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DO PRODUCERS EXHIBIT DISPOSITION EFFECT? EVIDENCE FROM GRAIN MARKETING

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Do Producers Exhibit Disposition Effect? Evidence from Grain Marketing

Abstract

The disposition effect is one of the most common types of behavior documented in financial markets, and reflects the notion that investors tend to hold losing positions too long and close winning positions too fast. This idea can also be applied to grain marketing. The disposition effect would be related to whether producers sell their grain more readily when prices are "high" and wait longer when prices are "low". This question is relevant because this type of behavior can affect marketing performance. If grain is sold too early, producers can miss opportunities to sell at higher price later. If producers hold their grain too long, price can go down and they will end up selling at a lower prices. Examination of pricing strategies of 15,564 wheat producers between 2003/04 and 2008/09 shows evidence of disposition effect in their marketing decisions. They seem to be eager to sell when the price offered by marketing contracts is above their reference price, and wait longer to sell when the price offered by marketing contracts is below their reference price.

Résumé

L'effet de disposition décrit le comportement d'investisseurs qui maintiennent des positions déficitaires trop longtemps et qui dénouent trop rapidement des positions profitables. Ce concept peut s'appliquer aussi à la mise en marché des céréales. L'effet de disposition impliquerait que les producteurs ont tendance à vendre rapidement lorsque les prix sont à la hausse et à garder leur grain entreposé lorsque les prix sont bas. La mise en marché des grains n'est pas efficace lorsque les producteurs vendent trop tôt et ne peuvent pas obtenir le meilleur prix possible. Si les producteurs gardent leur inventaire trop longtemps lorsque les prix sont bas, ils s'exposent à des baisses de prix. L'analyse des stratégies utilisées par 15564 producteurs de blé entre les années 2003/04 et 2008/2009 révèle la présence d'un effet de disposition dans les décisions de mise en marché. Les producteurs sont empressés de vendre lorsque le prix des contrats est plus élevé que leur prix de référence et ils sont trop patients lorsque le prix des contrats est sous leur seuil de référence.

Keywords: grain marketing, disposition effect, wheat
JEL codes: D0, D8, Q13

INTRODUCTION

Grain marketing studies have traditionally relied on standard economic theory in which producers make decisions that are logical and out of self-interest. However, Brorsen and Anderson (2001) discuss implications of behavioral finance for agricultural marketing and indicate psychological biases which can affect marketing decisions. Previous studies find evidence that producers exhibit loss aversion and probability weighting, and tend to overestimate price and underestimate risk (Eales et al., 1990; Collins et al., 1991; Humphrey and Verschoor, 2004; Cruz Junior, 2008; Lui, 2008; and Riley and Anderson, 2009). Thus there is empirical evidence that individual producer's behavior does not necessarily follow the standard rationality assumption, but rather exhibit features of prospect theory (such as loss aversion and probability weighting) and other alternative theories.

Studies in behavioral finance have identified several types of behavior often found among investors. One of the most common is the disposition effect, which reflects the notion that investors tend to hold losing positions too long and close winning positions too fast (Shefrin and Statman, 1985; Odean, 1998; Frino et al. 2004; Locke and Mann, 2005; Brown et al., 2006; Dhar and Zhu, 2006). Weber and Camerer (1998) discuss that the disposition effect can be explained by two dimensions of prospect theory. One is the idea that individuals make decisions based on reference points, with outcomes above the reference point being valued as gains and outcomes below it valued as losses. The second dimension is related to loss aversion, indicating that individuals would be willing to take more risk when faced with losses and less risk when faced with gains.

This discussion can also be applied in the context of grain marketing. Since commodity prices vary during the crop year, the time when grain is sold can affect final price received by producers and determine whether producers will receive high or low prices. The disposition effect would be related to whether producers sell their grain more readily when prices are "high" and wait longer when prices are "low". This question is relevant because selling too fast when prices are "high" or waiting too long when prices are "low" can affect marketing performance. If grain is sold too early, producers can miss opportunities to sell at higher prices later. Similarly, if producers hold their grain too long, price can go down and they end up selling at even lower prices.

The objective of this research is to explore the existence of disposition effect among Canadian wheat producers when marketing their grain. This study examines the question of whether producers wait too long to price their grain or whether they price their grain too soon. In both cases they can miss opportunities to obtain higher prices. A unique data set was made available by the Canadian Wheat Board (CWB) for the crop years 2003/04 through 2008/09 for all producers growing Canada Western Red Spring (CWRS) wheat. The data contain information on (i) type of contract used to market wheat, (ii) tonnes delivered, (iii) date when producer priced the grain, (iv) final price received by each producer, (v) seeded acres, and (vi) province.

The grain marketing system in Canada offered a unique opportunity to explore how producers make decisions. All wheat produced in Western Canada and sold for human consumption and export had to be marketed through the CWB,[1] which is the largest grain marketing agency in Canada and offered several pricing alternatives providing distinct combinations of return, risk and cash flow. These pricing options included different contracts which have distinct features but essentially allowed producers to use futures markets to price their wheat. Since all producers had to market their grain through the CWB, it was possible to follow exactly when they chose to market their grain, what market conditions were prevalent during the period they made their decisions, and what price they received at the end of the crop year.

In this study a unique data set of all wheat producers in Canada is used to perform a comprehensive analysis of the disposition effect in grain marketing. It is investigated whether this type of behavior is prevalent among producers and what characteristics help explain it. Exploring this phenomenon is relevant as it sheds more light on the decision making process in grain marketing. As indicated by Hagedorn et al. (2005), despite the importance of marketing in 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. Results from this study can provide new insights and move us towards a more complete understanding of grain marketing.

[1] The Canadian government has recently proposed changes to this marketing system. Bill C-18 was introduced on October 18, 2011 to remove the Canadian Wheat Board (CWB) as the sole seller of wheat produced in Western Canada. The Marketing Freedom for Grain Farmers Act passed on November 28, 2011 ratifying this change.

BACKGROUND

The Canadian Wheat Board (CWB) is the largest grain marketing agency in Canada and the sole marketer for wheat, durum wheat, and barley produced in Western Canada[2] until the 2011/12 crop year.[3] All wheat producers had to market their crop through the CWB, which offered different marketing alternatives allowing producers to choose a program that met their own needs and preferences regarding return, risk, and cash flow. The oldest pricing alternative is pool pricing, which was the default program, meaning the CWB assumed producers would keep their wheat in the pool accounts unless otherwise indicated.

The pool accounts work by pooling all wheat sales made during the crop year. Its goal is to guarantee that all producers receive the same final price regardless of when and to whom their grain is sold. With the pool accounts, producers receive an initial payment when deliveries are made to the grain handling facility, and additional payments as sales are completed throughout the crop year. During the crop year, the CWB also provides a projected price, the Pool Return Outlook (PRO), which is an estimate of what the final pool price will be at the end of the crop year. The PRO is often seen as a benchmark and can be used to alert famers as to whether to keep their wheat in the pool accounts or to use one of the other marketing alternatives offered by the CWB, collectively known as Producer Payment Options (PPO) contracts.

PPO contracts have been developed by the CWB in the last 10 years. They allow producers to price their own grain and provide them flexibility to manage their cash flow. With PPO contracts, producers can lock in their price or basis using futures contracts through the CWB. For all PPO contracts there is a marketing window during which producers need to let the CWB know about their marketing choices. Producers can also decide to use more than one alternative, in which case they need to tell the CWB what proportion of their grain will be marketed by each instrument. PPO contracts also differ from pool accounts in terms of payment schedule. Producers still receive an initial payment when they deliver their wheat to the grain handling facility, and their final payment will come within 10 business days upon confirmation of delivery.[4]

[2] Manitoba, Saskatchewan, Alberta, and the Peace River area of British Columbia
[3] The CWB will cease to be the sole marketer of wheat following the 2011/2012 crop year.
[4] Producers using the pool pricing and PPO contracts receive the same initial payment upon delivery to the grain handling facility because the federal government guarantees the payment.

There were five PPO contracts available to wheat producers between 2003/04 and 2008/09: Early Payment Option (EPO), Fixed Price Contracts (FPC), Basis Price Contract (BPC), Daily Price Contract (DPC), and FlexPRO. All of them were essentially developed to allow producers more flexibility to price their own grain and provide better cash flow management. PPO contracts and pool accounts can be used simultaneously, but producers must let the CWB know how many tonnes they plan to market on their own with PPO contracts.

PREVIOUS STUDIES

The disposition effect has been largely investigated in the context of financial markets and was first identified by Shefrin and Statman (1985). They highlight the aversion to loss realization as the theoretical background to explain why investors tend to sell winning positions too early and hold losing positions too long. They claim that loss aversion (as discussed in prospect theory) would make investors reluctant to realize losing positions, but also discuss other motivations such as mental accounting, regret aversion, and self-control.

Several other studies use market data to explore the existence of the disposition effect among different players in financial markets. Odean (1998) uses data provided by a discount brokerage house on 10,000 securities accounts traded between 1987 and 1993. Jordan and Diltz (2004) examine a group of accounts provided by a securities firm specializing in day trading between 1998 and 1999. Frino et al. (2004) use data on 8,762 trading accounts from the four main futures contracts traded at the Sydney Futures Exchange in 1999. Locke and Mann (2005) focus on 334 futures traders in currencies and commodities markets at the Chicago Mercantile Exchange in 1995. Dhar and Zhu (2006) use trading records of more than 50,000 individual investors from a discount brokerage firm between 1991 and 1996. Brown et al. (2006) use data on investors in 450 IPO stocks and 380 Australian Stock Exchange index stocks between 1995 and 2000. Choe and Eom (2009) follow all individual transactions of 69,391 different traders in the Korean stock index futures market between 2003 and 2005. All these studies find evidence that investors and professional traders tend to liquidate winning positions too early and ride losing positions too long.

There are also other interesting dimensions to be explored in the context of the disposition effect. Dhar and Zhu (2006) explore why the disposition effect might vary across

individuals. Some of their findings indicate that the disposition effect might be related to certain demographic characteristics. For example, investors with low income and nonprofessional occupations tend to exhibit the highest values for disposition effect in their sample. Another dimension that has been investigated is whether the disposition effect leads to lower returns. Evidence appears to be mixed in this matter. Odean (1998) finds costs associated with the disposition effect. On the other hand, Locke and Mann (2005) find no evidence that traders selling winning positions too early and holding losing positions too long would make less profit than their peers who exhibit less or no disposition effect. They argue that this finding suggests the disposition effect does not necessarily imply inferior trade quality, but rather a benign trading style that generates patterns consistent with the disposition effect.

RESEARCH METHOD

The procedure to examine the existence of disposition effect follows Odean (1998) and others which adopted similar methods, such as Frino et al. (2004), Brown et al. (2006), Dhar and Zhu (2006), and Choe and Eom (2009). Those studies investigate investors who trade financial assets (e.g. stocks), and look at the frequency with which winning and losing positions are closed relative to the opportunities to close them. They assume investors' objective is to sell at a price above what they paid when the asset was bought. Thus the purchasing price is assumed to be the reference price, and investors feel they realize a gain (loss) when they sell their assets above (below) the reference price. For a given time period, they calculate the number of days in which an asset could be sold at a gain and at a loss, and also the number of days in which an asset was actually sold at a gain and at a loss. For example, an investor buys 30 stocks at price p_0 on a given day. During the next 100 business days, the market price for that stock was above p_0 in 60 days and below p_0 in 40 days. Thus the investor had a chance to sell his stocks at a gain in 60 days and at a loss in 40 days of the sample period. If the investor actually sold half of his stocks at a gain over 11 days, and half of his stocks at a loss over 3 days, the proportion of gains realized is 0.183 (11/60) and the proportion of losses realized is 0.075 (3/40). These numbers would indicate the investor realized a gain (loss) in 18.3% (7.5%) of the days he had a chance to do so, suggesting he is more eager to realize gains than losses.

The investigation of disposition effect in grain marketing adopts the same procedure discussed above. Based on Odean (1998), four variables are defined for each producer during a crop year: realized gain, paper gain, realized loss, and paper loss. From these variables two ratios are calculated for each producer: proportion of gain realized (PGR) and proportion of loss realized (PLR), as shown in equations (1) and (2).

$$PGR_{i,t} = \frac{N_{RG}^{i,t}}{N_{RG}^{i,t} + N_{PG}^{i,t}} \quad (1)$$

$$PLR_{i,t} = \frac{N_{RL}^{i,t}}{N_{RL}^{i,t} + N_{PL}^{i,t}} \quad (2)$$

where $N_{RG}^{i,t}$ is the number of days in crop year *t* that producer *i* sold his grain at a gain (realized gain), $N_{RL}^{i,t}$ is the number of days in crop year *t* that producer *i* sold his grain at a loss (realized loss), $N_{PG}^{i,t}$ is the number of days in crop year *t* that producer *i* had a chance to sell his grain at a gain but did not execute it (paper gain), and $N_{PL}^{i,t}$ is the number of days in crop year *t* that producer *i* had a chance to sell his grain at a loss but did not execute it (paper loss). Note that $N_{RG}^{i,t} + N_{PG}^{i,t}$ represents the total number of days in a crop year when producer *i* had a chance to sell at a gain, and $N_{RL}^{i,t} + N_{PL}^{i,t}$ represents the total number of days in a crop year when producer *i* had a chance to sell at a loss.

The disposition effect (DE) for producer *i* in crop year *t* is given by the difference between PGR and PLR (equation 3). A positive (negative) DE indicates the producer is more likely to realize a gain (loss) than a loss (gain), i.e. the producer tends to sell his grain faster when the market price is above (below) his reference price than when the market price is below (above) his reference price.

$$DE_{i,t} = PGR_{i,t} - PLR_{i,t} \quad (3)$$

The choice of the reference price is crucial to investigate disposition effect, since the calculation of PGR and PLR depends on how gains and losses are defined. As indicated previously, studies in financial markets typically use the purchasing price of the asset as a reference price to calculate realized and paper gains and losses. This is an example of a static reference price, i.e. investors focus on the purchasing price regardless how market price moves

after the asset is purchased. However, Odean (2004) notes that purchasing price might be only one determinant of the reference price and investors might adjust their reference prices according to market developments. For example, assume an investor buys a stock for $20 and the stock price falls to $10 over the following months. If price then starts to increase the investor may be glad to sell for less than $20 because his reference price may have fallen after he purchased the stock (Odean, 2004). Baucells et al. (2011) conduct an experiment in a stock market environment and conclude that the purchasing price is not the only source for investors to form their reference prices. They find evidence that reference prices are mainly influenced by the purchasing price of a stock and the most recent price of that stock in the market, with the average of intermediate prices playing a smaller role in the formation of reference prices (Baucells et al., 2011).[5]

In grain marketing the reference price is not as clear. For a wheat producer, cost of production could be thought as a reference price consistent with the notion of purchasing price of a stock being the reference price for an investor. However, there is no available data on cost of production for individual producers. Further, producers may respond to changes in market prices and adjust their reference prices over time. McNew and Musser (2002) and Fryza (2011) study marketing decisions and find evidence that producers respond to market changes and may adopt different reference prices.

In the current study two reference prices are adopted: the Pool Return Outlook (PRO) price in the current crop year and the pool price in the previous crop year. The PRO price is the forecast of the pool price for the current year (prepared by the CWB) and used as a dynamic reference price in the sense that it is updated regularly during the crop year.[6] New announcements of the PRO price would be seen as reflection of recent market trends that could influence producers to update their reference price. The assumption behind the PRO as reference price is that producers would be glad to price their grain above what the CWB expects to obtain for the pool accounts, and avoid pricing below the price expected for the pool accounts. Figures 1 to 10 (Appendix) show PRO prices and prices offered by the FPC and DPC in each crop year when these contracts were available. The disposition effect is calculated based on the

[5] Intermediate prices are those in a time series occurring between the purchasing price and the most current price.
[6] PROs are usually released on the fourth Thursday of every month. The PRO price is calculated as a weighted average of prices obtained by the CWB for grain that has already been sold and prices expected by the CWB for grain that remains to be sold.

information on these graphs for the marketing window of each contract. In each crop year $PGR_{i,t}$ (equation 1) for each producer is calculated by dividing the number of days producers sold grain above the reference price $\left(N_{RG}^{i,t}\right)$ by the total number of days producers could have sold grain above the reference price $\left(N_{RG}^{i,t} + N_{PG}^{i,t}\right)$, and $PLR_{i,t}$ (equation 2) for each producer is calculated by dividing the number of days producers sold grain below the reference price $\left(N_{RL}^{i,t}\right)$ by the total number of days producers could have sold grain above the reference price $\left(N_{RL}^{i,t} + N_{PL}^{i,t}\right)$.

The measure of disposition effect (DE) is calculated for each producer who used PPOs in each crop year. For example, in 2008/09 the marketing window for the Fixed Price Contract (FPC) had 177 days. During this period, the price offered by the FPC was above the PRO price in 28 days and below the PRO price in 149 days. One of the producers in the sample used FPC to sell portions of his crop on 11 different days. The FPC price was above the reference price in two of those days and below the reference price in nine of those days, which means his PGR and PLR were 0.0714 (2/28) and 0.0604 (9/149), respectively. Thus his DE was 0.0110 in that year. In the same year, a producer who sold only once in a day with FPC price above the reference price would have PGR and PLR equal to 0.0357 and 0, respectively.

The same procedure is used with the other reference price, which is the pool price in the previous year. This price represents the price producers received in the CWB's pool accounts. It is a static reference price and assumes that in the current year producers would try to price their grain above the price received in the pool accounts in the previous year, i.e. they would be glad to do better than they did the year before and avoid performing worse than in the previous year.

DATA

Data were provided by the CWB and encompass producers who grew Canada Western Red Spring (CWRS) wheat in the crop years 2003/04 through 2008/09 in Manitoba, Saskatchewan, Alberta, and the Peace River area in British Columbia. The data set used for this research focuses on producers who grew CWRS wheat in at least one of the six crop years provided and marketed at least part of their crop with producer payment options (PPOs). Data contains transactions made by each producer that indicates (i) what marketing contract they used, (ii) how many

tonnes of wheat were delivered to each contract, (iii) exact dates when producers signed their marketing contracts, (iv) final price received by each producer for their wheat, and (v) Pool Return Outlook (PRO). The marketing programs include pool accounts and five types of PPOs (Fixed Price Contracts, Basis Payment Contracts, Early Payment Option, Daily Price Contract, and FlexPro).[7]

The first part of this research project focuses specifically on two type of marketing contract, the Fixed Price Contracts (FPC) and the Daily Price Contracts (DPC).[8] The analysis uses a data set with 15,564 wheat producers who used FPC and/or DPC between 2003/04 and 2008/09. Table 1 shows more details about producers and contract usage during those six crop years. The number of producers who priced their wheat with FPC and/or DPC in each crop year ranged from 104 to 10,117, and the number of contracts signed in each crop year varied from 122 to 21,111. On average, producers sold approximately 30%-50% of their wheat crop with the FPC and/or DPC.

Table 1: Number of producers and contracts, and proportion of wheat sold with contracts

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Number of producers	104	2,920	994	7,617	10,117	2,411
Number of contracts signed	122	3,878	1,368	13,993	21,111	3,460
Proportion of wheat crop priced with FPC and/or DPC[a]						
mean	34.6%	46.4%	45.6%	46.8%	57.0%	26.7%
max	100%	100%	100%	100%	100%	100%
min	1.3%	0.8%	1.1%	0.5%	0.4%	0.4%

(a) Mean represents the average across all producers in each year, while maximum and minimum refer to highest and lowest values observed for individual producers.

RESULTS

The calculations and discussion in this section focus on the disposition effect measured using the PRO price as the reference price. Results with the previous year's pool price as the reference price are qualitatively similar and not presented for brevity. Table 2 presents calculated values

[7] Some programs were available since the beginning of the data set, while others were created later. For a complete description of the different types of PPO contracts please see the Canadian Wheat Board (2012).

[8] The DPC was terminated after the 2007/08 crop year and the FlexPro was created in the 2008/09 crop year. Both contracts are very similar in their functions and specifications. Therefore, for the purpose of this paper the DPC and FlexPro are combined into one contract and generally referred to as "DPC".

for the disposition effect (DE) for each crop year between 2003/04 and 2008/09. Results show the mean values of DE are always positive, and a t test suggests they are statistically distinguishable from zero. Summary statistics also indicate that the distribution of DE is mostly asymmetric towards positive values and leptokurtic. In addition, the majority of producers exhibit positive DE (except for 2005/06). These findings suggest that producers are more eager to sell their grain when the price offered by the FPC and/or DPC is above the reference price, and wait longer when the price offered by the FPC and/or DPC is below the reference price. Thus they tend to make pricing decisions faster when they see an opportunity to price their grain above the PRO price, but wait longer to sign the marketing contract when they are faced with the possibility of pricing their grain below the PRO price.

Table 2: Descriptive statistics of disposition effect (DE) using PRO price as reference price

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Mean[a]	0.012	0.019	0.015	0.013	0.003	0.023
t statistic[b]	13.14	82.23	14.86	97.39	15.30	37.61
Max	0.057	0.149	0.216	0.131	0.158	0.275
Min	-0.022	-0.027	-0.025	-0.069	-0.196	-0.027
Skewness	0.761	2.461	1.605	1.259	-0.369	1.771
Kurtosis	9.527	13.583	3.316	10.416	3.892	8.557
Obs.	104	2,920	994	7,617	10,117	2,411
Positive[c]	98	2,824	460	7,280	6,509	1,479
	(94%)	(97%)	(46%)	(96%)	(64%)	(61%)
Negative[c]	6	96	534	337	3,608	932
	(6%)	(3%)	(54%)	(4%)	(36%)	(39%)

(a) Mean represents the average across all producers in each year, while maximum and minimum refer to highest and lowest values observed for individual producers; (b) Null hypothesis: mean is equal to zero; (c) *Positive* indicates the number of producers with DE above zero, *negative* indicates the number of producers with DE below zero, and the numbers in parentheses show the percentage of producers with positive or negative DE.

This result is consistent with several studies in financial markets which find that professional traders and investors tend to realize gains faster than they realize losses. However, there can be different motivations to either realize gains or losses or wait for further opportunities. Aversion to loss realization is a possible motivation to realize gains faster than losses, but there can be rational considerations as well. Odean (1998) argues that portfolio rebalancing, tax considerations, and favorable information are some reasons that could

potentially explain the asymmetric realization of gains and losses. Similarly, Frino et al. (2004) argue that investors might realize gains quickly or hold on to their losses because of information advantages. If investors with losing positions have a high subjective probability of favorable price changes, they might wait longer to liquidate their positions so that they have a chance to turn their positions into winners. Dorn and Strobl (2009) also highlight the importance of information asymmetry to claim that disposition effect is not necessarily caused by irrational behavior. In the context of this study, producers might decide to price their grain faster when they have the chance to sell at a price above their reference price because they believe prices will drop and future opportunities to price their grain will happen at lower prices. Alternatively, they might wait longer to sell their grain if the price is below their reference price because they believe price will increase and hence give them better opportunities to price their grain in the future.

An initial step to explore this issue is to look at the relationship between the calculated DE for each producer and the price obtained by selling wheat using FPC and/or DPC. In each crop year producers are ranked according to the prices they received by selling grain using these contracts.[9] Two groups with the same number of producers are created following the ranking of price received, one with the 50% of producers who obtained the highest prices and another with the 50% of producers who obtained the lowest prices. The mean DE is calculated for each group of producers (top 50% and bottom 50%). If behavior consistent with the disposition effect is motivated by better information or marketing skills, mean DEs should be higher for the top 50% and lower for the bottom 50% producers. If producers who obtain higher prices tend to sell faster when there is a gain opportunity and take longer to sell when faced with a loss, this can be an indication that they have informational advantage. Table 3 shows the mean prices obtained by each group. Since the groups are based on the ranking of price received, it is expected that the mean price of the top 50% would be higher than the mean price of the bottom 50%, and a t test indicates that the difference between them is statistically distinguishable from zero. Table 3 also shows the mean DE for each group of producers in each crop year. A t test allows to reject the null hypothesis that the means are the same in four (2005/06, 2006/07, 2007/08, and 2008/09) out of the six crop years, but in one of them (2007/08) the mean DE of the top 50% group is

[9] If a producer used an FPC or DPC more than once during the crop year, the final price received is a weighted average of all prices obtained each time a contract was signed (the weights are the quantity of grain sold each time).

smaller than the mean DE for the bottom 50% group. Hence, in only three of the six crop years there is statistical evidence that the top performing producers exhibit a higher DE than the bottom performing producers, which does not provide strong support for the idea that producers who sell faster when faced with a gain opportunity (or wait longer when faced with a loss opportunity) tend to obtain higher prices compared to those who take longer to sell when faced with a gain opportunity (or sell faster when faced with a loss opportunity).

Table 3: Mean disposition effect (DE) and price for producers who obtained the highest prices and producers who obtained the lowest prices

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Mean price						
Top 50% producers[a]	213.39	235.50	206.94	230.84	301.38	427.48
Bottom 50% producers	207.21	226.45	198.05	216.61	261.14	289.53
t statistic[b]	8.45	50.79	22.35	111.00	82.92	95.04
Mean DE						
Top 50% producers[a]	0.012	0.018	0.030	0.014	-0.002	0.041
Bottom 50% producers	0.012	0.019	-0.001	0.013	0.007	0.005
t statistic[b]	-0.24	-1.32	18.08	3.31	-27.48	36.28
Obs.	52	1,460	497	3,808	5,058	1,205

(a) Top (bottom) 50% refers to the producers who obtained the highest (lowest) prices with FPC and/or DPC in each crop year; (b) t test with null hypothesis H_0: $mean_{top} = mean_{bottom}$.

However, better information or analytical skills might be restricted to a few producers. Thus the investigation performed above is refined by focusing on smaller groups of producers. This new analysis concentrates only on high-performing producers who ranked among the 10% who obtained the highest prices in each crop year, and compare them to low-performing producers who ranked among the bottom 10% who obtained the lowest prices. Table 4 shows the mean prices obtained by each group. Again, since the groups are based on the ranking of price received, it is expected that the mean price of the top 10% would be higher than the mean price of the bottom 10%, and a t test indicates that the difference between them is statistically distinguishable from zero. Table 4 also shows the mean DE for each group of producers in each crop year. A t test allows to reject the null hypothesis that the mean DE are the same in both groups in four (2004/05, 2006/07, 2007/08, and 2008/09) out of the six crop years, but in one of them (2007/08) the mean DE of the top 10% group is smaller than the mean DE for the bottom 10% group. Therefore, the general result is qualitatively the same with the top and bottom 10%

groups as for the top and bottom 50% groups, i.e. only three of the six crop years exhibits statistical evidence that the top performing producers exhibit a higher DE than the bottom performing producers. This finding does not provide strong support for the notion that producers whose marketing decisions are consistent with the disposition effect do so because they have better information or analytical skills.

Table 4: Mean disposition effect (DE) and price for producers who obtained the highest prices and producers who obtained the lowest prices

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Mean price						
Top 10% producers[a]	220.23	237.70	222.04	240.46	339.48	444.20
Bottom 10% producers	201.77	216.46	193.62	209.13	241.86	232.05
t statistic[b]	16.72	45.47	43.06	219.54	56.73	1,060.16
Mean DE						
Top 10% producers[a]	0.011	0.016	0.012	0.010	-0.001	0.039
Bottom 10% producers	0.005	0.010	0.011	0.007	0.011	-0.004
t statistic[b]	1.49	6.58	0.17	5.78	-18.24	60.90
Obs.	10	292	99	761	1,011	241

(a) Top (bottom) 10% refers to the producers who obtained the highest (lowest) prices with FPC and/or DPC in each crop year; (b) t test with null hypothesis H_0: $mean_{top10} = mean_{bottom10}$.

CONCLUSION

This is a work in progress and the current paper reports preliminary findings regarding the disposition effect in grain marketing. Examination of pricing strategies of 15,564 wheat producers who used Fixed Price Contracts (FPC) and Daily Price Contracts (DPC) between 2003/04 and 2008/09 shows evidence of disposition effect in their marketing decisions. They seem to be keener to sell their grain when the price offered by FPC and DPC is above the reference price, and take longer to make decisions when the price offered by the FPC and DPC is below the reference price. Mean values for the disposition effect are positive in all crop years, suggesting producers sell wheat early when price is above the reference price and wait longer when price is below the reference price.

However, the disposition effect can have distinct motivations. Aversion to loss realization is a possible reason, but there can also be rational considerations such as better information or analytical skills. Producers might decide to market their grain faster when they have the chance

to sell at a price above their reference price because they believe price will drop and future opportunities to sell their grain will happen at lower prices. Alternatively, they might wait longer to sell their grain if the price is below their reference price because they believe price will increase and hence give them better opportunities to sell their grain in the future. If better information and analytical skills explain the evidence of disposition effect, then producers who obtain higher prices should also exhibit larger values of disposition effect compared to their peers who obtain lower prices. Statistical evidence does not offer strong support for this idea, since top performing producers showed higher values of disposition effect in only three of the six crop years considered in this study.

Further points remain to be explored in this research project. Tests of disposition effect are a joint examination of the hypothesis that individuals sell winning positions more quickly than they sell losing positions and of the specification of the reference price used to determine gains and losses (Odean, 1998). The current paper reports preliminary results using two reference prices (current PRO price and previous year's pool price), but there are other potential reference prices available to producers in Western Canada. Three of them could be cost of production, historical futures prices, and final price received by each producer in the previous crop year.

Additionally, producers might focus on different factors to make marketing decisions, such as risk management considerations and cash flow needs, rather than only on contract prices being above or below their reference price. Other variables may also provide more insights into how producers make their marketing decisions. A few examples are the price volatility in the market, the existence of price trends, and the proportion of the crop that has already been sold. The traditional procedure to investigate disposition effect adopted in the current stage of this research does not allow exploring these variables, but more recent studies have been using hazard models to explore other dimensions of selling decisions. Cox proportional hazard model can be used to estimate the time it takes for producers to sell their crop within the marketing window, where the hazard rate is the probability of selling grain on day t conditional on not having sold them until that day. As this research progresses a hazard model will also be adopted to include other variables in the analysis of marketing decisions.

Finally, it is also interesting to explore in more detail whether the presence of disposition effect is actually costly for producers. This idea raises the question of whether producers have actually missed higher prices by selling too soon when prices offered by marketing contracts were above their reference price, or whether they have actually received lower prices by waiting too long to sell when prices offered by marketing contracts were below their reference price. This analysis can be performed by tracking contract prices during the days after producers sold their grain, and investigating how much they could have gained or lost if they had priced later.

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APPENDIX

Figure 1: FPC price, reference price and number of contracts (FPC) signed in 2003/04

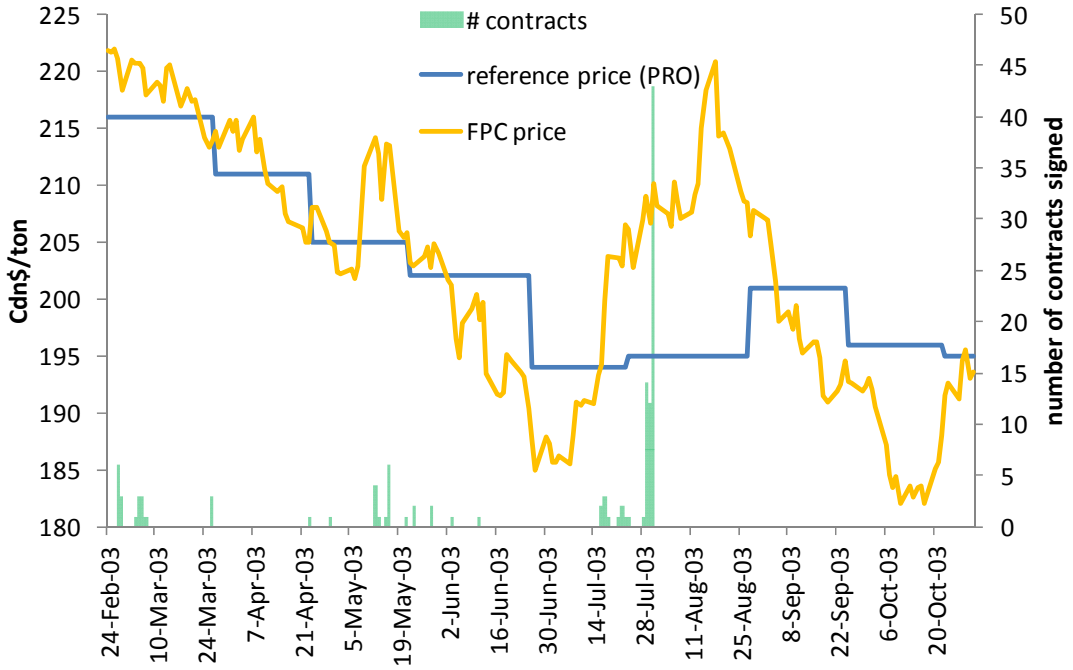

Figure 2: FPC price, reference price and number of contracts (FPC) signed in 2004/05

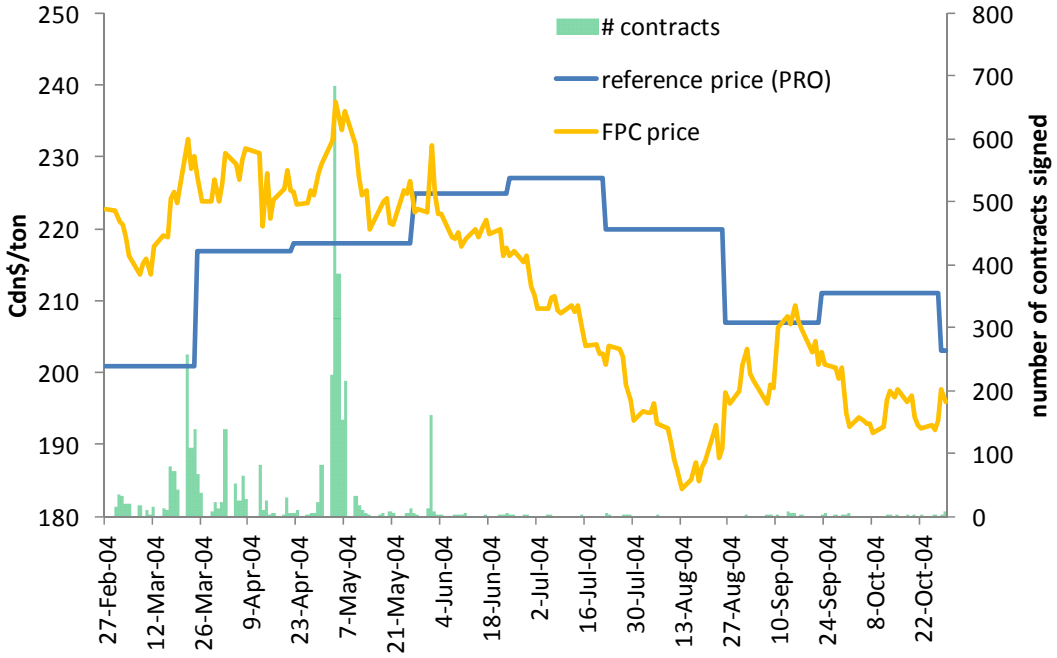

Figure 3: FPC price, reference price and number of contracts (FPC) signed in 2005/06

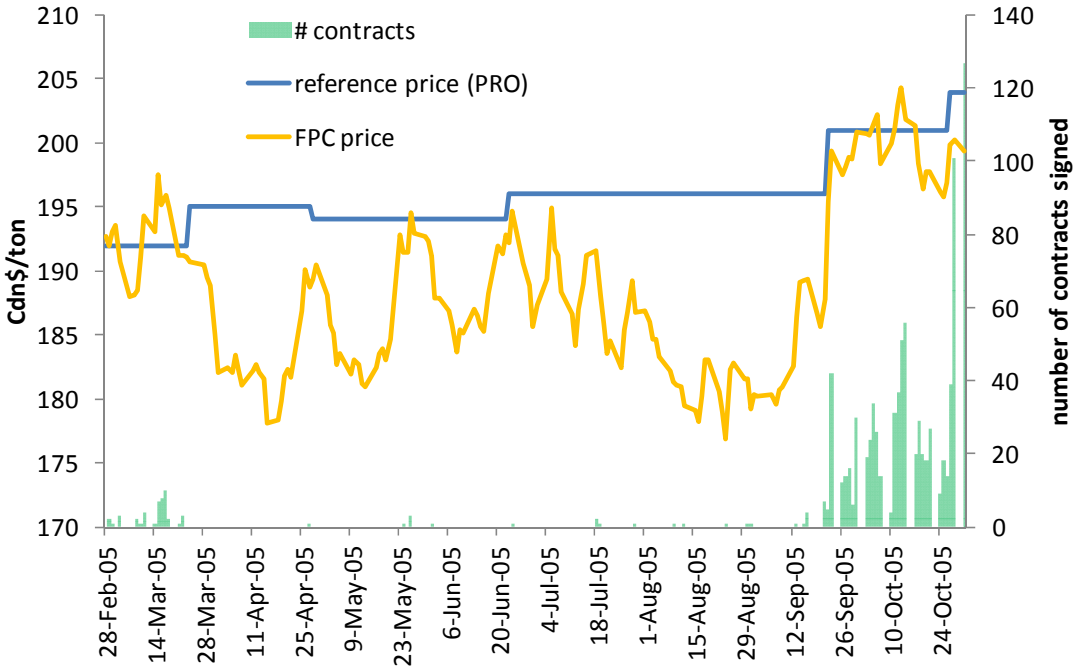

Figure 4: FPC price, reference price and number of contracts (FPC) signed in 2006/07

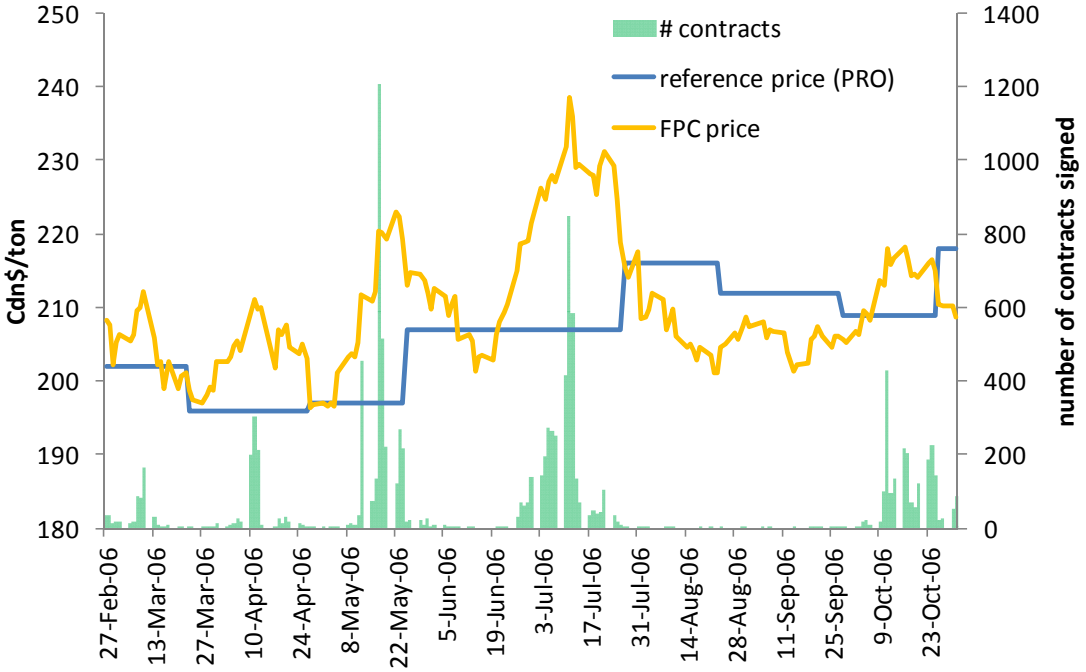

Figure 5: FPC price, reference price and number of contracts (FPC) signed in 2007/08

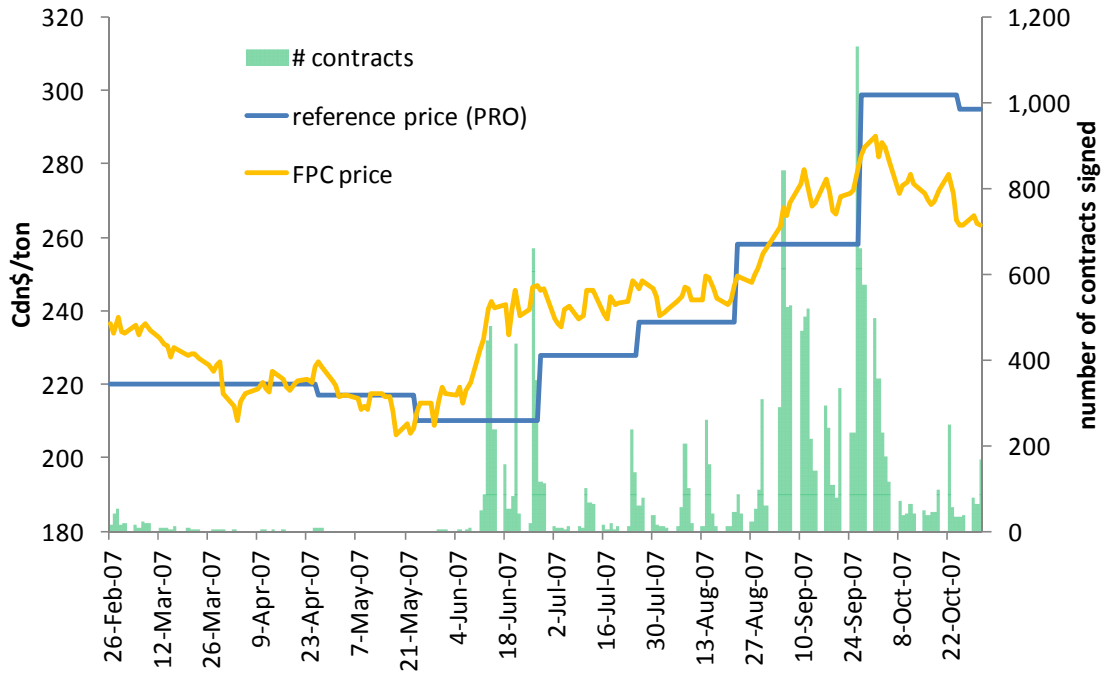

Figure 6: FPC price, reference price and number of contracts (FPC) signed in 2008/09

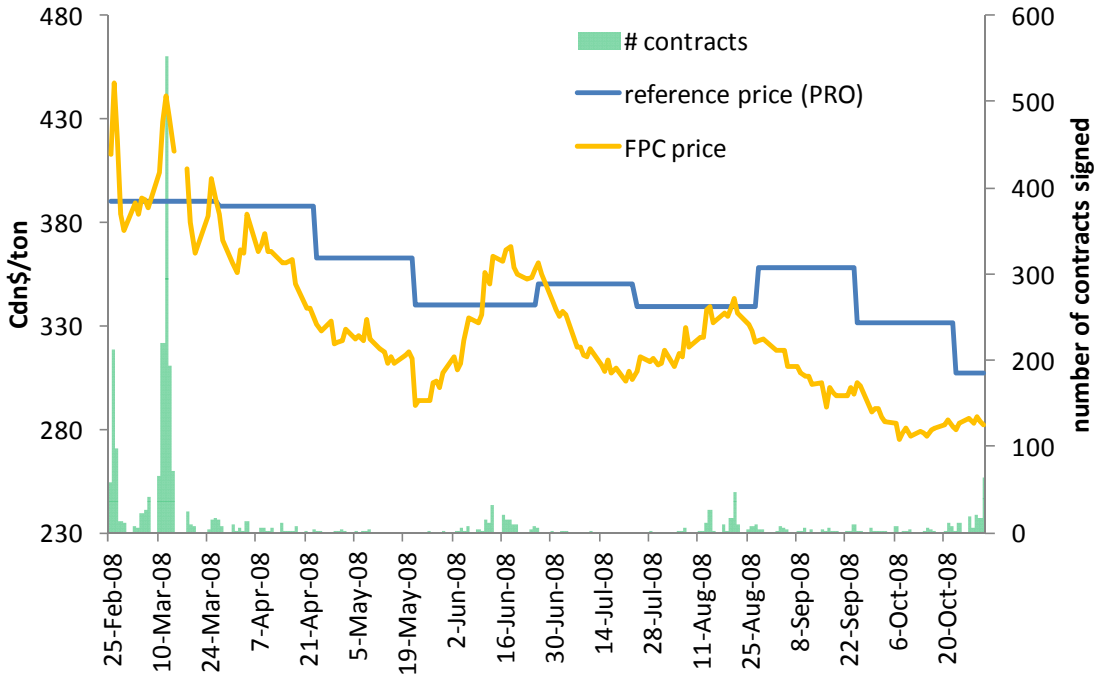

Figure 7: DPC price, reference price and number of contracts (DPC) signed in 2005/06

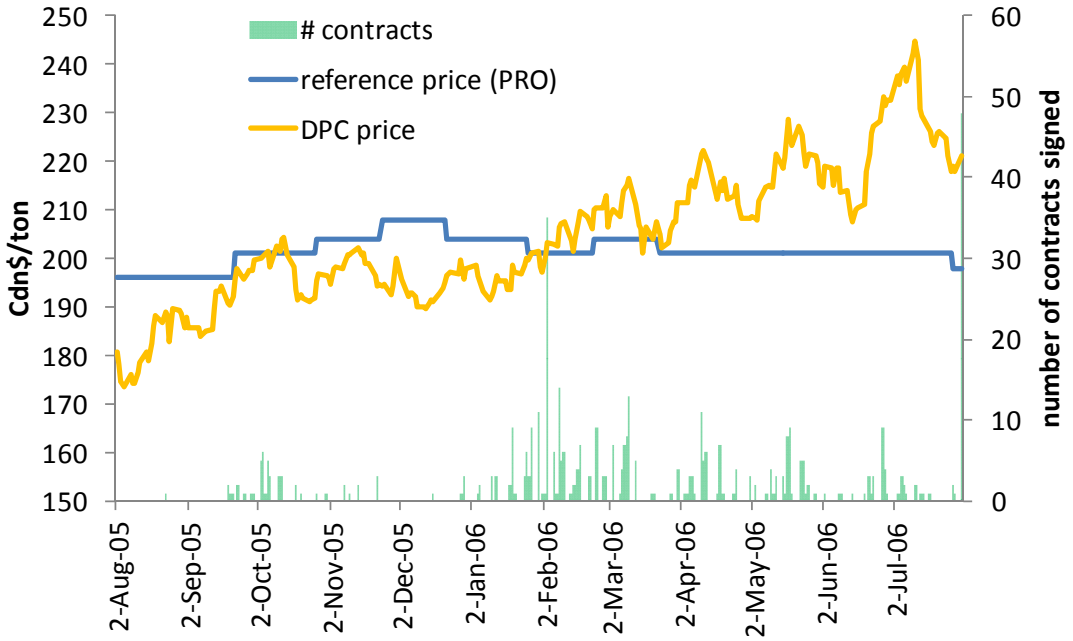

Figure 8: DPC price, reference price and number of contracts (DPC) signed in 2006/07

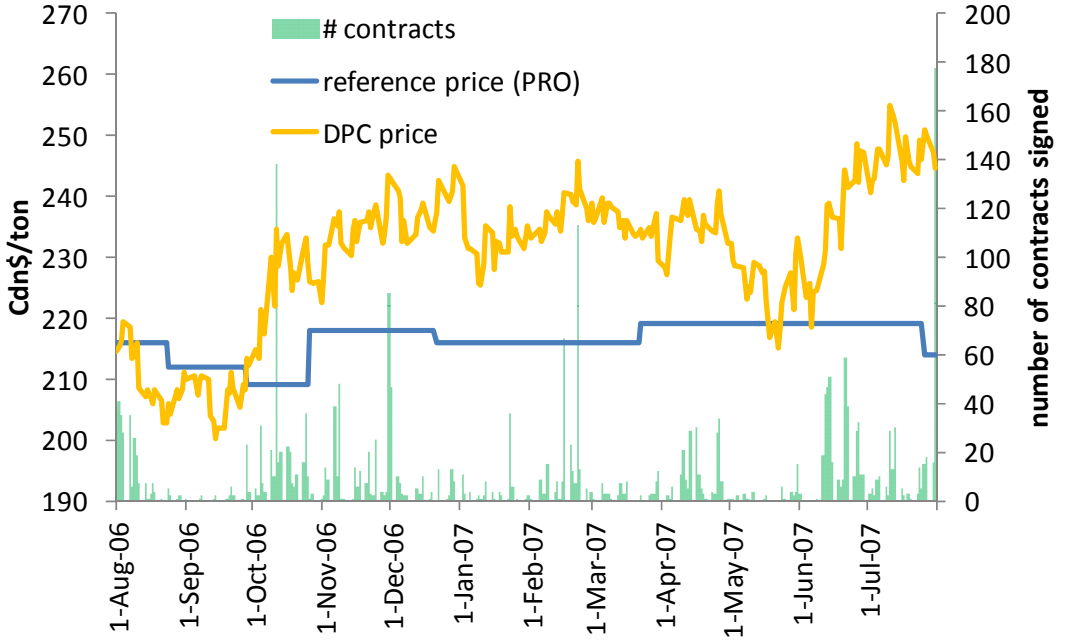

Figure 9: DPC price, reference price and number of contracts (DPC) signed in 2007/08

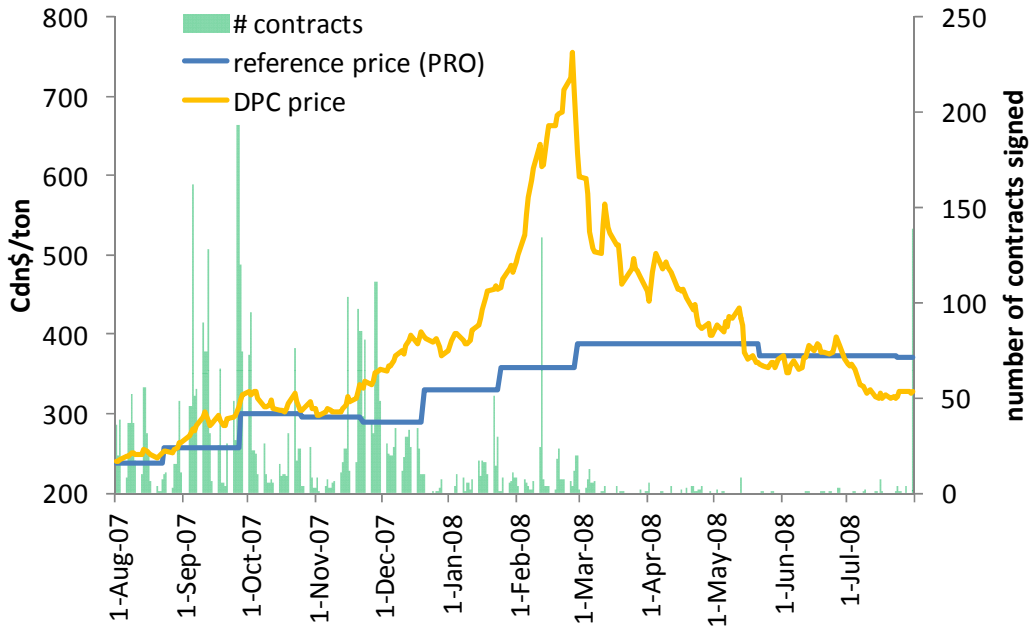

Figure 10: DPC price, reference price and number of contracts (DPC) signed in 2008/09