DO FARMERS EXHIBIT DISPOSITION EFFECT?:

EVIDENCE FROM GRAIN MARKETING

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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 behavioural finance for agricultural marketing and indicate psychological biases which can affect marketing decisions. Empirical studies find evidence that producers exhibit loss aversion and probability weighting, and tend to sometimes 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). Empirical studies show 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 theories.

Studies in behavioral finance have identified several types of behavior often found among investors. One of the most common types of behavior 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) explain that the disposition effect can be explained by two dimensions of prospect theory. One is the idea that individuals make decisions based on a reference points, with outcomes above this 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 take less risk when faced with gains.

The objective of this research is to explore the existence of disposition effect among farmers in Canada. More specifically, it investigates whether Canadian wheat farmers exhibit disposition effect when marketing their grain. This study tries to identify whether farmers wait too long to price their grain or whether they price their grain too soon, which in both cases imply that they miss opportunities to obtain higher prices. A unique data set was made available by the Canadian Wheat Board for the crop years 2003/04 through 2008/09 for all producers growing Canada Western Red Spring (CWRS) wheat. The data contains 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. Another data set was also obtained with additional information encompassing annual cost of production for each province and harvest pace showing how much of the crop was harvested on a weekly basis in each province.

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 offers several pricing alternatives providing distinct combinations of return, risk and cash flow. These pricing options include different contracts which have distinct features but essentially allow producers to use futures markets to price their wheat. Since all producers have to market their grain through the CWB, it is 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.

This study uses a unique data set of all wheat producers in Canada to perform a comprehensive analysis of the disposition effect in grain marketing. It is investigated whether or not this type of behavior is prevalent among farmers 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. This study aims to fill in these gaps and move us towards a more complete understanding of grain marketing.

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. All wheat producers must market their crop through the CWB, which includes producers from Manitoba, Saskatchewan, Alberta, and the Peace River area of British Columbia, who are selling wheat for human consumption and export. The CWB offers several different marketing alternatives which allow producers to choose a program that meets their own needs and preferences regarding return, risk, and cash flow. The oldest pricing alternative is pool pricing, which is the default program, meaning the CWB assumes producers will keep their wheat in the pool accounts unless otherwise indicated.

The pool accounts work by pooling together all the wheat sales made during the crop year and its goal is to guarantee that all producers receive the same final price regardless of when and to whom their grains are 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) that is the best estimate of what the final pool price will be at the end of the crop year. The PRO is often seen as the benchmark price and can be used to alert famers as to whether to keep their wheat in the pool accounts or to sign one of the other marketing alternatives offered by the CWB, collectively known as Producer Payment Options (PPO) contracts.

PPO contracts have only 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. Once producers make their initial delivery to the grain handling facility and receive that same initial payment as the pool accounts, they receive their final payment within 10 business days upon confirmation of delivery.[1]

[1] 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.

This study focuses on pricing programs for wheat, including five contracts: 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 try to obtain higher prices. The only exception is the EPO, which was developed to provide better cash flow management for producers. 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 by indicating tonnage when signing a contract.

PREVIOUS STUDIES

The disposition effect has been largely investigated in the context of financial markets. Shefrin and Statman (1985) have first identified this kind of behavior. 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) try to answer the question of 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 explored 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 method adopted to examine the existence of disposition effect in grain marketing follows Choe and Eom (2009) and is similar to Odean (1998), Frino et al. (2004), Brown et al. (2006), and Dhar and Zhu (2006). This method looks at the frequency with which winning and losing positions are closed relative to the opportunities to close them. Four variables are defined for each farmer during a crop year: realized gain, paper gain, realized loss, and paper loss. From these variables two ratios are calculated for each farmer: proportion of gain realized (PGR) and proportion of loss realized (PLR), as shown in equations (1) and (2).

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

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

where $N_{RG}^{i,t}$ is the number of days in crop year *t* that farmer *i* priced his grain at a gain, $N_{RL}^{i,t}$ is the number of days in crop year *t* that farmer *i* priced his grain at a loss, $N_{PG}^{i,t}$ is the number of days in crop year *t* that farmer *i* had a chance to price his grain at a gain but did not execute it, and $N_{PL}^{i,t}$ is the number of days in crop year *t* that farmer *i* had a chance to price his grain at a loss but did not execute it.

The disposition effect (DE) for farmer *i* in crop year *t* is given by the difference between PGR and PLR, as shown in equation 3. A positive (negative) DE indicates the farmer is more (less) likely to realize a gain than a loss, i.e. the farmer tends to price his grain faster when he is gaining than when he is losing.

$$DE_{i,t} = PGR_{i,t} - PLR_{i,t} \tag{3}$$

Studies in equity markets typically use the purchasing price of the equity as a reference price to calculate realized and paper gains and losses. In the context of grain marketing the reference price is not as clear. In the current study realized and paper gains and losses are measured against two benchmarks: the pool price in the previous crop year, and the Pool Return Outlook (PRO) price in the current crop year. The pool price in the previous year represents the price farmers would have gotten if they had marketed their whole crop using CWB's pool accounts (and hence using no marketing contracts that allow them to price grain outside the pool accounts). It is a static benchmark and assumes that in the current year farmers would try to price their grain above the price obtained by the pool accounts in the previous year. The PRO price is the forecast of the pool price for the current year and is used as a dynamic benchmark in the sense that it is updated regularly during the crop year. The assumption behind this benchmark is that farmers would try to price their grain at a higher price compared to what the CWB expects to obtain for the pool accounts.

Starting at the beginning of each crop year, paper gains and losses are calculated by comparing the current price offered by a marketing contract on a daily basis with the reference price. Realized gains and losses are calculated by comparing the actual price obtained by a farmer on the day that he signed a marketing contract with the reference price. These calculations

provide values for PGR and PLR for each farmer in each crop year, and therefore for the disposition effect (DE).

DATA

Data for this research was provided by the CWB and includes producers growing Canada Western Red Spring (CWRS) wheat in the crop years 2003/04 through 2008/09 in Western Canada (Manitoba, Saskatchewan, Alberta, and British Columbia). The data set contains information on all producers who grew CWRS wheat in at least one of the six crop years provided and marketed their wheat in pool accounts, new marketing contracts (PPOs), or both. Even though PPOs were first available in 2000/01, the data set starts in 2003/04 because the initial three crop years had minimal PPO usage.

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 up their marketing contracts, (iv) final price received by each producer for their wheat, (v) Pool Return Outlook (PRO) and futures prices, (vi) seeded acres, and (vii) province/municipality. The marketing contracts include pool accounts and five types of PPO contract (Fixed Price Contracts, Basis Payment Contracts, Early Payment Option, Daily Price Contract, and FlexPro).[2]

RESULTS

The first part of this research project focuses only on one type of marketing contract, the Fixed Price Contracts (FPCs). Therefore the analysis uses a data set with 12,520 wheat producers who used either FPCs or pool accounts in all crop years between 2003/04 and 2008/09. So no producer in this sample has used any of the other new marketing contracts available to them (DPCs, BPCs, or EPOs). Discussion will also be concentrated on the disposition effect measured using the current PRO price as the reference price. Results with the previous pool price as the reference price are qualitatively similar, but have the drawback of not allowing to calculate disposition effect in three years because prices were always above or below the reference price (which made it impossible to calculate either PGR or PLR).

Table 1 presents calculated values 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 statistically distinguishable from zero based on a t test. Summary statistics also indicate that the distribution of DE is mostly asymmetric towards positive values and leptokurtic. In addition, almost all farmers exhibit positive DE (except for the crop year 2005/06). Histograms of the distribution of DE in Figure 1 provide an illustration of the findings based on the summary statistics just discussed.

[2] 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 website at www.cwb.ca.

Table 1: DE using current PRO price as reference price – Descriptive Statistics

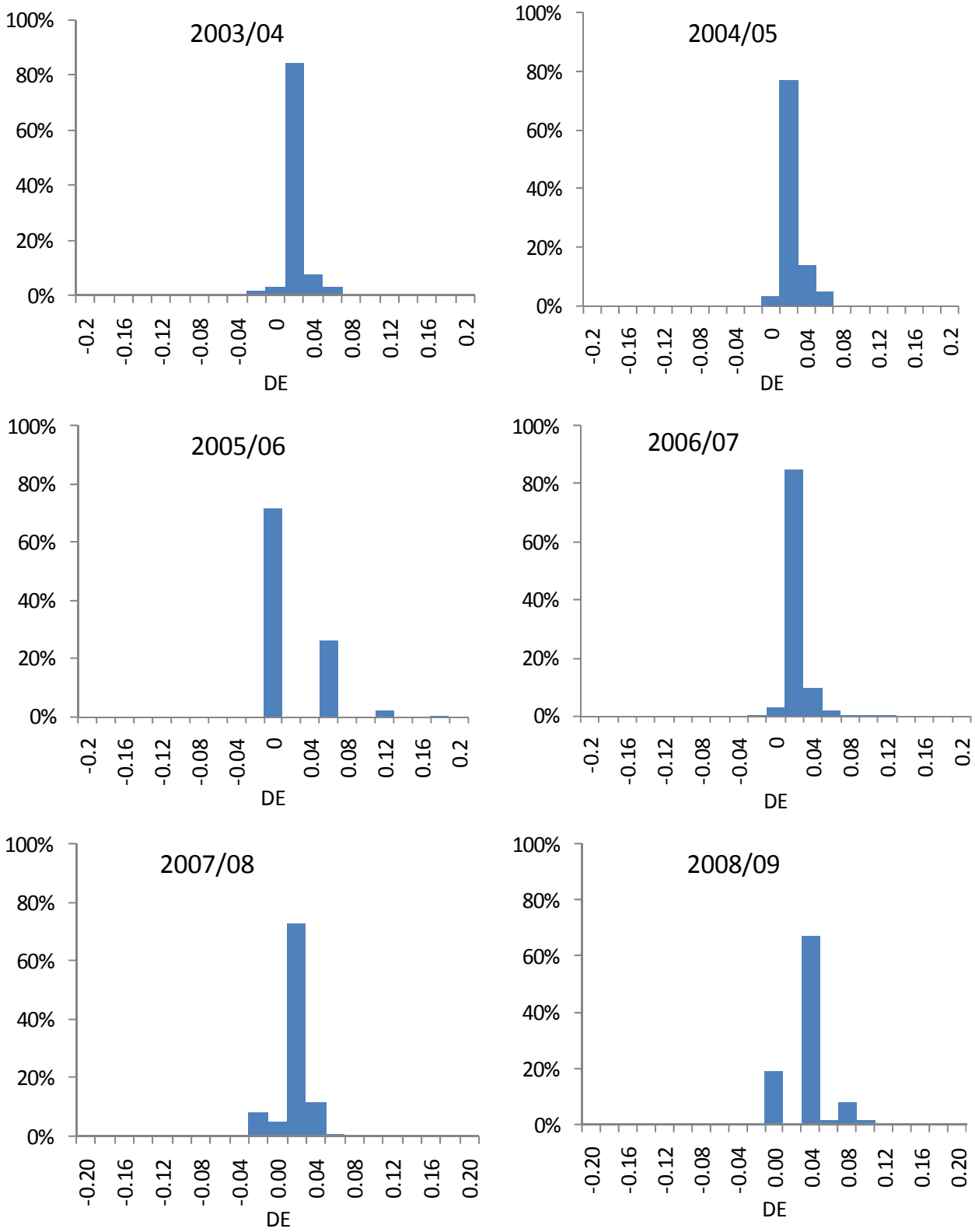
	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Mean	0.0124	0.0182	0.0127	0.0134	0.0083	0.0268
t statistic [a]	9.94	75.25	8.73	90.25	50.45	40.11
Std. dev.	0.0100	0.0113	0.0327	0.0107	0.0142	0.0232
Skewness	1.1396	2.1303	1.3800	1.6849	-0.3613	1.2426
Kurtosis	9.6511	10.8023	1.2008	9.6796	3.6186	6.9439
Highest	0.0568	0.1194	0.1765	0.1111	0.1016	0.1920
Lowest	-0.0222	-0.0090	-0.0191	-0.0340	-0.0964	-0.0278
Obs.	64	2,202	506	5,176	7,365	1,190
Positive[b]	61	2,127	143	5,017	6,321	959
	(95%)	(97%)	(28%)	(97%)	(86%)	(81%)
Negative[b]	3	75	363	159	1,044	231
	(5%)	(3%)	(72%)	(3%)	(14%)	(19%)

(a) Null hypothesis: mean is equal to zero; (b) *Positive* indicates the number of farmers with DE above zero, *negative* indicates the number of farmers with DE below zero, and the numbers in parentheses show the percentage of farmers with DE positive or negative.

These findings suggest that farmers tend to price their grain faster when the current price offered by the FPC is above their reference price (which is assumed to be the current PRO price), and take longer when the price offered by the FPC is below their reference price. In other words, they tend to make pricing decisions faster when they see an opportunity to price their grain above their reference price, but wait longer to sign the marketing contract when they are faced with the possibility of pricing their grain below the reference price.

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 informational 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.

Figure 1: Histograms of DE for each crop year (current PRO price as reference price)



In the context of this study, farmers 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 if they believe price will increase and hence give them have 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 farmer and the price each farmer obtained by selling wheat using FPCs. In each crop year farmers are ranked according to the prices they received by selling grain using FPC[3]. Then average DE values are calculated for the top 10% and bottom 10% farmers of these rankings. If there are rational motivations behind the disposition effect, averaged DEs should be higher for the top 10% and lower for the bottom 10% farmers. In other words, if farmers who obtain higher prices tend to price faster when there is a gain opportunity and take longer to make a sell when faced with a loss, this can be an indication that they have informational advantage.

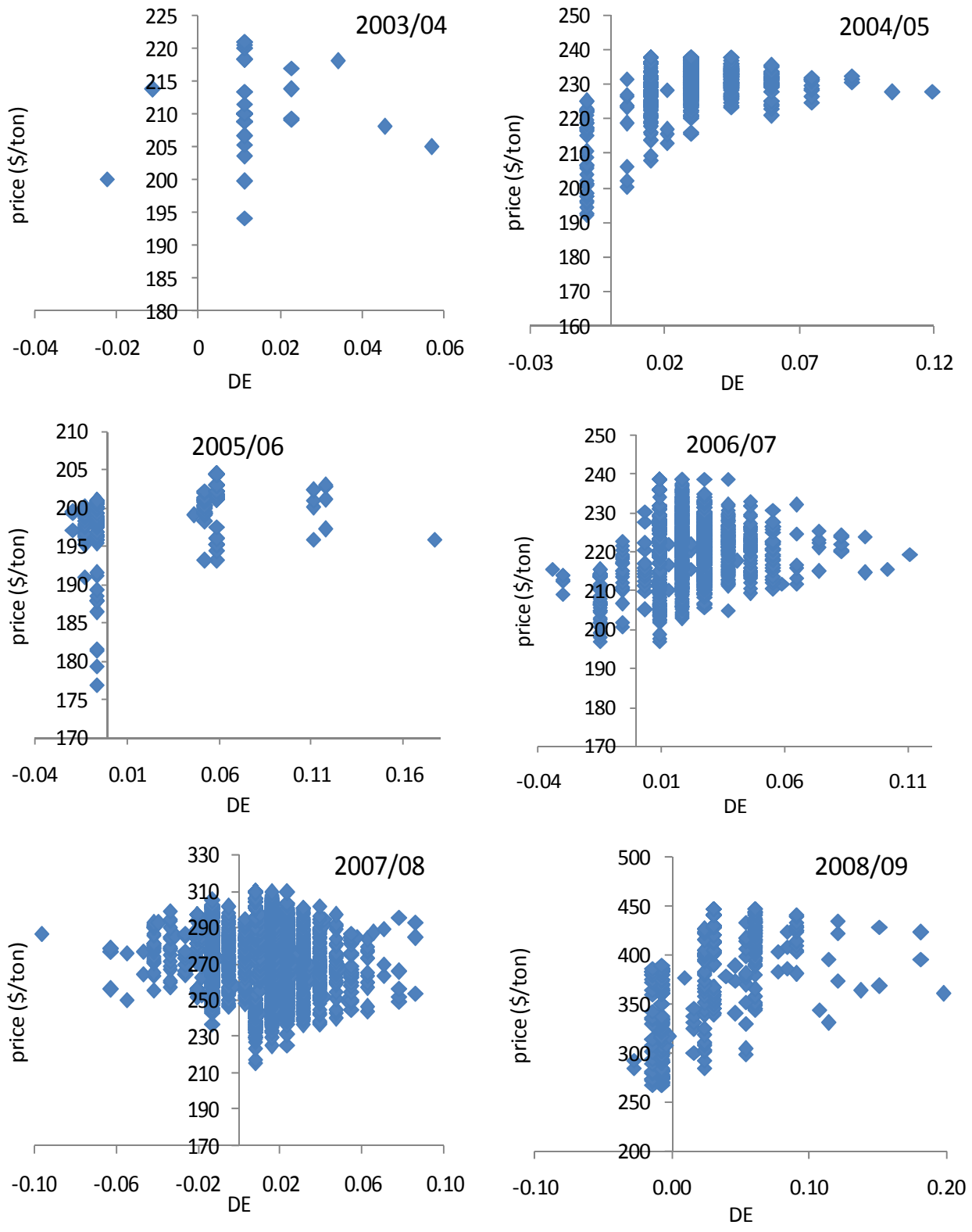
Table 2 shows the average DE for the two groups of farmers in each crop year. The t test allows to reject the null hypothesis that the means are the same in both groups (except for the crop year 2003/04), suggesting there are differences in DE among farmers who obtain higher prices and those who obtain lower prices. In four out of five crop years in which the difference between DEs is statistically distinguishable from zero, the top 10% farmers exhibit higher DE than the bottom 10% farmers. This result indicates that farmers who sell faster when faced with a gain opportunity (or those who 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 those who sell faster when faced with a loss opportunity). Scatter plots of prices and DE for each farmer in each crop year provide a broader picture of this finding, suggesting there might be some positive relationship between higher prices and marketing strategies consistent with the disposition effect (Figure 2).

Table 2: Average DE for farmers who obtain higher prices and farmers who obtain lower prices

	Average DE for top 10% farmers	Average DE for bottom 10% farmers	Obs.	t statistic
2003/04	0.0114	0.0133	6	0.1924
2004/05	0.0157	0.0089	220	-7.0752
2005/06	0.0645	0.0118	50	-8.2982
2006/07	0.0097	0.0073	517	-4.9228
2007/08	0.0083	0.0108	736	8.8389
2008/09	0.0341	-0.0046	119	-26.1325

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

Figure 2: Scatter plots of DE and price received by farmer in each crop year (current PRO price as reference price)



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 12,520 wheat farmers who used Fixed Price Contracts (FPC) between 2003/04 and 2008/09 shows evidence of disposition effect in their marketing decisions. They seem to make marketing decisions faster when the price offered by FPCs is above the reference price, and to take longer to make decisions when the price offered by the FPCs is below the reference price. On average, calculated values for the disposition effect are positive in all crop years, suggesting farmers sell wheat too early (late) when price is above (below) the reference price. However, there appears to be no cost associated with this behavior. Preliminary analysis also shows that farmers with larger positive values for the disposition effect tend to obtain higher prices than their peers with lower values for the disposition effect. This finding would indicate that farmers who quickly sell wheat at a gain but wait longer to sell if faced with possible losses might be actually following a rational strategy rather than behaving irrationally (in the traditional notion of disposition effect).

Further points remain to be explored in this research project. Tests of disposition effect are a joint examination of the hypothesis that people 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 (previous pool price and current PRO price), but there are other potential reference prices available to farmers in Western Canada. Three of them could be cost of production, historical futures prices, and final price received by each farmer in the previous crop year, which will also be adopted as reference prices as this project progresses.

Another dimension is the inclusion of other marketing contracts. The present paper only considers one of the new marketing contracts developed by the CWB, namely the Fixed Price Contract (FPC). This is helpful in the first stage of the research project as it allows focusing on farmers who chose to use a single marketing contract. The scope of the analysis can be expanded by considering farmers who use other marketing contracts and also different combinations of marketing contracts.

It is also interesting to explore in more detail whether the presence of disposition effect actually makes producers miss better opportunities to price their grain and therefore obtain higher prices. Preliminary analysis presented here suggest farmers who price their grain at a gain faster than they do at a loss obtain higher prices, but more work is needed in order gather more convincing evidence either supporting or contradicting this initial finding.

Finally, once the existence of disposition effect is identified, a regression analysis can be performed to better understand the impact of market and individual characteristics on this type of behavior. The variable DE would be the dependent variable in the regression model, and explanatory variables can include harvest pace, type of marketing contract used to price the grain, seeded acres, and years of experience in farming.

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