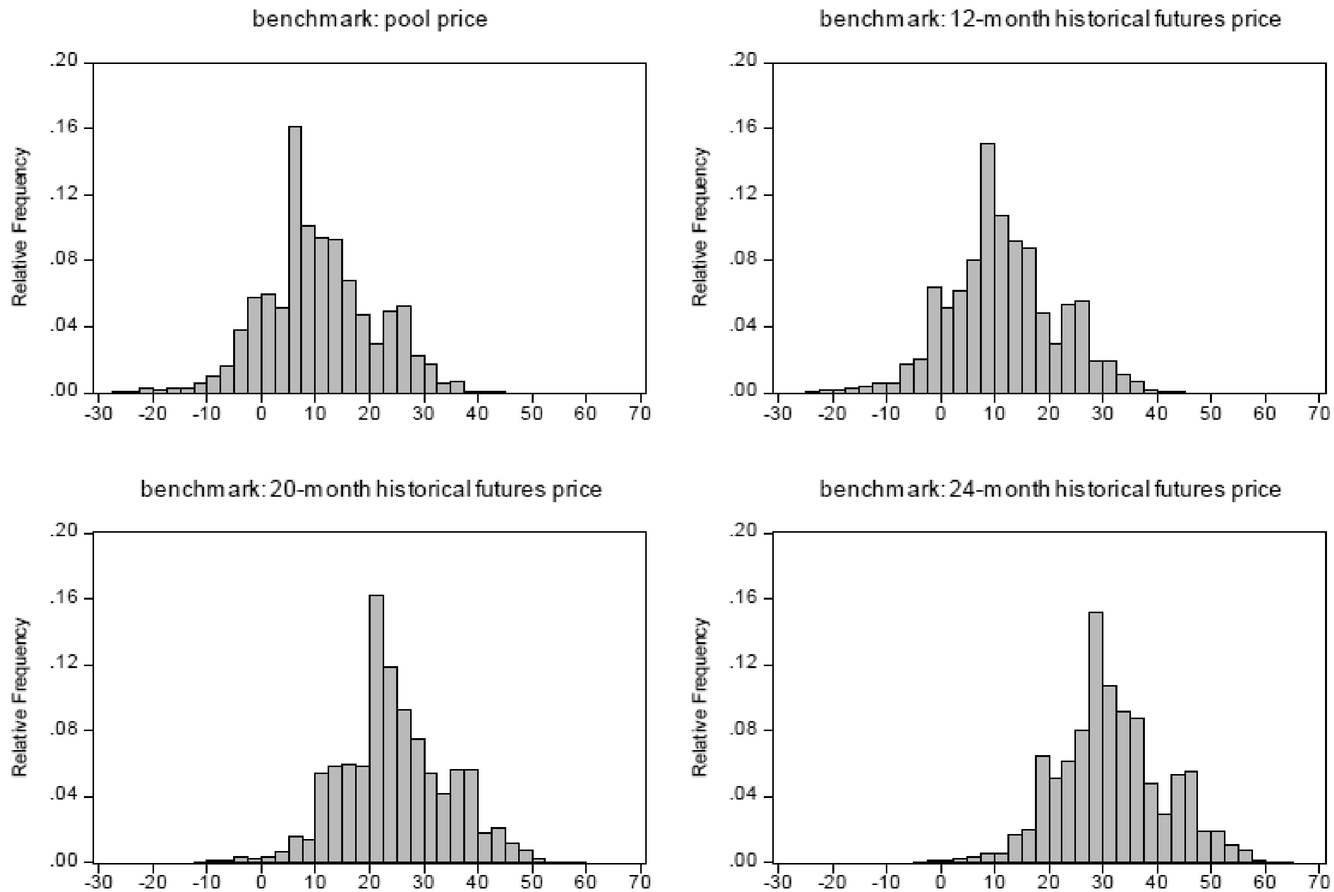
b) 2004/05 crop year



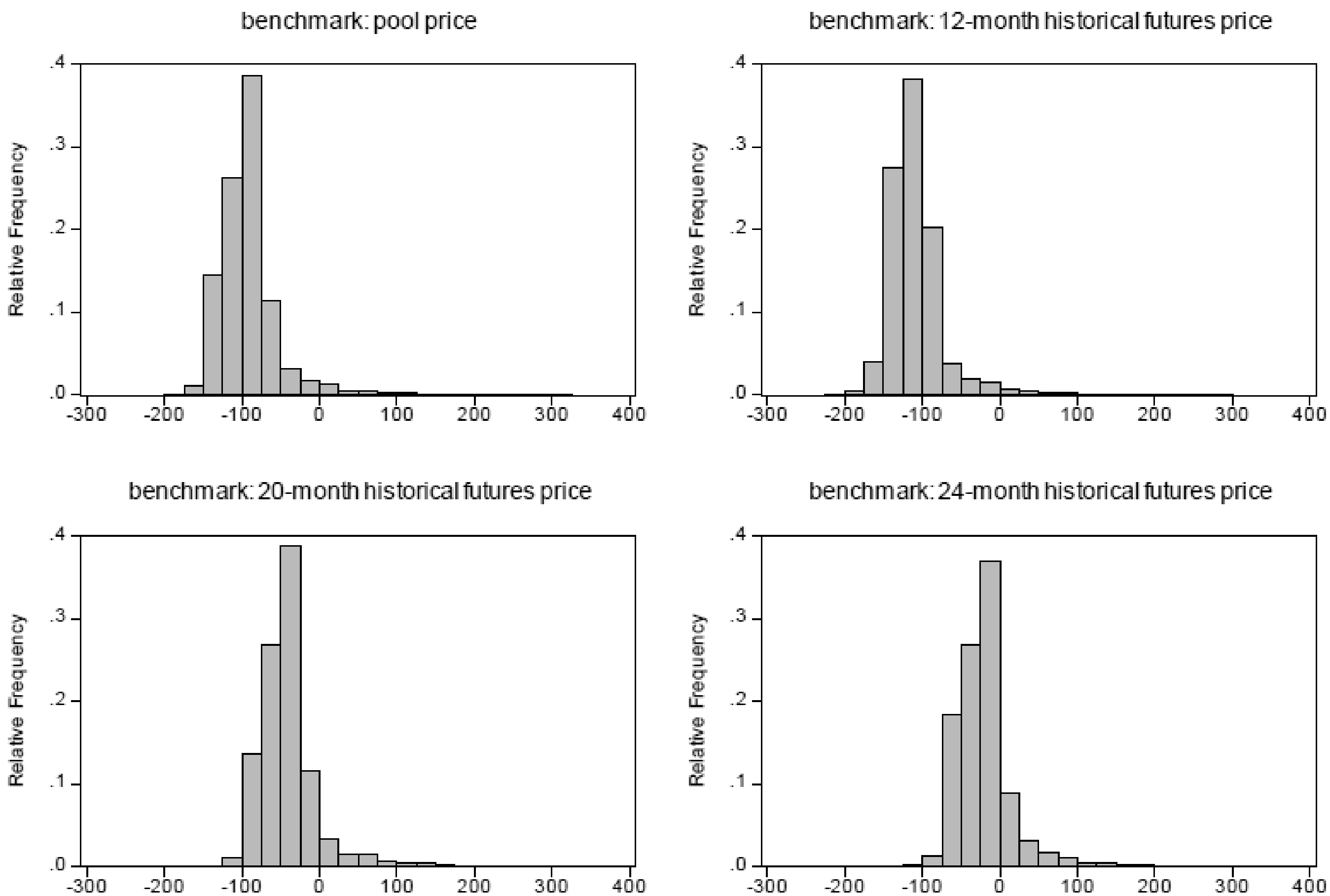
c) 2005/06 crop year



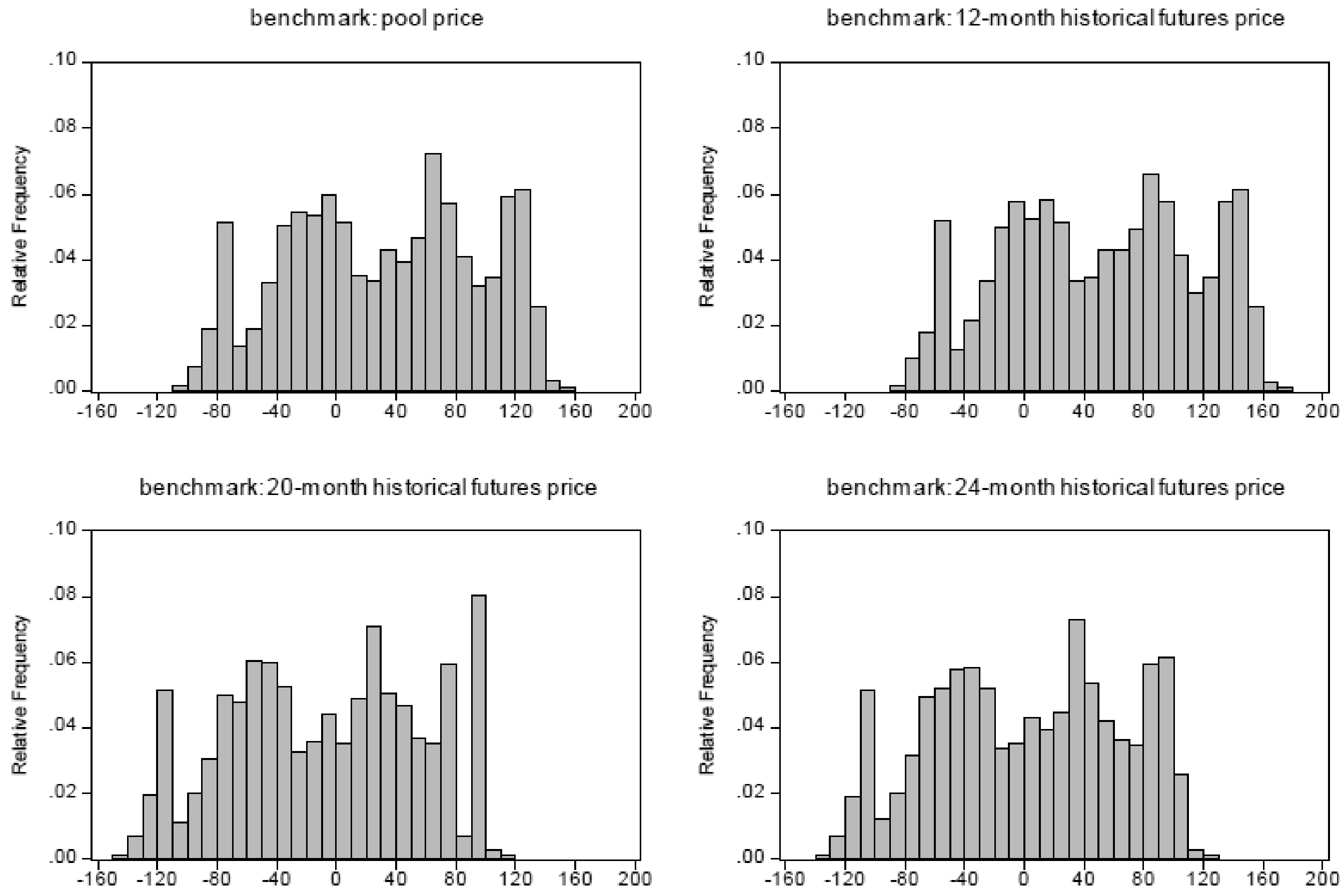
d) 2006/07 crop year



e) 2007/08 crop year



f) 2008/09 crop year



Appendix G:Descriptive Statistics-Performance with Respect to Market Benchmark

a) Performance with respect to 24-month market benchmark

	Crop Year					
Location/Statistic	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Western Canada─Performance* ($/ton)						
Average	7.78	48.27	35.96	31.58	-19.71	1.91
Standard deviation	8.78	16.82	11.04	9.99	39.79	64.20
t-statistic**	14.40	138.29	124.88	238.77	-38.65	1.72
Minimum	-11.71	-23.15	7.85	-4.13	-115.54	-135.10
Maximum	34.73	72.22	72.87	64.56	379.73	126.01
Number of Producers	264	2,322	1,470	5,705	6,040	3,351
Number w/ Positive Performance	212	2,222	1,470	5,691	998	1,736
Number w/ Negative Performance	52	100	0	14	5,042	1,615
Alberta─Performance* ($/ton)						
Average	5.84	50.03	35.57	30.78	-22.92	7.54
Standard deviation	6.05	13.30	10.54	10.00	34.33	64.90
t-statistic**	5.87	97.22	70.79	137.00	-30.54	4.13
Minimum	-3.80	-20.28	14.20	-2.84	-109.27	-135.10
Maximum	16.68	60.39	72.87	58.98	260.12	121.32
Number of Producers	37	668	440	1,981	2,092	1,261
Number w/ Positive Performance	28	658	440	1,972	306	713
Number w/ Negative Performance	9	10	0	9	1,786	548
Saskatchewan─Performance* ($/ton)						
Average	7.33	51.47	35.64	31.09	-20.22	9.44
Standard deviation	9.14	14.30	10.64	9.55	44.78	66.02
t-statistic**	9.21	101.93	84.81	155.69	-20.88	4.39
Minimum	-10.57	-23.15	10.86	-4.13	-115.54	-127.85
Maximum	34.73	66.90	71.97	62.83	379.73	126.01
Number of Producers	132	802	641	2,287	2,139	944
Number w/ Positive Performance	101	776	641	2,283	391	521
Number w/ Negative Performance	31	26	0	4	1,748	423
Manitoba─Performance* ($/ton)						
Average	9.13	43.82	36.93	33.53	-15.41	-10.91
Standard deviation	9.08	20.28	12.17	10.42	39.07	59.98
t-statistic**	9.70	62.88	59.77	121.56	-16.75	-6.14
Minimum	-11.71	-23.15	7.85	-4.05	-87.49	-133.99
Maximum	31.88	72.22	71.97	64.56	376.34	125.58
Number of Producers	93	847	388	1,427	1,804	1,138
Number w/ Positive Performance	81	783	388	1,426	299	494
Number w/ Negative Performance	12	64	0	1	1,505	644

* $\text{Performance}_{i,t} = (\text{price received}_{i,t} - \text{benchmark}_t)$

**Ho: average performance = 0, Ha: average performance > 0 (or < 0)

b) Performance with respect to 20-month market benchmark

Location/Statistic	Crop Year 2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Western Canada─Performance* ($/ton)						
Average	19.06	49.57	36.15	24.65	-40.45	-7.72
Standard deviation	8.78	16.82	11.04	9.99	39.79	64.20
t-statistic**	35.27	142.01	125.54	186.37	-79.01	-6.96
Minimum	-0.43	-21.85	8.04	-11.06	-136.27	-144.73
Maximum	46.01	73.52	73.06	57.63	359.00	116.38
Number of Producers	264	2,322	1,470	5,705	6,040	3,351
Number w/ Positive Performance	263	2,231	1,470	5,649	501	1,593
Number w/ Negative Performance	1	91	0	56	5,539	1,758
Alberta─Performance* ($/ton)						
Average	17.11	51.33	35.76	23.84	-43.65	-2.09
Standard deviation	6.05	13.30	10.54	10.00	34.33	64.90
t-statistic**	17.20	99.75	71.17	106.11	-58.16	-0.35
Minimum	7.48	-18.98	14.39	-9.78	-130.00	-144.73
Maximum	27.95	61.69	73.06	52.05	239.39	111.69
Number of Producers	37	668	440	1,981	2,092	1,261
Number w/ Positive Performance	37	659	440	1,945	137	665
Number w/ Negative Performance	0	9	0	36	1,955	596
Saskatchewan─Performance* ($/ton)						
Average	18.61	52.77	35.83	24.16	-40.95	-0.19
Standard deviation	9.14	14.30	10.64	9.55	44.78	66.02
t-statistic**	23.39	104.51	85.26	120.98	-42.29	-0.09
Minimum	0.71	-21.85	11.05	-11.06	-136.27	-137.48
Maximum	46.01	68.20	72.16	55.90	359.00	116.38
Number of Producers	132	802	641	2,287	2,139	944
Number w/ Positive Performance	132	778	641	2,273	209	485
Number w/ Negative Performance	0	24	0	14	1,930	459
Manitoba─Performance* ($/ton)						
Average	20.41	45.12	37.12	26.59	-36.14	-20.53
Standard deviation	9.08	20.28	12.17	10.42	39.07	59.98
t-statistic**	21.68	64.75	6.08	96.40	-39.29	-11.55
Minimum	-0.43	-21.85	8.04	-10.98	-108.22	-143.62
Maximum	43.16	73.52	72.16	57.63	355.61	155.95
Number of Producers	93	847	388	1,427	1,804	1,138
Number w/ Positive Performance	92	789	388	1,421	155	435
Number w/ Negative Performance	1	58	0	6	1,649	703

* $\text{Performance}_{i,t} = (\text{price received}_{i,t} - \text{benchmark}_t)$

**Ho: average performance = 0, Ha: average performance > 0 (or < 0)

c) Performance with respect to 12-month market benchmark

	Crop Year					
Location/Statistic	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Western Canada─Performance* ($/ton)						
Average	19.77	66.04	29.72	11.58	-108.29	50.62
Standard deviation	8.78	16.82	11.04	9.99	39.79	64.20
t-statistic**	36.59	189.20	103.21	87.55	-211.51	45.64
Minimum	0.27	-5.38	1.61	-24.13	-204.11	-86.39
Maximum	46.71	89.99	66.63	44.56	291.16	174.72
Number of Producers	264	2,322	1,470	5,705	6,040	3,351
Number w/ Positive Performance	264	2,313	1,470	5,001	137	2,493
Number w/ Negative Performance	0	9	0	704	5,903	858
Alberta─Performance* ($/ton)						
Average	17.82	67.80	29.33	10.78	-111.49	56.25
Standard deviation	6.05	13.30	10.54	10.00	34.33	64.90
t-statistic**	17.92	131.75	58.37	47.98	-148.54	30.78
Minimum	8.18	-2.51	7.96	-22.84	-197.84	-86.39
Maximum	28.66	78.16	66.63	38.98	171.55	170.03
Number of Producers	37	668	440	1,981	2,092	1,261
Number w/ Positive Performance	37	667	440	1,691	32	951
Number w/ Negative Performance	0	1	0	290	2,060	310
Saskatchewan─Performance* ($/ton)						
Average	19.31	69.24	29.40	11.09	-108.79	58.15
Standard deviation	9.14	14.30	10.64	9.55	44.78	66.02
t-statistic**	24.27	137.12	69.96	55.53	-112.36	27.06
Minimum	1.41	-5.38	4.62	-24.13	-204.11	-79.14
Maximum	46.71	84.67	65.73	42.83	291.16	174.72
Number of Producers	132	802	641	2,287	2,139	944
Number w/ Positive Performance	132	779	641	1,983	57	717
Number w/ Negative Performance	0	3	0	304	2,082	227
Manitoba─Performance* ($/ton)						
Average	21.11	61.59	30.69	13.53	-103.98	37.80
Standard deviation	9.08	20.28	12.17	10.42	39.07	59.98
t-statistic**	22.42	88.39	49.67	49.05	-113.04	21.26
Minimum	0.27	-5.38	1.61	-24.05	-176.06	-85.28
Maximum	43.86	89.99	65.73	44.56	287.77	174.29
Number of Producers	93	847	388	1,427	1,804	1,138
Number w/ Positive Performance	93	842	388	1,318	48	817
Number w/ Negative Performance	0	5	0	109	1,756	321

* $\text{Performance}_{i,t} = (\text{price received}_{i,t} - \text{benchmark}_t)$

**Ho: average performance = 0, Ha: average performance > 0 (or < 0)

Appendix H: Descriptive Statistics for Model 1

Location/Statistic	%DPC_t	%FPC_t	%BPC_t	$Month_t$	$Active_t$
Western Canada					
Average	6.06	32.61	12.93	0.42	0.00
Standard deviation	18.28	31.15	24.54	0.19	0.63
Minimum	0.00	0.00	0.00	0.00	-2.07
Maximum	100.00	100.00	100.00	1.00	3.02
Number of Observations	19,152	19,152	19,152	19,152	19,152
Alberta					
Average	5.10	35.00	8.48	0.42	-0.03
Standard deviation	16.28	30.81	19.73	0.19	0.61
Minimum	0.00	0.00	0.00	0.00	-1.70
Maximum	100.00	100.00	100.00	1.00	3.02
Number of Observations	6,479	6,479	6,479	6,479	6,479
Saskatchewan					
Average	6.09	33.09	12.92	0.40	0.00
Standard deviation	19.19	31.55	25.17	0.19	0.65
Minimum	0.00	0.00	0.00	0.00	-1.72
Maximum	100.00	100.00	100.00	1.00	2.95
Number of Observations	6,945	6,945	6,945	6,945	6,945
Manitoba					
Average	7.15	29.56	17.98	0.44	0.04
Standard deviation	19.25	30.74	27.51	0.19	0.64
Minimum	0.00	0.00	0.00	0.00	-2.07
Maximum	100.00	100.00	100.00	1.00	2.87
Number of Observations	5,697	5,697	5,697	5,697	5,697

Appendix I: Estimated Panel Regression Models, 2003/04 to 2006/07 Crop Years

a) Performance with respect to farmer benchmark (pool price) ($/ton)

$$Performance_{i,t} = \alpha + \beta_D (\%DPC)_{i,t} + \beta_F (\%FPC)_{i,t} + \beta_B (\%BPC)_{i,t} + \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t}$$

	All Producers (2003/04-2006/07)		Alberta (2003/04-2006/07)		Saskatchewan (2003/04-2006/07)		Manitoba (2003/04-2006/07)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	23.90	1.25***	29.27	1.71***	22.99	2.33***	18.62	2.28***
$\%DPC_t$	0.04	0.02*	-0.01	0.04	0.03	0.04	0.13	0.04***
$\%FPC_t$	-0.09	0.02***	-0.19	0.03***	-0.08	0.04***	0.01	0.04
$\%BPC_t$	-0.30	0.04***	-0.40	0.05***	-0.33	0.07***	-0.15	0.07**
$Month_t$	-13.20	1.48***	-16.15	2.38***	-10.79	2.56***	-12.39	2.70***
$Activeness_t$	11.36	1.90***	13.78	2.71***	12.91	3.35***	5.53	3.57
R^2 within	0.11		0.15		0.15		0.08	
between	0.11		0.09		0.09		0.16	
overall	0.10		0.11		0.10		0.11	
Number of observations	6,081		1,793		2,472		1,803	
Number of producers	2,859		837		1,191		823	

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

b) Performance with respect to 24-month market benchmark ($/ton)

$$Performance_{i,t} = \alpha + \beta_D (\%DPC)_{i,t} + \beta_F (\%FPC)_{i,t} + \beta_B (\%BPC)_{i,t} + \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t}$$

	All Producers (2003/04-2006/07)		Alberta (2003/04-2006/07)		Saskatchewan (2003/04-2006/07)		Manitoba (2003/04-2006/07)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	50.78	1.50***	59.61	2.28***	45.63	2.75***	46.67	2.47***
$\%DPC_t$	-0.03	0.03	-0.15	0.04***	-0.00	0.50	0.05	0.04
$\%FPC_t$	-0.13	0.03***	-0.31	0.03***	-0.05	0.05	-0.03	0.05
$\%BPC_t$	-0.34	0.04***	-0.56	0.06***	-0.31	0.08***	-0.15	0.07**
$Month_t$	-14.83	1.72***	-11.83	2.79***	-10.43	3.04***	-21.17	3.04***
$Activeness_t$	14.90	2.14***	22.16	3.06***	12.86	3.73***	8.12	3.63**
R^2 within	0.08		0.12		0.10		0.08	
between	0.09		0.06		0.09		0.16	
overall	0.08		0.07		0.08		0.11	
Number of observations	6,081		1,793		2,472		1,803	
Number of producers	2,859		837		1,191		823	

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

c) Performance with respect to 20-month market benchmark ($/ton)

$$Performance_{i,t} = \alpha + \beta_D (\%DPC)_{i,t} + \beta_F (\%FPC)_{i,t} + \beta_B (\%BPC)_{i,t} + \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t}$$

	All Producers (2003/04-2006/07)		Alberta (2003/04-2006/07)		Saskatchewan (2003/04-2006/07)		Manitoba (2003/04-2006/07)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	55.81	1.71***	65.71	2.45***	47.88	3.28***	54.03	2.42***
$\%DPC_t$	-0.19	0.03***	-0.33	0.05***	-0.15	0.06***	-0.11	0.05**
$\%FPC_t$	-0.24	0.03***	-0.45	0.04***	-0.13	0.05**	-0.15	0.04***
$\%BPC_t$	-0.48	0.05***	-0.76	0.07***	-0.41	0.09***	-0.27	0.07***
$Month_t$	-17.26	1.91***	-11.02	3.33***	-9.37	3.32***	-30.05	3.23***
$Activeness_t$	20.93	2.46***	31.37	3.59***	17.30	4.55***	13.27	3.52***
R^2 within	0.09		0.15		0.08		0.12	
between	0.08		0.06		0.08		0.13	
overall	0.06		0.06		0.06		0.12	
Number of observations	6,081		1,793		2,472		1,803	
Number of producers	2,859		837		1,191		823	

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

d) Performance with respect to 12-month market benchmark ($/ton)

$$Performance_{i,t} = \alpha + \beta_D (\%DPC)_{i,t} + \beta_F (\%FPC)_{i,t} + \beta_B (\%BPC)_{i,t} + \delta_M Month_{i,t} + \gamma_A Activeness_{i,t} + \varepsilon_{i,t}$$

	All Producers (2003/04-2006/07)		Alberta (2003/04-2006/07)		Saskatchewan (2003/04-2006/07)		Manitoba (2003/04-2006/07)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	87.63	2.84***	102.48	3.85***	72.10	5.66***	89.31	3.49***
$\%DPC_t$	-0.54	0.05***	-0.75	0.07***	-0.47	0.09***	-0.45	0.06***
$\%FPC_t$	-0.61	0.05***	-0.94	0.06***	-0.40	0.10***	-0.52	0.06***
$\%BPC_t$	-1.08	0.08***	-1.51	0.10***	-0.93	0.16***	-0.78	0.10***
$Month_t$	-51.31	3.03***	-40.09	5.43***	-35.39	5.31***	-76.69	4.85***
$Activeness_t$	51.79	4.12***	68.64	5.63***	44.58	8.08***	41.32	4.77***
R^2 within	0.21		0.24		0.15		0.32	
between	0.07		0.04		0.06		0.18	
overall	0.08		0.06		0.06		0.19	
Number of observations	6,081		1,793		2,472		1,803	
Number of producers	2,859		837		1,191		823	

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

Appendix J: Descriptive Statistics for Model 2

	Producer Payment Option (PPO)			
Variable/Statistic	Fixed Price Contract (FPC)	Basis Price Contract (BPC)	Daily Price Contract (DPC)	Early Payment Option (EPO)
$Performance_{t-1}$ (farmer benchmark)				
Average	-4.73	-2.79	-10.77	2.36
Standard deviation	43.62	45.74	49.98	34.00
Minimum	-180.42	-151.57	-180.42	-138.30
Maximum	382.23	381.94	388.56	367.36
$Performance_{t-1}$ (24-month benchmark)				
Average	24.92	30.87	26.63	27.43
Standard deviation	32.99	38.38	38.73	33.08
Minimum	-109.27	-80.41	-109.27	-67.15
Maximum	453.39	453.09	459.72	438.52
$Performance_{t-1}$ (20-month benchmark)				
Average	18.86	25.98	17.37	26.80
Standard deviation	36.10	40.61	41.80	32.67
Minimum	-130.00	-101.14	-130.00	-87.88
Maximum	432.65	432.36	438.99	417.78
$Performance_{t-1}$ (12-month benchmark)				
Average	0.61	10.78	-9.99	22.26
Standard deviation	52.49	57.68	58.77	41.67
Minimum	-197.84	-168.98	-197.84	-155.72
Maximum	364.81	364.52	371.15	349.94
Harvest Progress at $Signing_t$				
Average	29.69	73.65	83.70	84.52
Standard deviation	35.69	39.55	28.43	29.61
Minimum	0.00	0.00	0.00	0.00
Maximum	100.00	100.00	100.00	100.00
30-Day Price $Spread_t$ ($/ton)*				
Average	10.41	-4.73	1.77	-2.93
Standard deviation	22.43	31.12	40.35	60.38
Minimum	-49.87	-52.60	-63.27	-53.43
Maximum	69.56	243.15	233.93	243.15
30-Day Price $Trend_t$ ($/ton)				
Average	27.51	7.46	12.07	1.36
Standard deviation	31.10	29.86	38.41	27.32
Minimum	-37.80	-105.37	-130.82	-130.82
Maximum	62.84	88.50	66.30	88.50

*Price Spread is based on summary statistics for simple averages

Appendix K: Estimated Panel Regress Model Using 10-Day Price Signals and Market Benchmarks

a) Performance with respect to 24-month market benchmark

	Fixed Price Contract (FPC) (2004/05-2008/09) (a)		Basis Price Contract (BPC) (2004/05-2008/09) (a)		Daily Price Contract (DPC) (2006/07-2008/09) (a)		Early Payment Option (EPO) (2004/05-2008/09) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	44.81	0.74***	55.52	1.97***	58.24	3.97***	66.78	2.57***
Same PPO_{t-1}	-0.22	0.02***	-0.14	0.02***	-0.12	0.03***	-0.17	0.02***
$\%EPO_t$	-0.42	0.02***	-0.44	0.05***	-0.49	0.08***		
$\%DPC_t$	-0.41	0.03***	-0.38	0.05***			-0.49	0.06***
$\%FPC_t$			-0.60	0.04***	-0.46	0.05***	-0.49	0.04***
$\%BPC_t$	-0.49	0.03***			-0.50	0.06***	-0.61	0.06***
$Performance_{t-1}$ (b)	0.03	0.01**	0.12	0.03***	-0.01	0.03	-0.10	0.02***
Harvest Progress at $Signing_t$	0.08	0.01***	-0.01	0.02	-0.06	0.04	0.07	0.03***
10-Day Price $Spread_t$	0.01	0.02	0.12	0.02***	0.22	0.02***	-0.03	0.01**
10-Day Price $Trend_t$	0.82	0.03***	0.20	0.05***	0.56	0.06***	0.01	0.05
R^2 within	0.44		0.31		0.53		0.20	
between	0.08		0.10		0.27		0.07	
overall	0.14		0.13		0.30		0.09	
Number of observations	8,547		2,591		2,000		5,112	
Number of producers	5,982		1,865		1,543		3,557	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, DPC, and EPO)

(b) Marketing performance is measured against a market benchmark (24-month)

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

b) Performance with respect to 20-month benchmark

	Fixed Price Contract (FPC) (2004/05-2008/09) (a)		Basis Price Contract (BPC) (2004/05-2008/09) (a)		Daily Price Contract (DPC) (2006/07-2008/09) (a)		Early Payment Option (EPO) (2004/05-2008/09) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	44.67	0.70***	55.39	1.95***	58.18	3.90***	65.48	2.56***
Same PPO_{t-1}	-0.22	0.02***	-0.13	0.02***	-0.13	0.03***	-0.18	0.02***
$\%EPO_t$	-0.43	0.02***	-0.46	0.05***	-0.49	0.08***		
$\%DPC_t$	-0.40	0.03***	-0.39	0.04***			-0.49	0.06***
$\%FPC_t$			-0.61	0.04***	-0.46	0.06***	-0.50	0.04***
$\%BPC_t$	-0.49	0.03***			-0.50	0.06***	-0.63	0.06***
$Performance_{t-1}$ (b)	0.04	0.01***	0.15	0.03***	-0.01	0.02	-0.05	0.02***
Harvest Progress at $Signing_t$	0.08	0.01***	-0.01	0.02	-0.06	0.04	0.07	0.03***
10-Day Price $Spread_t$	0.00	0.02	0.13	0.02***	0.22	0.02***	-0.03	0.01***
10-Day Price $Trend_t$	0.80	0.03***	0.18	0.05***	0.56	0.06***	0.01	0.05
R^2 within	0.44		0.33		0.53		0.19	
between	0.08		0.11		0.27		0.07	
overall	0.14		0.14		0.30		0.08	
Number of observations	8,547		2,591		2,000		5,112	
Number of producers	5,982		1,865		1,543		3,557	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, DPC, and EPO)

(b) Marketing performance is measured against a market benchmark (20-month)

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

c) Performance with respect to 12-month market benchmark

	Fixed Price Contract (FPC) (2004/05-2008/09) (a)		Basis Price Contract (BPC) (2004/05-2008/09) (a)		Daily Price Contract (DPC) (2006/07-2008/09) (a)		Early Payment Option (EPO) (2004/05-2008/09) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	45.39	0.63***	58.65	1.88***	57.90	3.82***	64.61	2.53***
Same PPO_{t-1}	-0.03	0.02***	-0.10	0.02***	-0.12	0.03***	-0.18	0.02***
$\%EPO_t$	-0.43	0.02***	-0.49	0.05***	-0.49	0.08***		
$\%DPC_t$	-0.41	0.03***	-0.40	0.04***			-0.50	0.06***
$\%FPC_t$			-0.61	0.04***	-0.47	0.06***	-0.51	0.04***
$\%BPC_t$	-0.49	0.03***			-0.49	0.06***	-0.63	0.06***
$Performance_{t-1}$ (b)	0.05	0.01***	0.11	0.02***	0.00	0.02	-0.00	0.02
Harvest Progress at $Signing_t$	0.08	0.01***	-0.02	0.02	-0.05	0.04	0.07	0.03***
10-Day Price $Spread_t$	0.03	0.02	0.12	0.02***	0.22	0.02***	-0.03	0.01***
10-Day Price $Trend_t$	0.74	0.03***	0.14	0.05***	0.56	0.06***	0.01	0.05
R^2 within	0.44		0.33		0.53		0.18	
between	0.09		0.14		0.28		0.07	
overall	0.15		0.17		0.31		0.08	
Number of observations	8,547		2,591		2,000		5,112	
Number of producers	5,982		1,865		1,543		3,557	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, DPC, and EPO)

(b) Marketing performance is measured against a market benchmark (12-month)

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

Appendix L: Model 2-Estimated Panel Regression Models, 2004/05 to 2006/07 Crop Years

	Fixed Price Contract (FPC) (2004/05-2006/07) (a)		Basis Price Contract (BPC) (2004/05-2006/07) (a)		Early Payment Option (EPO) (2004/05-2006/07) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	56.83	1.98***	71.17	3.72***	65.89	3.67***
Same PPO_{t-1}	-0.27	0.04***	-0.27	0.04***	-0.31	0.02***
$\%EPO_t$	-0.44	0.05***	-0.49	0.07***		
$\%DPC_t$	-0.36	0.09***	-0.43	0.09***	-0.69	0.08***
$\%FPC_t$			-0.59	0.07***	-0.32	0.06***
$\%BPC_t$	-0.55	0.06***			-0.51	0.08***
$Performance_{t-1}$ (b)	0.10	0.04**	-0.06	0.07	-0.08	0.03***
Harvest Progress at $Signing_t$	-0.01	0.05	-0.01	0.04	0.10	0.03***
10-Day Price $Spread_t$	0.23	0.06***	0.39	0.09***	-0.25	0.04***
10-Day Price $Trend_t$	-0.53	0.39	-0.06	0.31	1.12	0.28***
R^2 within	0.34		0.37		0.27	
between	0.07		0.10		0.00	
overall	0.09		0.11		0.01	
Number of observations	2,688		1,420		3,545	
Number of producers	2,257		1,140		2,607	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, and EPO)

(b) Marketing performance is measured against a farmer benchmark (pool price)

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

Appendix M: Model 2-Estimated Panel Regression Models Using 30-Day Price Signals and Farmer and Market Benchmarks

a) Performance with respect to farmer benchmark (pool price)

	Fixed Price Contract (FPC) (2004/05-2008/09) (a)		Basis Price Contract (BPC) (2004/05-2008/09) (a)		Daily Price Contract (DPC) (2006/07-2008/09) (a)		Early Payment Option (EPO) (2004/05-2008/09) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	46.97	0.63***	60.49	1.87***	54.50	3.75***	64.72	2.52***
Same PPO_{t-1}	-0.22	0.02***	-0.11	0.02***	-0.12	0.03***	-0.18	0.02***
$\%EPO_t$	-0.42	0.02***	-0.47	0.05***	-0.49	0.08***		
$\%DPC_t$	-0.42	0.03***	-0.42	0.05***			-0.51	0.06***
$\%FPC_t$			-0.63	0.04***	-0.50	0.05***	-0.53	0.04***
$\%BPC_t$	-0.49	0.03***			-0.47	0.06***	-0.62	0.06***
$Performance_{t-1}$ (b)	0.04	0.01**	0.15	0.02***	-0.01	0.02	0.02	0.02
Harvest Progress at $Signing_t$	0.06	0.01***	-0.02	0.02	-0.04	0.04	0.07	0.03***
30-Day Price $Spread_t$	-0.01	0.02	0.10	0.02***	0.21	0.03***	-0.03	0.01***
30-Day Price $Trend_t$	0.31	0.02***	0.08	0.02***	0.29	0.03***	0.03	0.03
R^2 within	0.45		0.34		0.54		0.19	
between	0.08		0.13		0.30		0.07	
overall	0.15		0.17		0.33		0.09	
Number of observations	8,847		2,591		2,000		5,112	
Number of producers	5,982		1,865		1,543		3,557	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, DPC, and EPO)
(b) Marketing performance is measured against a farmer benchmark (pool price)
***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

b) Performance with respect to 24-month market benchmark

	Fixed Price Contract (FPC) (2004/05-2008/09) (a)		Basis Price Contract (BPC) (2004/05-2008/09) (a)		Daily Price Contract (DPC) (2006/07-2008/09) (a)		Early Payment Option (EPO) (2004/05-2008/09) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	46.46	0.72***	56.32	1.98***	55.22	3.90***	66.66	2.57***
Same PPO_{t-1}	-0.23	0.02***	-0.13	0.02***	-0.12	0.03***	-0.17	0.02***
$\%EPO_t$	-0.41	0.02***	-0.43	0.05***	-0.48	0.08***		
$\%DPC_t$	-0.43	0.03***	-0.40	0.05***			-0.49	0.06***
$\%FPC_t$			-0.60	0.04***	-0.49	0.05***	-0.50	0.04***
$\%BPC_t$	-0.49	0.03***			-0.47	0.06***	-0.60	0.06***
$Performance_{t-1}$ (b)	0.00	0.01	0.11	0.03***	-0.02	0.03	-0.10	0.02***
Harvest Progress at $Signing_t$	0.06	0.01***	-0.02	0.02	-0.04	0.04	0.07	0.03***
30-Day Price $Spread_t$	-0.04	0.02**	0.11	0.03***	0.20	0.03***	-0.03	0.01**
30-Day Price $Trend_t$	0.34	0.01***	0.13	0.02***	0.30	0.03***	0.04	0.03
R^2 within	0.44		0.31		0.55		0.20	
between	0.07		0.11		0.30		0.07	
overall	0.14		0.14		0.33		0.09	
Number of observations	8,547		2,591		2,00		5,112	
Number of producers	5,982		1,865		1,543		3,557	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, DPC, and EPO)

(b) Marketing performance is measured against a market benchmark (24-month)

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

c) Performance with respect to 20-month market benchmark

	Fixed Price Contract (FPC) (2004/05-2008/09) (a)		Basis Price Contract (BPC) (2004/05-2008/09) (a)		Daily Price Contract (DPC) (2006/07-2008/09) (a)		Early Payment Option (EPO) (2004/05-2008/09) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	46.15	0.68***	56.20	1.95***	55.11	3.83***	65.38	2.56***
Same PPO_{t-1}	-0.23	0.02***	-0.13	0.02***	-0.12	0.03***	-0.18	0.02***
$\%EPO_t$	-0.41	0.02***	-0.45	0.05***	-0.48	0.08***		
$\%DPC_t$	-0.43	0.03***	-0.41	0.05***			-0.50	0.06***
$\%FPC_t$			-0.61	0.04***	-0.49	0.05***	-0.51	0.04***
$\%BPC_t$	-0.49	0.03***			-0.47	0.06***	-0.62	0.06***
$Performance_{t-1}$ (b)	0.02	0.01	0.14	0.03***	-0.02	0.02	-0.05	0.02***
Harvest Progress at $Signing_t$	0.06	0.01***	-0.02	0.02	-0.04	0.04	0.07	0.03***
30-Day Price $Spread_t$	-0.03	0.02*	0.12	0.03***	0.21	0.03***	-0.03	0.01***
30-Day Price $Trend_t$	0.34	0.01***	0.11	0.02***	0.30	0.03***	0.03	0.03
R^2 within	0.44		0.32		0.55		0.19	
between	0.08		0.12		0.30		0.07	
overall	0.14		0.15		0.32		0.09	
Number of observations	8,547		2,591		2,000		5,112	
Number of producers	5,982		1,865		1,543		3,557	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, DPC, and EPO)

(b) Marketing performance is measured against a market benchmark (20-month)

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%

d) Performance with respect to 12-month market benchmark

	Fixed Price Contract (FPC) (2004/05-2008/09) (a)		Basis Price Contract (BPC) (2004/05-2008/09) (a)		Daily Price Contract (DPC) (2006/07-2008/09) (a)		Early Payment Option (EPO) (2004/05-2008/09) (a)	
	coefficient	std. error	coefficient	std. error	coefficient	std. error	coefficient	std. error
constant	46.46	0.62***	59.21	1.89***	54.55	3.75***	64.51	2.53***
Same PPO_{t-1}	-0.22	0.02***	-0.10	0.02***	-0.12	0.03***	-0.18	0.02***
$\%EPO_t$	-0.42	0.02***	-0.48	0.05***	-0.48	0.08***		
$\%DPC_t$	-0.43	0.03***	-0.42	0.05***			-0.51	0.06***
$\%FPC_t$			-0.61	0.04***	-0.49	0.06***	-0.52	0.04***
$\%BPC_t$	-0.49	0.03***			-0.47	0.06***	-0.63	0.06***
$Performance_{t-1}$ (b)	0.03	0.01***	0.10	0.02***	-0.02	0.02	-0.00	0.02
Harvest Progress at $Signing_t$	0.06	0.01***	-0.02	0.02	-0.04	0.04	0.07	0.03***
30-Day Price $Spread_t$	-0.01	0.02	0.12	0.03***	0.21	0.03***	-0.03	0.01***
30-Day Price $Trend_t$	0.32	0.01***	0.09	0.02***	0.30	0.03***	0.03	0.03
R^2 within	0.45		0.33		0.55		0.18	
between	0.08		0.14		0.29		0.07	
overall	0.15		0.17		0.32		0.09	
Number of observations	8,547		2,591		2,000		5,112	
Number of producers	5,982		1,865		1,543		3,557	

(a) Dependent variable in each equation is the percentage of crop priced with a given marketing contract (FPC, BPC, DPC, and EPO)

(b) Marketing performance is measured against a market benchmark (12-month)

***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%