Risk Exposure of Financial Failure

for North Dakota Grain Handling

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Introduction

An important element of risk for North Dakota grain and oilseed growers is commonly referred to as "counter-party" risk for transactions involving grain sales and input purchases. Growers are exposed to some elements of risk related to default on transactions with buyers and input suppliers. Mechanisms exist in North Dakota (and in most states) to protect growers against buyer default. The purpose of these mechanisms is to protect grain sellers against default of the grain buyer. These mechanisms include requiring buyers to be licensed and to have bond coverage. Detailed statutes explain these mechanisms and requirements in addition to the process of reclaiming losses.

The exposure to risk has escalated in recent years. There have been important changes that impact risk of default. First, price levels have increased. Whereas corn, soybeans and wheat were traditionally in areas of $3, $7 and $5/bushel, these values have now increased by a factor of nearly two and are more recently in the area of $4-6, $11-12 and $7-8, respectively, and, have since declined. Second, the volumes handled by individual shippers have increased due, in part, to the shift in commodities, the adoption of shuttle facilities and consolidation. Third, volatility (risk) for all prices has increased. Our work suggests that the volatility (as conventionally measured) has increased from about .18 in the early 1980s to about .4 or more in recent years. Fourth, the increased cost and value of inputs as well as their volatility (notably fertilizer) have escalated. The combination of these changes has heightened the risk exposure for all firms in this industry and its supply chain. While the grain handling sector is well managed and has had limited defaults, the mechanisms and protections offered to growers will escalate in importance as these changes ensue.

The purpose of this report is to document risks to growers and the mechanisms used to mitigate risks related to buyer default. This report is structured as follows: First, current North Dakota programs are discussed. Second, mechanisms used in other states are examined, and proposed/recent changes are summarized. Third, changes in growers' risk exposure in North Dakota are examined, and changes in North Dakota grain-elevator characteristics are summarized. Fourth, estimated default probabilities for U.S. grain handlers are examined over time. Fifth, results from a simulation model are presented. Finally, recommendations are discussed.

North Dakota Grain Buyer/Warehouse Bankruptcy Programs

North Dakota has two programs that provide coverage for grain-buyer financial failures. The first has two parts: the grain warehouse licensing and bonding program, and the grain buyer licensing and bonding program. These programs require warehouses and grain buyers to be

licensed and to submit a bond which is dependent on the warehouse's rated storage capacity and on the grain buyer's average sales over the last 3 years.

The second program is the North Dakota grain insurance fund which provides coverage for credit sales (which are not covered by the grain buyer's bond). The North Dakota grain insurance fund, or credit-sale indemnity fund, was established in 2003 to cover credit sales deferred for more than 30 days. The fund assesses $2 per $1,000 of credit sales' value; when the fund rises to $10 million, the assessment is dropped until the fund declines to $6 million; then, the assessment is re-imposed. In 2007, the maximum fund was dropped from $10 million to $6 million, and the minimum was lowered from $6 million to $3 million. The indemnity fund pays 80% of claims, up to a maximum of $280,000 per producer.

North Dakota licenses warehouses for storage and requires bonding, with a minimum bond of $50,000 up to a maximum of $1.5 million. The minimum bond requirements are assessed from a bond schedule based on storage capacity. Grain buyer licenses can be either facility based, or for roving grain buyers. There is also a federal bond that is required for licensed federal storage capacity. The federal bond also requires a minimum bond of $50,000 and a maximum of $1 million. The minimum bond requirement is based on the average the last 3 years of volumes handled. Bonds on file for ethanol plants appear to be equal to the required bond for the warehouses' storage capacity.[1]

There have been 40 insolvencies for the North Dakota Grain Warehouse and Buyer Programs since 1975, with periods of multiple insolvencies (the early and late 1980's, the late 1990's to early 2000's, and from 2007 forward (Figure 1). There have been 11 insolvencies since 2007 (Appendix Table B1). The recent insolvencies included nine grain warehouses and two roving grain buyers, and three of these insolvencies made claims on the Credit-Sale Contract Indemnity fund. The insolvencies included two in 2007, three in 2009, two in 2010, one in 2011, two in 2012 and one in 2013. The total payouts for claims against the three Indemnity fund insolvencies ranged from $110,315 to $330,630.

A recent insolvency, Earth Harvest Mills in 2013, which was still in process when Appendix Table B1 was developed, was recently completed with the claims paid amounting to $948,630 (ND PSC, 2014a). This claim was the largest one paid, to date, from the Indemnity fund and left a balance around $4.5 million in the fund (Port, 2014). Three other claims (Mitchell Feeds, Anderson Seed and Falkirk Farmers Elevator Co) are still in the process of completion with significant claims on the Indemnity fund for at least two of them (ND PSC 2013a,b). These two claims could potentially lower the Indemnity fund balance to near $3.6 million, and the balance could be further impacted depending on what occurs with the Mitchell

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[1] Ethanol plants have lower bonding requirements because the bond is based on storage capacity. Ethanol plants usually have a higher turnover rate than elevators having similar storage capacity.

Feeds insolvency. There is a trend for the size of the claims paid by the Indemnity fund. These claims have increased from 2007 with the latest one being the largest at $948,953.
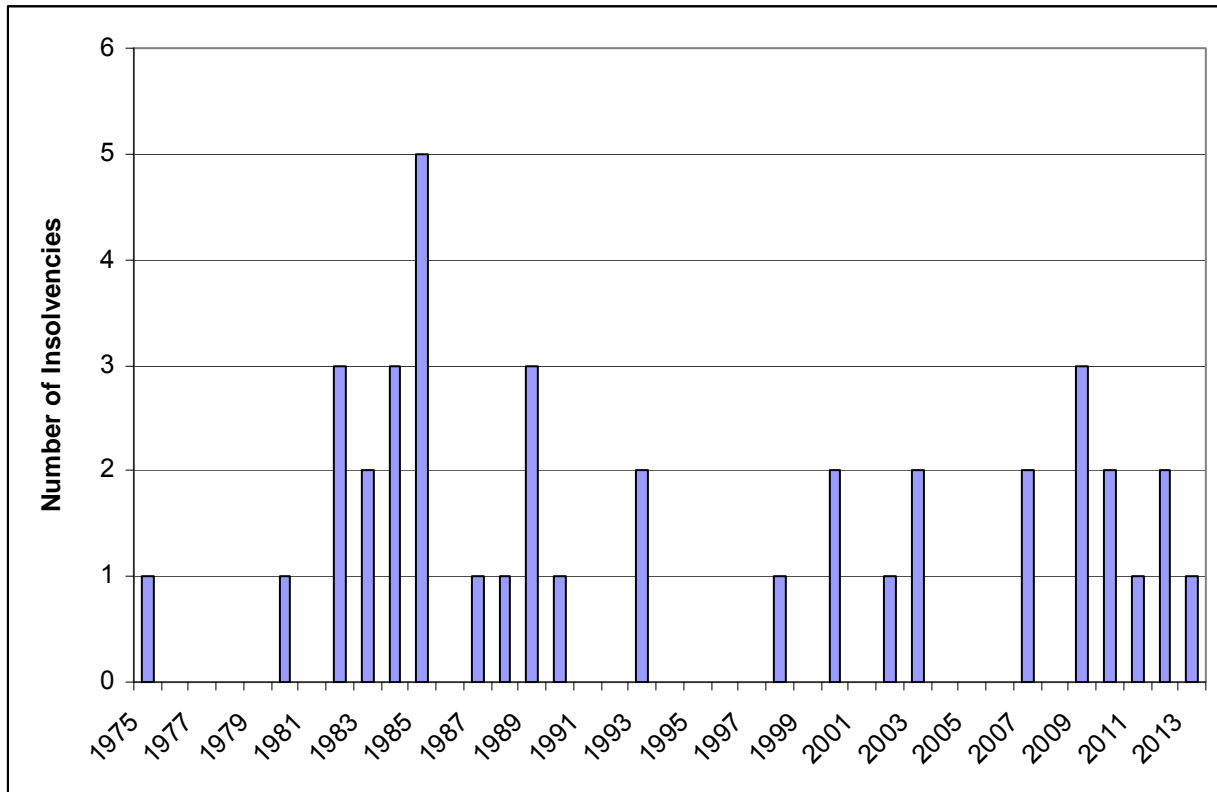
Figure 1. North Dakota Warehouse/Grain Buyer Insolvencies per Year.

The probability of insolvencies occurring for any year was estimated (Figure 2). The probabilities calculated indicates that North Dakota warehouse/grain buyer programs experienced no insolvencies per year about 46% of the time, 1 insolvency 23% of the time, 2 insolvencies about 18% of the time, etc. from 1975 to 2013. The estimated probabilities also indicate that the likelihood of at least 1 insolvency in a year is about 54%. The probability of 1 or less insolvencies in a year was 69%; two or less insolvencies was 87%; and 3 or less insolvencies was 97% (Figure 3).
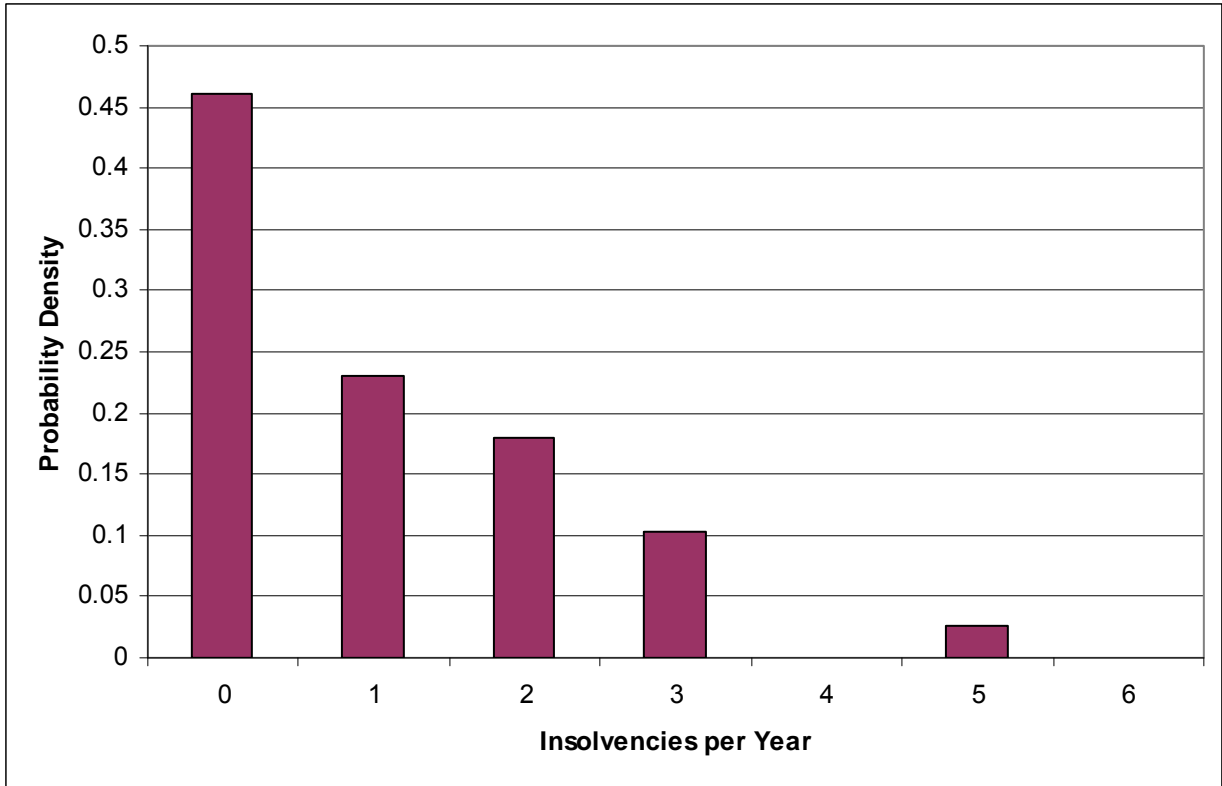
Figure 2. Probability of Given Number of Insolvencies Occurring per Year.
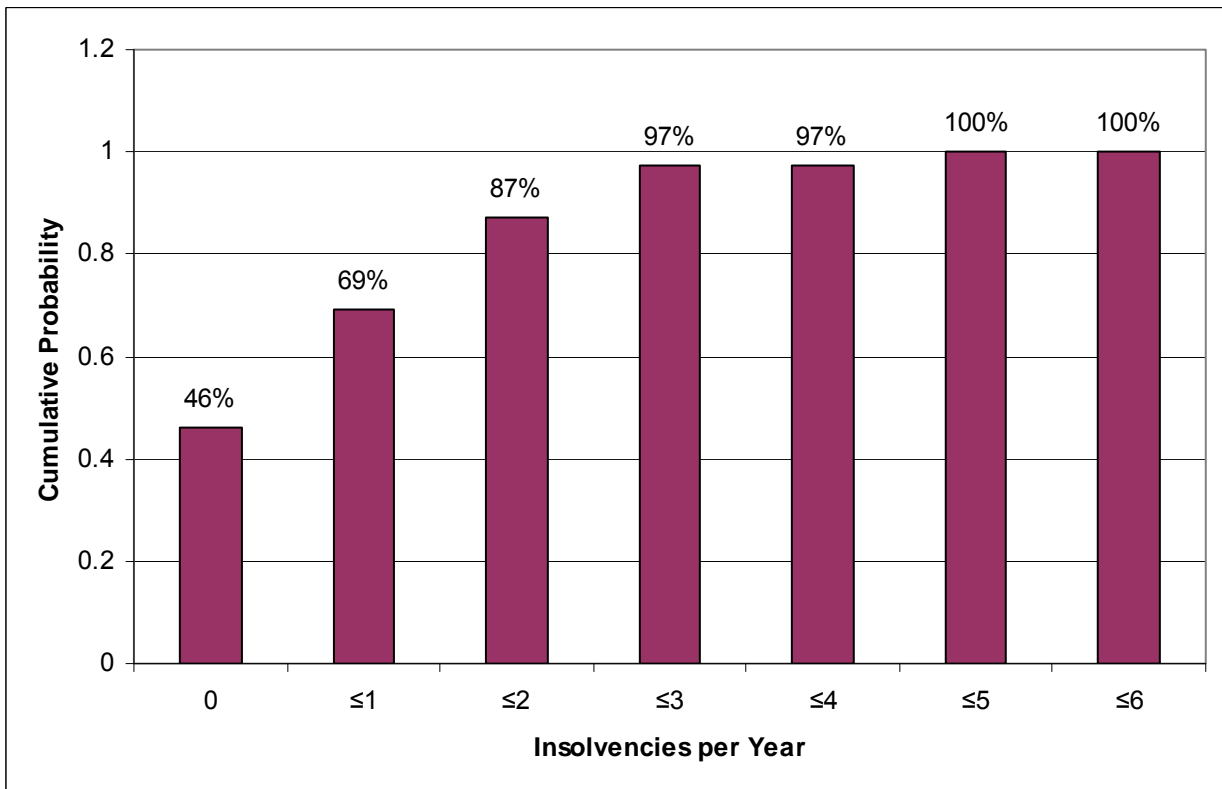
Figure 3. Cumulative Probability of Insolvencies per Year.

Mechanisms in Other States

States generally have either indemnity funds or bonding programs. Only North Dakota and Oklahoma have both, while Oregon has neither. States that only have bonding include: Alabama, Arkansas, Colorado, Georgia, Kansas, Maryland, Minnesota, Mississippi, Missouri, Montana, Nebraska, South Dakota, Texas, Virginia and Wyoming. States that only have indemnity funds include: Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Michigan, New York, Ohio, South Carolina, Tennessee, Washington and Wisconsin (AGRO, 2014).

Most states with bonding have warehouse bonding requirements. A few have both warehouse and grain buyer bonding requirements (Alabama, Colorado, Georgia, Minnesota, Mississippi, Missouri, Montana, Nebraska, North Dakota, South Dakota and Virginia). It is notable that other states with grain buyer bonding requirements apply the bond based on a percentage of the value of agricultural commodities purchased in the prior year (Colorado, Minnesota, Missouri, Montana, Nebraska and South Dakota) while North Dakota uses a three year average for volumes handled as the basis for its bonding requirements.

Two of the states with bonding apply different requirements for dry bean warehouse storage bonding requirements than for commodity grains (Colorado and Wyoming). The Colorado requirements for dry beans imply bonding requirements could be up to three times higher than for a similarly sized non-dry bean facility over one for commodity grains. Nebraska varies the bonding requirement based on the type of storage (normal vs. without turning or aeration capabilities). Virginia splits its bonding requirements into two categories: grain dealers (who can purchase or store grain from Virginia growers) and grain handlers (who can buy bulk grain and either resell the grain or grain products, but cannot purchase or store grain from Virginia growers).

Several states also impose net worth requirements which, if violated, require an additional bond to be licensed (Colorado, Kansas, Missouri, Nebraska, Texas and Wyoming). These net worth bonding requirements typically require net worth to equal 20 to 25 cents/bu. of storage capacity, and an additional bond is required to make up the difference for shortfalls. Most states treat bonds for grain buyers and warehouses separately, so a firm that both buys and stores grain would require two bonds. Colorado determines it's bonding requirements as the maximum of either the estimated bond for the warehouse or the grain buyer.

In addition to state regulations, there are bonding requirements to become a federal warehouse. These rules are similar to state level bonding requirements in several of the states. Bond requirements are scaled based on storage capacity and require 20 cents/bu. for the first 1 million bushels of storage, 15 cents/bu. for 1 million to 2 million bushels and 10 cents/bu. for storage capacity over 2 million bushels. The minimum bond required is $50,000, and the

maximum is $500,000. Also, an additional bond is required if the firm's net worth falls below 25 cents/bu. of storage capacity.

The Association of Grain Regulatory Officials (AGRO) conducted a study on the characteristics of indemnity funds for those states that offered them (AGRO, 2013). It found minimum and maximum sizes for insurance funds varied by state. The lowest specified minimum for an insurance fund was $1 million dollars for New York and Oklahoma. The highest minimum was $10 million dollars for Idaho and Indiana. Maximum amounts for the insurance funds ranged from a low of $3 million in Washington to a high of $15 million in Indiana (Table 1).

Most insurance funds covered "priced later" sales. Only Iowa, Louisiana and Oklahoma did not cover "priced later" sales. The maximum coverage for claims varied from 80 to 100%, with the lowest coverage by Indiana, Kentucky, North Dakota, New York and Ohio; and the highest coverage was by South Carolina. North Dakota and Illinois also impose maximum limits on farmer payouts in addition to coverage limits. North Dakota limits farmer payouts to $280,000 per farmer while Illinois limits the amount to $250,000 per farmer. The insurance funds have been in operation for a range of years. The Oklahoma fund started in 1980 and was the oldest. The Louisiana fund started in 2008 and was the newest.

Table 1 shows the total failures and claims paid, from which we calculated the average failure per year of operation and the average claims paid per failure. Most states had failures that averaged less than one per year and average claims were generally less than $400,000 per failure.

The average claims per failure, by state, were fitted for a relationship with either the maximum or minimum of the state's indemnity fund (Appendix Figures A1-A2). These relationships suggest that North Dakota actually has a slightly higher minimum indemnity fund value related to its average claims per failure than in other states, although the value is not as high as Ohio, Indiana or Idaho. For the relationship between average claims per failure and the indemnity fund's maximum, North Dakota is about on average with that implied across all states with indemnity funds (Appendix Figure A2). These relationships suggest that North Dakota's Indemnity fund minimum and maximum values are in line with other states. These relationships also suggest that if average payouts for claims increase, the size of the minimum and maximum for the state's indemnity fund would likely need to increase to be consistent with other states.

If we include the latest insolvency against the indemnity fund (The Earth Harvest Mills insolvency was not completed at the time of the AGRO study), this increases North Dakota's average claim per failure from $94,363 to $216,937. This value does not include potential payouts for the several unresolved insolvencies which could increase average claims per failure to around $341,000. This level of average claims per failure further shifts North Dakota's

position for minimum and maximum fund sizes to a smaller than average position across the states. It is notable that North Dakota's average claims per failure $216,937 would still be less than that observed in most other states (Idaho, Illinois, Indiana, Iowa, Louisiana, Ohio and Oklahoma) ranging from $251,350 in Iowa to $853,205 in Idaho. Only Kentucky, Michigan, New York, South Carolina, Tennessee, Washington and Wisconsin have lower average claims per failure. At $341,000 per claim, only Idaho, Indiana, Louisiana and Ohio would have higher claims per insolvency.

Table 1. Selected Characteristics of State Indemnity/Insurance Funds[1]

State	Minimum ($ Million)	Maximum ($ Million)	Cover Price Later Sales	Max Coverage (Percent)	Farmer Max Payout ($)	Established Year	Failures Total	Average Failures per Year	Total Claims Paid ($)	Average Claims/Failure ($)
ID	10	12	Y	90		1989	12	0.50	10,238,459	853,205
IL	2	6	Y	85	250,000	1983	82	2.73	21,203,519	258,580
IN	10	15	Y	80		1996	11	0.65	4,280,703	389,155
IA	3	8	N	0		1986	58	2.15	14,578,304	251,350
KY		4	Y	80		1984	14	0.48	2,415,267	172,519
LA	3	6	N	0		2008	1	0.20	400,000	400,000
MI	3	5	Y	90		2003	6	0.60	920,382	153,397
ND	3	6	Y	80	280,000	2003	6	0.60	566,178	94,363
NY	1	4	Y	80		1984	64	2.21	4,565,386	71,334
OH	8	10	Y	80		2004	37	4.11	12,710,798	343,535
OK	1	6	N	0		1980	14	0.42	4,300,000	307,143
SC	1.5	5	Y	100		1982	107	3.45	2,850,353	26,639
TN		10	Y	85		1990	6	0.26	958,995	159,833
WA		3	Y	Sliding		1987	0	0.00	0	0
WI	1	6	Y			2002	0	0.00	0	0

Source: Derived from ARGO (2013).

[1.] Only states having indemnity funds are shown. Many Midwestern wheat producing states including the nearby states of MN, MT and SD only have bonding programs

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Changes/Proposed Changes to State Regulations

South Dakota requires licensing and bonding of warehouses and grain buyers. Warehouses are required to submit a minimum bond that is equal to the maximum of $25,000 times the number of facilities or 50% of the value of grain in storage. The value of grain in storage must be reported monthly (SD Public Utilities Commission, 2014). In 2013, the South Dakota law was changed from requiring the last annual financial report to be licensed to requiring more frequent information about financials, thus requiring buyers to self-report financial difficulties to the South Dakota Public Utilities Commission if the firm experiences financial trouble (GrainNet, 2013). The South Dakota Public Service Commission proposed changing the rules for oral credit sales in July 2013, and changes were enacted in September 2013. The new rule required that contracts be mailed to the farmer; then, the farmer has 48 hours to object in writing, or the contract goes into effect (Pates, 2013).

Iowa has an indemnity fund with a maximum of $6 million. The fund assesses .014 cents/bu. on grain transactions and .014 cents/bu. on storage capacity for grain warehouses, and producers are charged .25 cents/bu. on grain sold. The fee was stopped in 1989, however, fees are still collected for grain buyer's license fees. This fund only covers loses for cash sales and does not cover losses on credit sale contracts (South Dakota Farmers Union, 2013).

In 2013 Ohio increased the size of its indemnity fund and made farmers first in line for assets in the case of a bankruptcy (Seachrist, 2013). The language covering the order of claims on assets removed the ambiguity of preferences on claims but retained farmers as having priioty. The Ohio indemnity fund allows lenders to participate. Ohio increased the indemnity fund minimum/maximum from $8/$10 million to $10/$15 million. The fund, which contained $8 million, would collect a ½ cent/bu. levy until the fund cap of $15 million is reached. Then, the levy is suspended until funds drop to $10 million. The fund generally reimburses 100% for storage grain, deferred payments up to 90 days with a signed agreement and insufficient funds checks (Moore, 2012). The fund provides 100% coverage for the first $10,000 and 80% of the balance for delayed price grain and basis grain. Lenders have the ability to use the grain indemnity fund by asking handlers to utilize state warehouse receipts (OABA, 2014).

The Texas Grain Producer Indemnity Board proposed an indemnity fund that would be designed to mitigate up to 90% of losses when grain buyers fail (Texas Department of Agriculture, 2013). The fund would have made an assessment of 0.2% to 0.6% of the final value of the sale to fund the indemnity at the first point of sale grain buyer. However, the proposal required a two-thirds vote to be adopted, and growers voted not to adopt the Texas Grain Producer Indemnity Board (Smith, 2013).

Nebraska has a bonding/surety mechanism. The Nebraska Public Service Commission brought up the idea of an indemnity fund in 2008 and 2009. Little support existed from the state's commodity and farm groups in 2009 (Dakota Farmer, 2009).

Changes in Risk Exposure for Growers

Crops grown and farm sizes have changed over time for North Dakota farmers. In an effort to examine the risk exposure of farmers, we constructed an average size farm and applied planted and harvested acres, yields and marketing year prices to derive a measure of gross receipts. Farm sizes were taken from Swenson (Various), reported an average size farm for commercial operators in North Dakota. Crop mix was estimated as the proportion of total planted acres devoted to individual crops by year. The ratio of harvested to planted acres was estimated from actual North Dakota planted and harvested acres, by year, from 1990 to 2013 (USDA-NASS, 2014). Yields and marketing year prices were also obtained from USDA-NASS (2014). Gross receipts from crop sales were estimated by crop and aggregated. Gross receipts were estimated by multiplying harvested acres by yields and marketing year average prices.

Estimated gross receipts per farm grew from about $100,000 in 1991 to $803,351 in 2012 (Figures 4-5). The increase in gross receipts was due to increased farm sizes, changes in crop mix, increased yields, and higher prices for crops. Farm size grew from 1,387 acres in 1991 to around 2,000 acres from 2007 forward. The crop mix shifted toward higher production of corn, soybeans, canola and durum wheat, and away from barley, sunflowers, spring wheat and winter wheat. Marketing year average prices for 2013 increased, on average, from 1.8 to 4.1 times 1991 prices, with corn rising 1.8 times and flax increasing 4.1 times 1991 prices.

The gross receipts per farm increased from about $100,000 in 1991 to over $800,000 in 2012, reflecting a large increase in farmers' risk exposure given the coverage limits for the bonding and indemnity programs. The indemnity fund limits farmer payouts to 80% of the claim, up to a maximum of $280,000 per producer. This limit suggests that, in the early 1990's to early 2000's, an average farmer would likely not run into the maximum per farm limits. From 2007 forward, an average farmer in North Dakota would have significant risk exposure if all crops were sold to a single firm and, even if split evenly between bonding and indemnity programs, may exceed grower limits for maximum payments. In fact, in the most recent insolvency, two claimants had claims exceeding the $280,000 payout limit (ND PSC, 2014a).

The indemnity fund would potentially provide coverage for up to a maximum of $350,000 ($280,000/.80) in gross receipts. For a farm in 1991 to obtain gross receipts of about $350,000, a farm size of about 4,725 acres is implied. In 2003, the year the indemnity fund
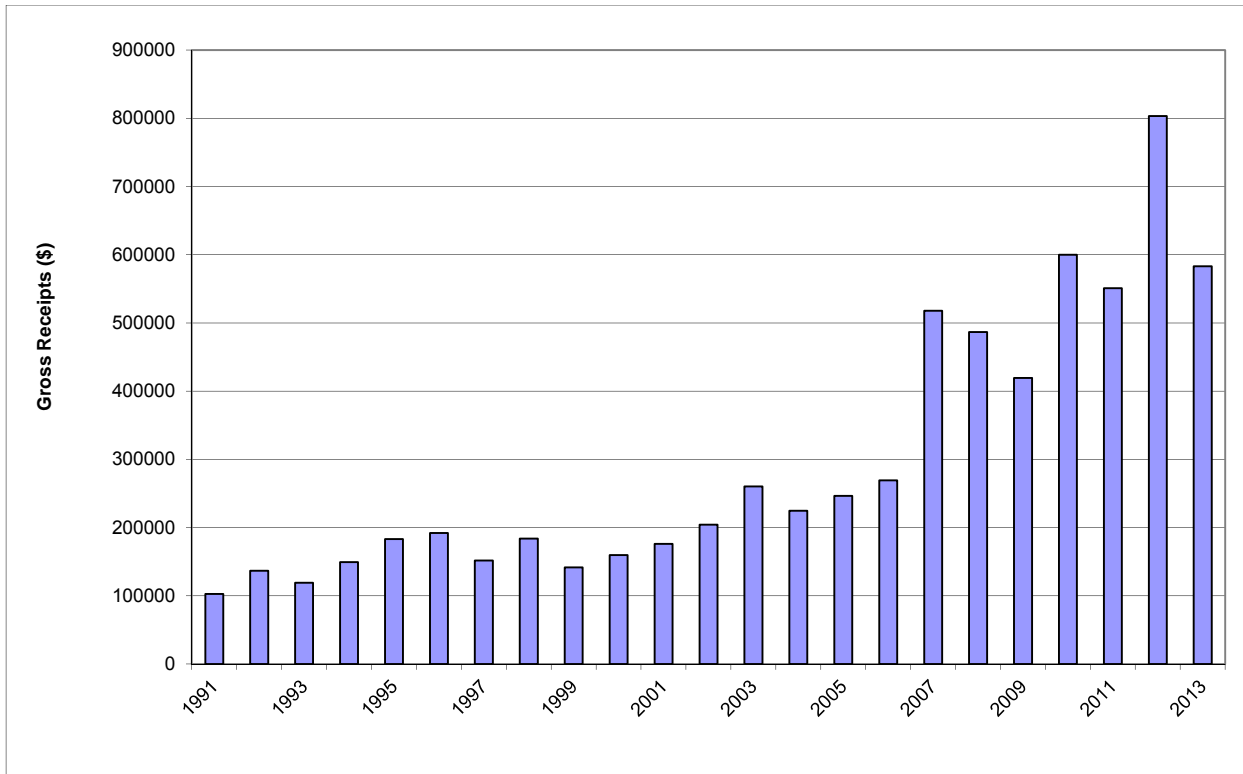
Figure 4. Gross Receipts for an Average Size Farm, North Dakota, 1991 to 2013.
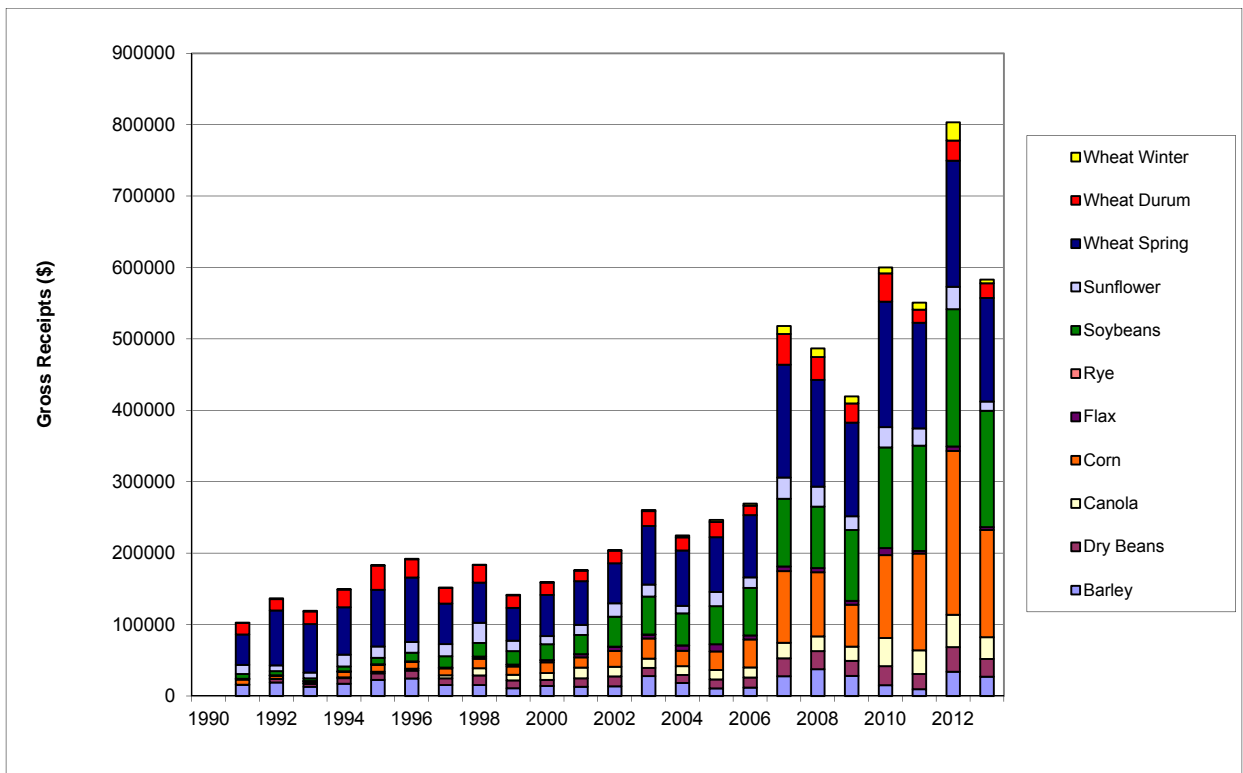

Figure 5. Gross Receipts for an Average Size Farm, North Dakota, 1991 to 2013, by Crop.

was established, this limit would cover an average farm of 2,680 acres. In 2013, the payment limit would only imply an average farm size of 1,160 acres. If the maximum payment were to provide the same coverage for the same size farm as in 1991, this would imply a maximum payment of $1,140,000 ($1,426,352 gross receipts *.8). If the maximum payment were to cover a farm size equivalent to that in 2003, this would imply a maximum payment of about $650,000 ($809,021 gross receipts *.8). Thus, the indemnity fund should provide less coverage to fewer and smaller farms in 2013 than it did in 2003.

Volatility of monthly prices received by growers was evaluated by marketing year from 1990 to 2013 for North Dakota (Appendix Figures C.1-C.7). These figures show changes over time with volatilities increasing for some crops (soybeans, durum and spring wheat) and declining for others (dry beans). The increase in volatilities adds risk for both growers and elevators. The results also show that dry beans are somewhat more risky than other crops. This is complicated further in that price risks for dry beans are not readily hedgeable..

Changes for North Dakota Grain Handlers

Changes in the number, size and distribution of grain elevators in North Dakota have been ongoing (Vachal and Benson, Various). The number of firms has declined from 363 in 2000/01 to 292 in 2012/13, and the total storage capacity has increased from 209,474,000 to 302,048,000 bushels (Figure 6). With declining firms and increased total storage capacity, the distribution of firms by type of elevator shipping capability has also changed. The proportion of elevators by type is largely similar from 2000 to 2012 for firms with No Rail, Single Car or Multi-Car capabilities. The proportion of 100 car shippers has increased and Unit trains have decreased in importance (Figure 7). This relationship changes dramatically when we look at the share of storage capacity. Most elevator shipping types declined in terms of their share of total capacity while the 100 car shippers grew from about 9% of capacity in 2000/01 to 44% of storage capacity in 2012/13 (Figure 8).

The average volume handled by size of rail shipping capabilities, shows increased volumes per elevator, especially for the 100 car shippers (Figure 9). 100 car shippers grew in average volume from 8 million bushels per elevator in 2000/01 to over 16 million bushels per elevator in 2012/13. While the turnover ratios for this category of grain elevators have been declining, the size of storage capacity has been increasing (Figures 9-10). The net effect on bushels handled has been for volumes to continue increasing (Figure 11).
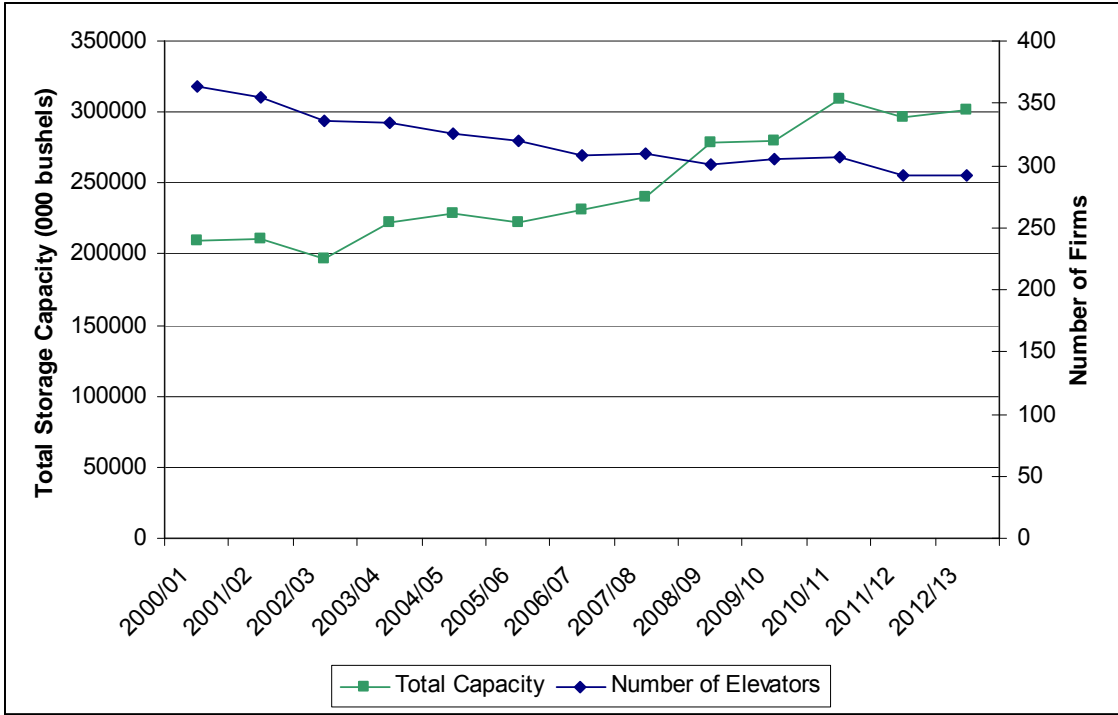
Figure 6. Total Storage Capacity and Number of Grain Elevators in North Dakota, 2000/01 to 2012/13.
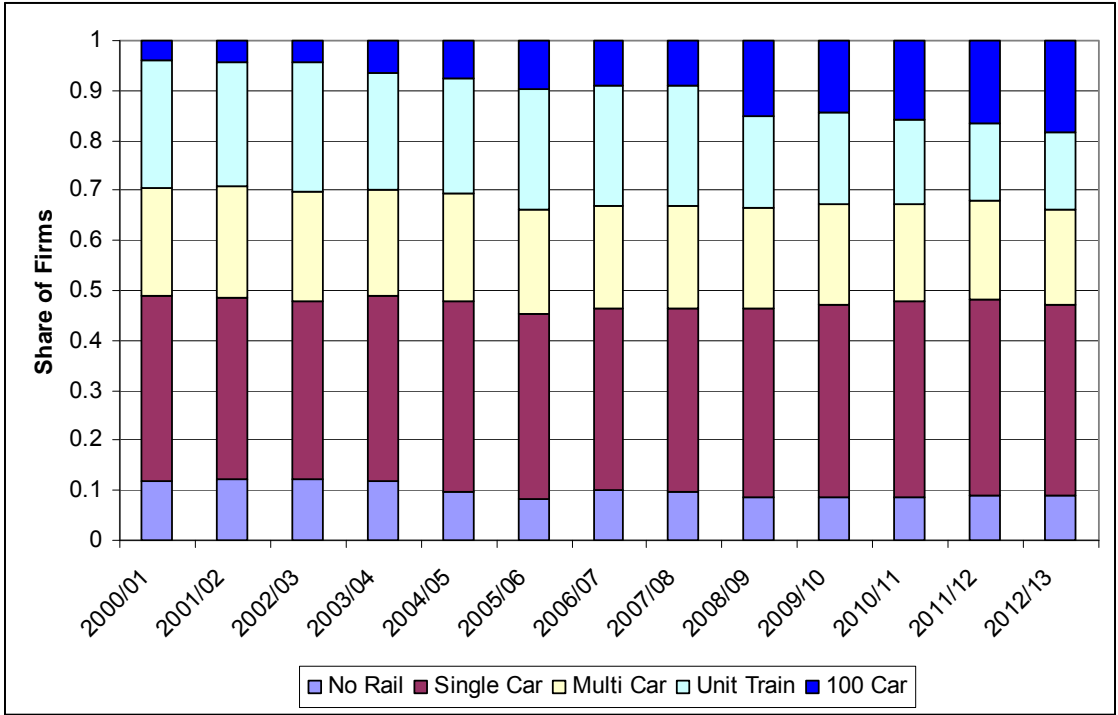
Figure 7. Share of Grain Elevators in North Dakota, by Shipping Type, 2000/01 to 2012/13.
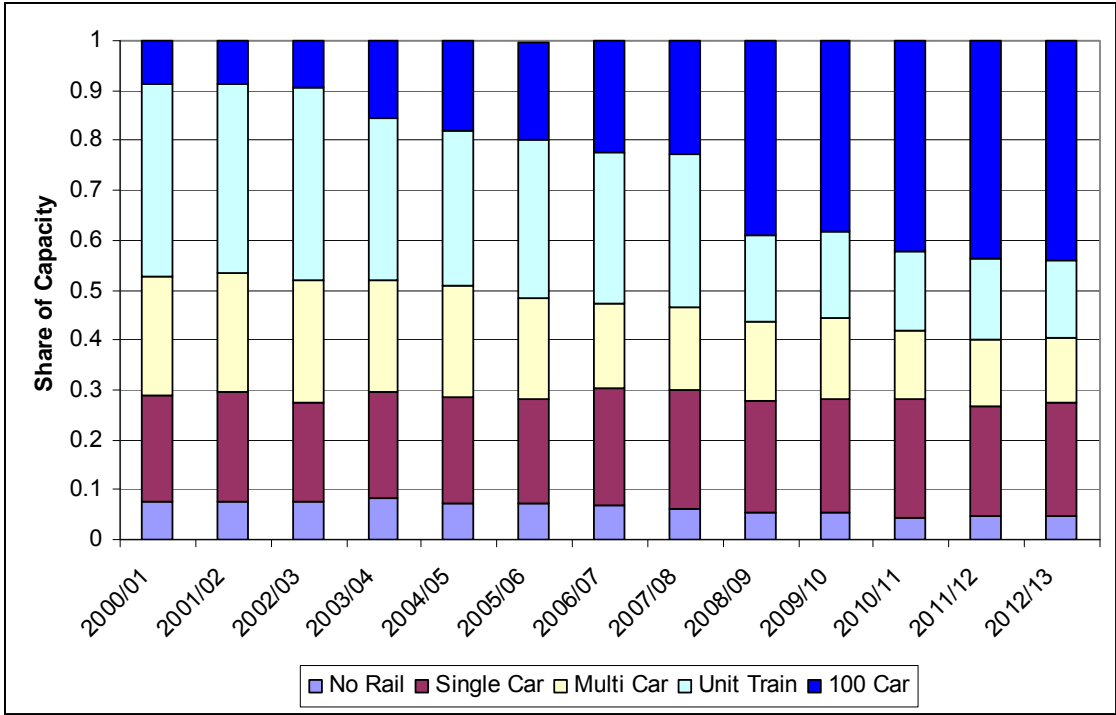
Figure 8. Share of Grain Elevator Storage Capacity in North Dakota, by Shipping Type, 2000/01 to 2012/13.

Figure 9. Average Storage Capacity, by Shipping Type, for Grain Elevators in North Dakota, 2000/01 to 2012/13.

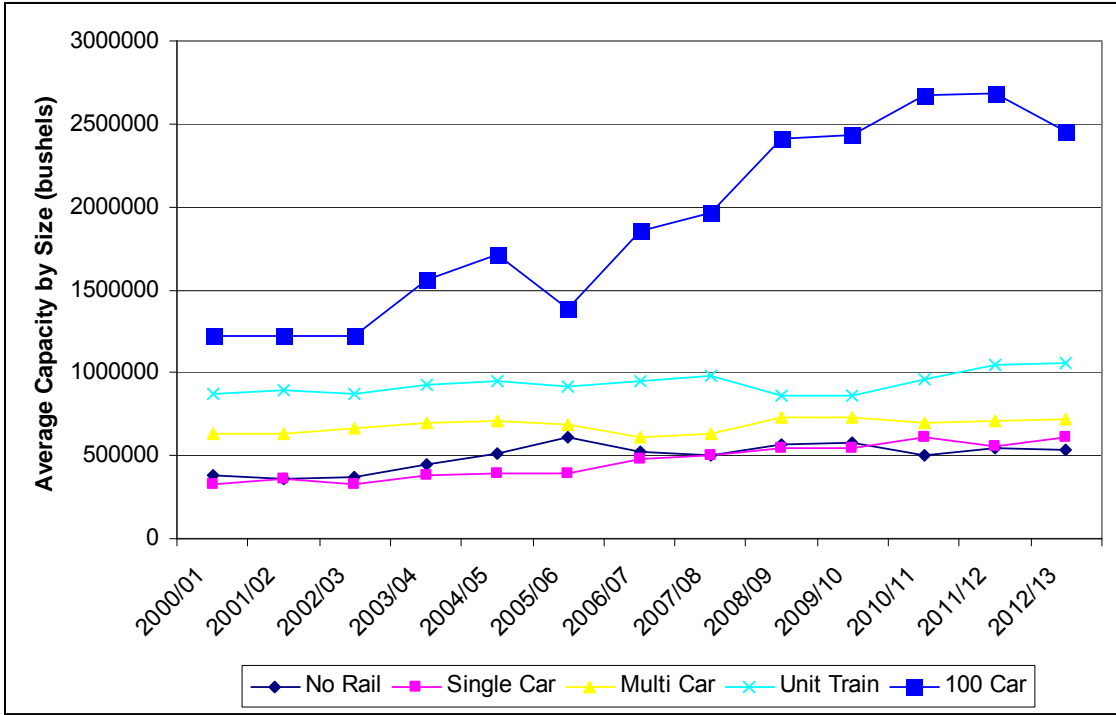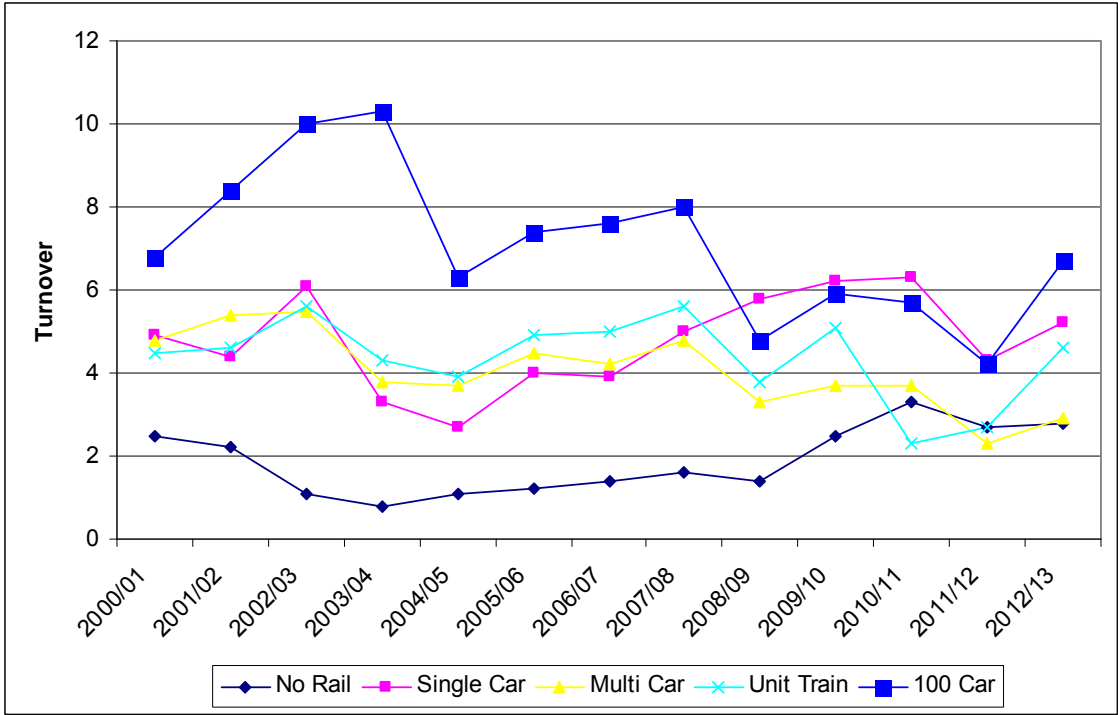Figure 10. Average Turnover, by Shipping Type, for Grain Elevators in North Dakota, 2000/01 to 2012/13.
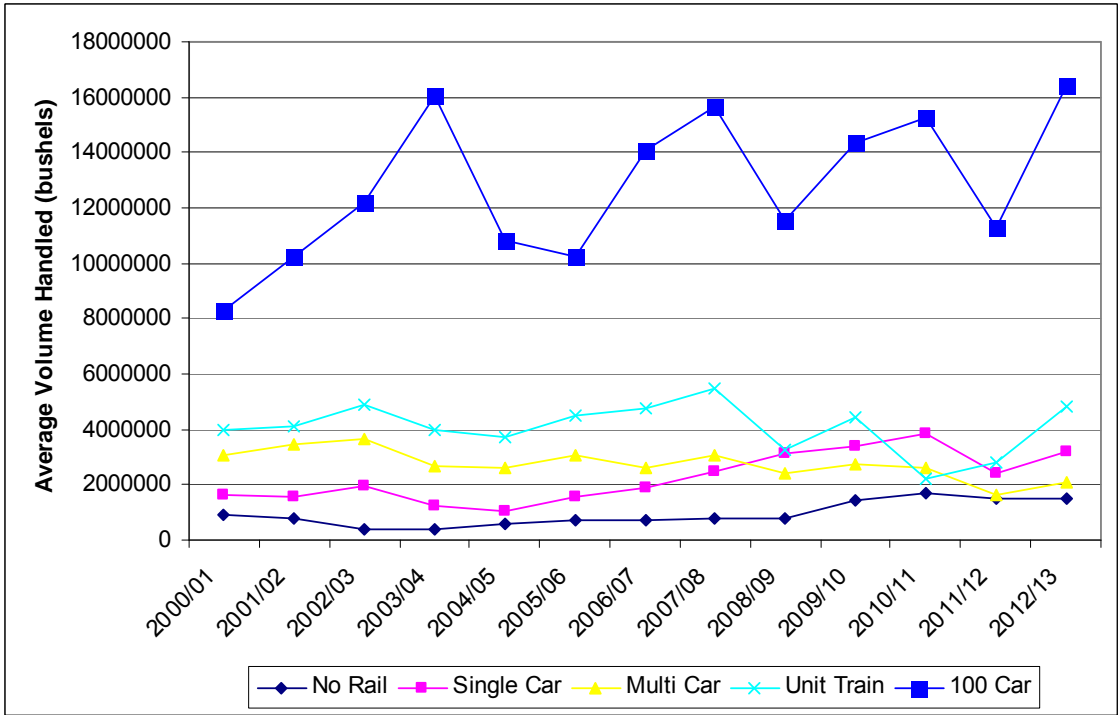

Figure 11. Average Volume Handled (Average Capacity * Average Turnover), by Shipping Type, for Grain Elevators in North Dakota, 2000/01 to 2012/13.

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Characteristics of North Dakota Ethanol Processors

Characteristics of North Dakota ethanol producers were developed from the North Dakota PSC (2014b,c). These reports list grain storage licenses for licensed storage capacity and bonding levels. Average rated capacities were obtained from industry sources. Using storage capacity and rated capacities, prospective turnover rates were estimated assuming plants run at rated capacities. Estimated turnover rates for the three ethanol plants were 6 for Underwood, 18 for Casselton and 33 for Hankinson (Table 2). These turnover rates are much higher than averages reported for grain elevators (Vachal and Benson, Various)).

Table 2. Characteristics of Ethanol Plants, North Dakota 2014.				
City	Licensed Storage Capacity	Corn Use Based on Ethanol Production	Storage Turnover Rate	ND Grain Storage Bond 2014
	Bushels	Bushels	Turns/year	
Casselton	3,006,000	54,642,857	18	5,000,000
Underwood	3,644,000	21,867,857	6	880,000
Hankinson	1,441,000	47,142,857	33	40,000

Sources: ND PSC (2014bc) and Industry Sources.

Estimated Default Probability of U.S. Grain Handlers

Industry studies of annual reports typically evaluate characteristics of annual reports by industry and publish these for use in benchmarking participants in the industry. RMA is one agency that publishes annual studies by industry (RMA, 2014). An industry similar to grain elevators is that for Wholesale Grain and Field Bean Wholesalers (424510). RMA (2014) reported 5 year histories of estimated 1 and 5 year default probabilities, including the mean and 25% and 75% percentiles.

These default probabilities show that, for U.S wholesale grain and field bean wholesalers, the distribution of 1 year default probabilities was generally less than 1% for 2003/04 to 2012/13, except for the 3 years from 2007/08 to 2009/10, with the largest increase in 2008/09. In 2008/09, the 1 year defaults ranged from 1.76%, 3.75% and 7.36% for the lower quartile, median and upper quartile of the distribution. The quartile results imply 25% of default probabilities would be lower than 1.75%, 25% would be between 1.76 and 3.75%, 25% would be from 3.75 to 7.36% and 25% would be over 7.36%. Five year estimated default rates show the same pattern, with most years from 2003/04 to 2012/13 below 8%; with the 5-year default rates increasing to 7%, 11% and 20% for the lower quartile, median and upper quartile of the distribution, respectively. Again, the quartiles imply 25% of the 5 year default probabilities would be less than 7%, that 25% would be from 7% to 11%, that 25% would be from 11% to 20% and that 25% would be above 20%.
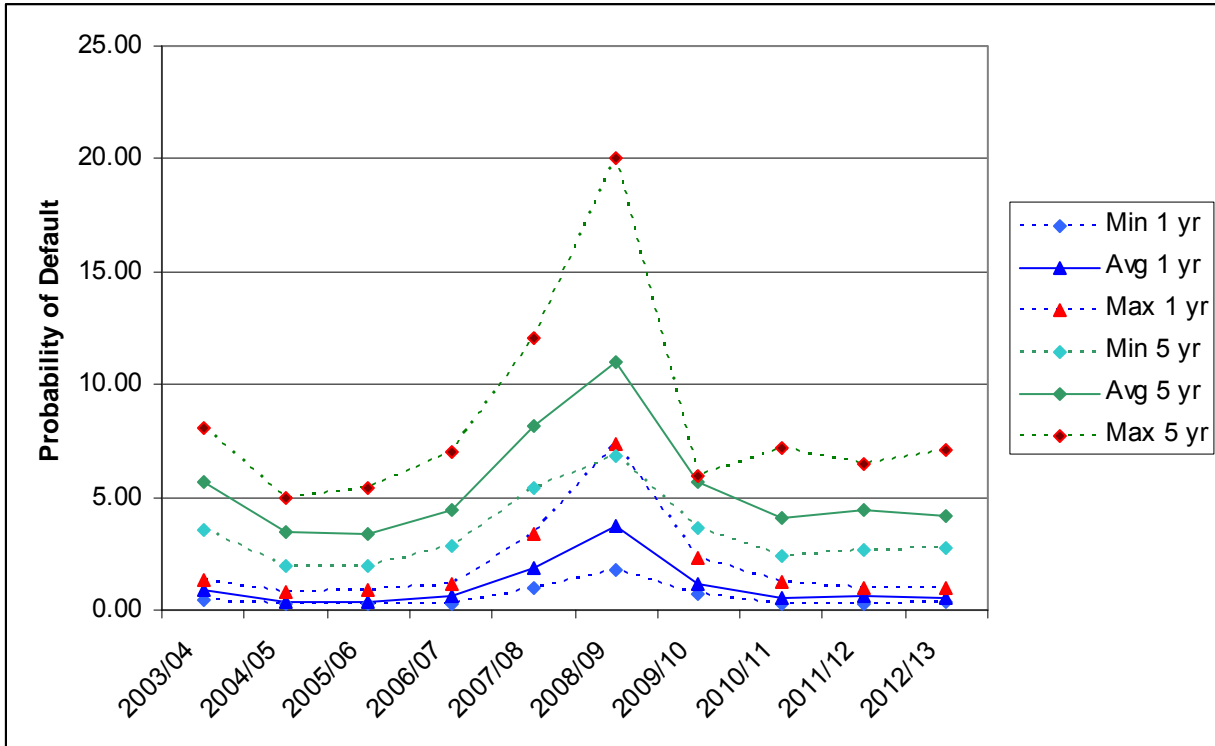
Figure 12. Estimated 1 and 5 Year Default Probabilities for Wholesale Grain and Field Bean Wholesalers, 2003/04 to 2012/13.
Source: RMA (2014).

Simulation Model

In order to quantify and illustrate the prospective risks of failure, we developed a stochastic simulation model for a representative grain merchandiser (co-op and corporate) in North Dakota. The model was used to illustrate the effect of risk and stresses on profitability. A stochastic simulation model from McKee, Wilson and Dahl (forthcoming) was adapted for a co-op and corporate structure representative of a North Dakota firm. This model simulated the profitability of a North Dakota cooperative or corporate firm where distributions for volume handled and gross margins were random.[2]

Volume handled for corn, soybeans and wheat was defined as representative of a North Dakota shuttle elevator located in Stutsman County. The average handle was 17 million bushels per year, ranging from a minimum of 15.3 to a maximum of 18.7 million bushels per year. Volumes per crop were estimated as the proportion of grain handled by elevators in Crop Reporting District 5 (CRD5) for corn (48%), soybeans (34%) and wheat (19%), respectively, and

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[2] A detailed description and the assumptions for the model used here are in Appendix D.

were estimated from Vachal and Benson (2013) for 2012/13.[3] Representative distributions were based on industry contacts (Table 3) for gross margins.

Table 3. Parameters for Gross Margin Distributions of a Representative North Dakota Elevator.			
	Minimum	Most Likely	Maximum
Corn	$0.10	$0.25	$0.40
Soybeans	0.12	$0.30	$0.60
Wheat	$-0.20	$0.35	$2.00

Rail costs (tariff and fuel service charges) were assumed to be included in the gross margin calculations. Shuttle premiums were modeled based on secondary car markets for daily car values (DCV). These DCVs were either added to gross margins, if DCVs were negative, or subtracted from gross margins, if DCVs were positive, implying a high cost for shuttle rail freight. Distributions for DCVs were estimated using data from Tradewest Brokerage Co. (Various) from 2006 to 2014. Primary car values were obtained from BNSF (2014), and distributions were estimated from 2006 to 2014. A discount rate of 6% was used.

The model was run which represented a cooperative firm, and for a corporate firm. The reason for modeling both ownership types is the difference in tax treatment across ownership structures. Three cases were simulated. The first assumed a cooperative elevator with managed freight as part of its operations, so freight was assumed to be limited in variability (co-op-fixed). In this case the elevator has covered its freight and for this reason, freight values were not at risk. The second was for a corporate elevator which was also assumed to manage freight operations, so freight was, again, considered to be limited in variability (corporate-fixed). The third assumed a cooperative elevator where freight was not covered and had to be procured for all shipments in the secondary market (co-op-risky).

Results: The three models were simulated in an unstressed version where all distributions were assumed to be equal to the base case; then, the distribution for freight (DCV) in year 1 was stressed,[4] representing a year with adverse changes in freight costs. The results showed distributions for net present values (NPV) for the elevator operated over a 10 year time frame. Average NPVs were profitable for all three unstressed cases, showing little probability of negative NPVs during the 10 year horizon (Table 4).

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[3] Volumes of corn and soybeans shipped from CRD5 are only reported in Vachal and Benson (Various) for the most recent year available, 2012/13. Volumes for state level shipments of corn, soybeans and wheat from 2006/07 to 2012/13 reveal large shifts from wheat toward corn and soybeans.

[4] The distribution in Year 1 for freight (DCV) was stressed by forcing the distribution to only allow the choice of values in the top 10% of the distribution, thus only allowing for high costs for freight.

The NPV was higher for the co-op than for the corporate elevator, largely due to different tax treatment. Variability of NPVs nearly doubled in size when freight was shifted from fixed (limited variability) to risky (reflecting the full purchase of freight in the secondary market). The probability of NPV being negative increased from .02% to 1.2% (Figure 13). While this result is not the probability of bankruptcy, it is the closest that can be approximated.
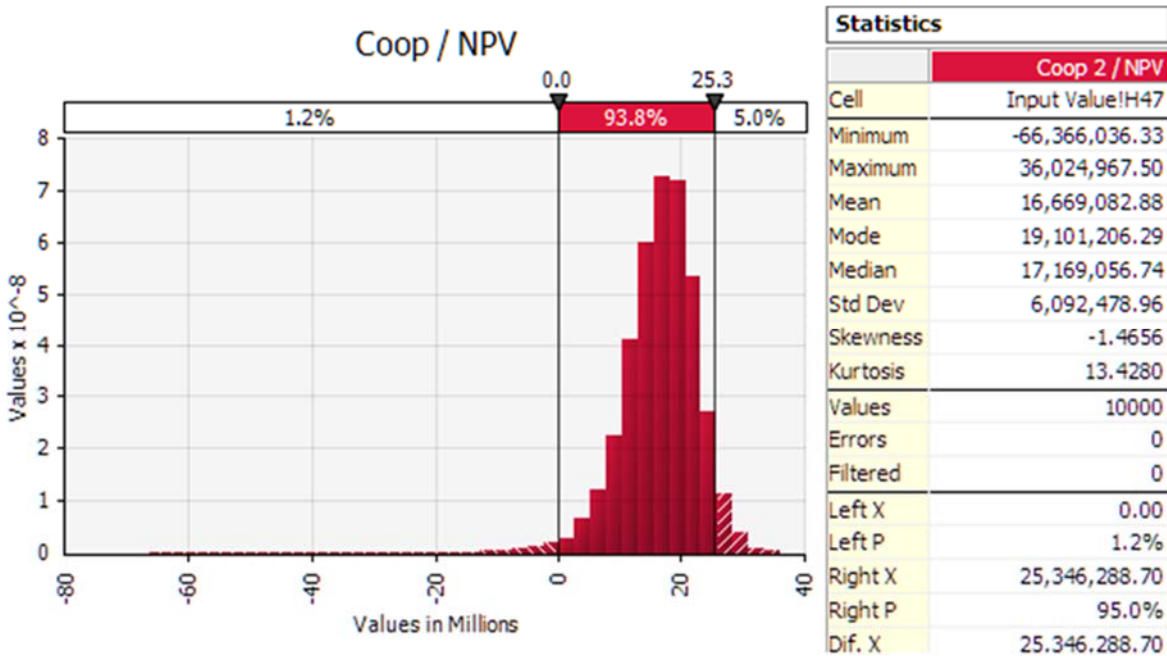
Figure 13. Distribution for NPV for a Co-op with Risky Freight Costs.

The sensitivity of NPV to changes in the value of random inputs shows that the base unstressed co-op and corporate firms with fixed freight were similarly affected by randomness. Both cases were affected the most by margins for wheat, soybeans and corn, with margins in early years having the largest impact and then declining with time. For example, a 1 unit increase in wheat margins in year 1 would increase the NPV by .34 while a 1 unit increase in wheat margins in year 10 would only increase NPV by .20 (Table 4). The sensitivity of the co-op-risky case to input distributions showed a change, where freight costs (DCV) had the largest impact on NPV, followed by margins for wheat, soybeans and corn. Here, a 1 unit increase in freight costs, reduced the NPV by .33 in year 1 and by .19 in year 10. The effect of the crop margins on the co-op risky case also declined in impact from the freight fixed cases. Thus, a 1 unit increase in wheat margins in year 1 only increased the NPV by .20 while, in the fixed freight cases, it increased NPV by .34.

When we stress the cost for freight in year 1 (of the 10 year time horizon) to be in the top 10% of the distribution, it has limited impacts on NPV when freight is fixed. However, where freight is risky, the co-op's mean NPV drops by over $4 million; the standard deviation increases by $800,000; and the probability of a negative NPV goes from 1.2% to 3.7%. Thus, one bad

year with uncovered freight in the top 10% of the secondary market costs can dramatically impact the financial performance of an elevator.

We also stressed margins so that the distributions for corn, soybeans and wheat were in the lower 25% of the distributions for each. This had limited impacts on the probability of a negative NPV occurring (Table 5). The average NPV declined by $1.9-$2.5 million, and the standard deviation of NPV declined by $104,000 to $237,000. Similarly, when we stressed margins in year 1 to the lowest 10% of the distributions for corn, soybeans and wheat, the average NPV declined by $2.5 million to $3.2 million. Standard deviations declined by $103,000 to $251,000. Restricting margins to the lower 10% of distributions did impact the probability of a negative NPV for the corporate and risky co-op cases. The non-risky corporate probability of a negative NPV increased from 0.4% to 3%, and the risky co-op increased from 1.2% to 2.3% (Table 6).

Table 4. Results for the Simulation Model, Unstressed and Freight Stressed, in Year 1 ($).						
	Unstressed			Freight Stressed in Year 1		
	Co-op-Fixed	Corp-Fixed	Co-op-Risk	Co-op-Fixed	Corp-Fixed	Co-op-Risk
Mean	16,854,099	7,026,782	16,669,083	16,108,239	6,454,111	12,630,695
Std. Dev.	3,561,601	2,735,160	6,092,479	3,600,321	2,770,929	6,896,045
Prob NPV Negative	0.02%	0.4%	1.2%	0.03%	0.7%	3.7%
Tornado Graph: Range of Regression Coefficients for the Sensitivity of Results to Random Input Draws from Year 1-Year 10						
Most Important	Wheat Margin .34-.20	Wheat Margin .34-.20	DCV -.33 to -.19			
	Soybean Margin .13-.08	Soybean Margin .13-.08	Wheat Margin .20-.12			
	Corn Margin .11-.07	Corn Margin .11-.07	Soybean Margin .08-.05			
	DCV -.10 to -.06	DCV -.10 to -.06	Corn Margin .07-.04			
Least Important	Volume Handled .06-.04	Volume Handled .06-.04	Volume Handled .04-.02			

Table 5. Results for the Simulation Model, Unstressed and Margins Stressed, in Year 1 to Lower 25% of Distribution ($)						
		Unstressed		Margins Stressed in Year 1 to Lower 25%		
	Co-op-Fixed	Corp-Fixed	Co-op-Risk	Co-op-Fixed	Corp-Fixed	Co-op-Risk
Mean	16,854,099	7,026,782	16,669,083	14,3424,90	5,103,322	14,145,889
Std. Dev.	3,561,601	2,735,160	6,092,479	3,324,397	2,554,617	5,988,536
Prob NPV Negative	0.02%	0.4%	1.2%	0.03%	1.8%	1.9%

Table 6. Results for the Simulation Model, Unstressed and Margins Stressed, in Year 1 to Lower 10% of distribution ($)						
		Unstressed		Margins Stressed in Year 1 to Lower 10%		
	Co-op-Fixed	Corp-Fixed	Co-op-Risk	Co-op-Fixed	Corp-Fixed	Coop-Risk
Mean	16,854,099	7,026,782	16,669,083	13,655,270	4,576,788	13,451,800
Std. Dev.	3,561,601	2,735,160	6,092,479	3,310,809	2,544,649	5,989,334
Prob NPV Negative	0.02%	0.4%	1.2%	0.03%	3.00%	2.30%

Conclusions and Recommendations

Grain and oilseed growers confront numerous risks. One of the uncertainties relates to the risk that buyers may become insolvent, ultimately resulting in losses for the grower. Most states, including North Dakota, have mechanisms that partially protect against these losses. However, the grain market has changed drastically, giving rise to increased risks. These mechanisms serve to protect grain sellers against default by the grain buyer. These mechanisms include requiring buyers and storage facilities to be licensed and to have bond coverage. The purpose of this report is to document risks to growers and the mechanisms used to mitigate the risks related to buyer default.

Risks confronting growers: Growers confront a number of risks when selling grains and oilseeds. First, growers are becoming larger operators. The average farm size increased from 1,387 acres in 1991 to around 2,000 acres from 2007 forward. The mix of crops planted has shifted toward higher production of corn, soybeans, canola and durum wheat and away from barley, sunflowers, spring wheat and winter wheat. Along with recent increases in price levels and volatility for most agricultural commodities, the combination of these changes has resulted in the value of gross receipts for an average farmer increasing dramatically and being subject to

higher variability. Estimated gross receipts per farm grew from about $100,000 in 1991 to $803,351 in 2012.

The grain elevator industry is also experiencing trends toward consolidation and concentration into larger shuttle loading facilities with higher volumes handled. Notably, the elevator industry in North Dakota is larger in capacity and volumes handled, and the volumes handled are becoming more concentrated at large shuttle facilities.

Mechanisms in North Dakota: Mechanisms exist in North Dakota (and in most states) to protect growers against buyer default. The purpose of these mechanisms is to protect grain sellers against default by the grain buyer. North Dakota has two basic programs to deal with buyer defaults. The first program includes a licensing and bonding program for grain warehouses and for grain buyers. These mechanisms require warehouses and grain buyers to be licensed and to submit a bond which is dependent on the rated storage capacity of the warehouse and on the 3 year average sales volume for grain buyers. The second program is the North Dakota grain insurance fund which provides coverage for credit sales (which are not covered by the grain buyer's bond). The North Dakota grain insurance fund, or credit-sale indemnity fund, was established in 2003 to cover credit sales deferred for more than 30 days.

The North Dakota Indemnity fund has a maximum farmer payout. The farmer's payout limit is more limiting now than in 2003 when the Indemnity fund was created. The average claims paid from the indemnity fund per insolvency suggest that this issue has not been a big issue yet, although it has impacted claims for one of the recent insolvencies. The size of claims per insolvency on the Indemnity fund has increased, with the largest claims being the most recent ones. The balance for the Indemnity fund is currently around $4.5 million, but the balance could drop to around $3.6 million or lower depending on outcomes from the unresolved insolvencies.

When comparing programs in other states, most states either have an indemnity fund or warehouse/grain buyer bonding. States that focus on corn and soybeans tend to have indemnity funds while more traditional wheat producing states tend toward bonding programs. Only two states do both (North Dakota and Oklahoma).

Most other states with bond funds apply the bond to a proportion of the value of grain handled (value * volume) over the last three years. North Dakota calculates the bond value based on storage capacity. Discussions about changing North Dakota's bond schedule have included moving to a 3 year average based on either the volume or value of grain handled.

Changes for bond funds have also included handling dry bean facilities/buyers and processors differently than other grain handlers. Colorado and Wyoming apply higher bonding requirements for dry bean facilities than other grain handlers. In Colorado, there is about a

threefold increase in the bonding level required for a dry bean facility than a similar sized facility that handles other grains. Processors, primarily ethanol producers in North Dakota, can have much higher turnover rates than country elevators, suggesting that there might be a higher risk for a given storage level for a processor than for a country elevator.

Mechanisms in other states that do not exist in North Dakota: Most other states base bonding requirements on a proportion of the average value of grains handled in the last 3 years. Several other states also require a bond on net worth to cover shortfalls below 25%. South Dakota appears more proactive in this area, requiring within year reporting for financial conditions and imposing legal requirements on elevators to report net worth issues within the year. Many states with bonding programs also require an additional bond to make up shortfalls in net worth below a minimum (usually 25%).

Ohio modified its indemnity program in 2013 and made farmers first in line for bankruptcies. This change is being watched by Ohio and other states because it may have adverse impacts on elevator borrowing.

Risks confronting elevators in North Dakota: A couple of results are shown to depict the risks of elevator failure. One of these is from existing studies, and the other one is a model we developed to illustrate these risks in North Dakota.

The RMA publishes annual studies, by industry, on the probability of bankruptcy (RMA, 2014). Projections for the probabilities of 1 and 5 year bankruptcies were estimated for the wholesale grain and field bean wholesalers in the U.S. These indicated the distribution of 1 year default probabilities was generally less than 1% for 2003/04 to 2012/13, except for the 3 years from 2007/08 to 2009/10. In 2008/09, 25% of the 1 year default probabilities would be lower than 1.75%; 25% would be between 1.76 and 3.75%; 25% would be from 3.75 to 7.36%; and 25% would be over 7.36%. Five year estimated default rates show the same pattern, with most years from 2003/04 to 2012/13 below 8%. The distribution for 5 year defaults in 2008/09 being 25% would be less than 7%, 25% from 7% to 11%, 25% from 11% to 20% and 25% above 20%.

We also developed a model to quantify and illustrate the prospective risks of failure for a representative grain merchandiser (co-op and corporate) in North Dakota. The model was used to illustrate the effect of risk and stresses on profitability. The model analyzed the impacts of overall risks on profitability as well as the impact of the recent rise in secondary freight costs on grain elevators. The base case suggested that the probability of negative NPV's was in the area of .02% to 1.2%. Stressing the parameters for freight costs reduced the mean NPV by over $4 million; the standard deviation increased by 800,000; and the probability of a negative NPV went from 1.2% to 3.7%. Thus, one bad year with uncovered freight in the top 10% of the secondary market costs at the beginning of a 10-year time horizon can dramatically impact financial

performance of an elevator. These results showed that freight management can have a significant impact on elevator profitability.

Recommendations for further review and/or analysis: The purpose of this study was to identify the changes in relevant risks that confront grain and oilseed producers in North Dakota and to assess the adequacy of mechanisms designed to mitigate these risks. The intent was not to prescribe specific changes but, rather, to identify those areas worthy of consideration for legislative changes to assure protections for growers. It appears that the most important considerations for North Dakota include:

1) Increasing the maximum payment from the indemnity fund. Currently, the fund pays 80% of the claims, up to a maximum of $280,000 per producer.

   Given the increase in producer size, production and market volatility, this value is probably inadequate. Indeed, given current market parameters, the maximum would have to increase to provide equivalent coverage as originally intended by this mechanism.

2) There are several recent insolvencies that could potentially lower the Indemnity fund balance to near $3.6 million, which is much less than earlier minimum levels at which assessments would be re-imposed.

3) Re-evaluating the structure of the mechanisms. Alternatives include considering
   - Value of the commodity. Currently, the mechanisms in North Dakota are based on storage capacity (or sales).
   - Whether to use indemnity funds or bonding, or to use both. Currently, North Dakota is one of the few states that uses both methods.
   - Adding net worth requirements. Typically, minimum net worth requirements are imposed and an additional bond is required to make up the difference for shortfalls.
   - The relationships between claims and indemnity fund min/max suggest that, if average payouts for claims increase, then minimums and maximums for the indemnity fund would likely need to increase to be consistent with other states.

4) Dry beans: This crop has greater risks than other crops. Other states' bonding requirements for dry beans are much greater than those in North Dakota.

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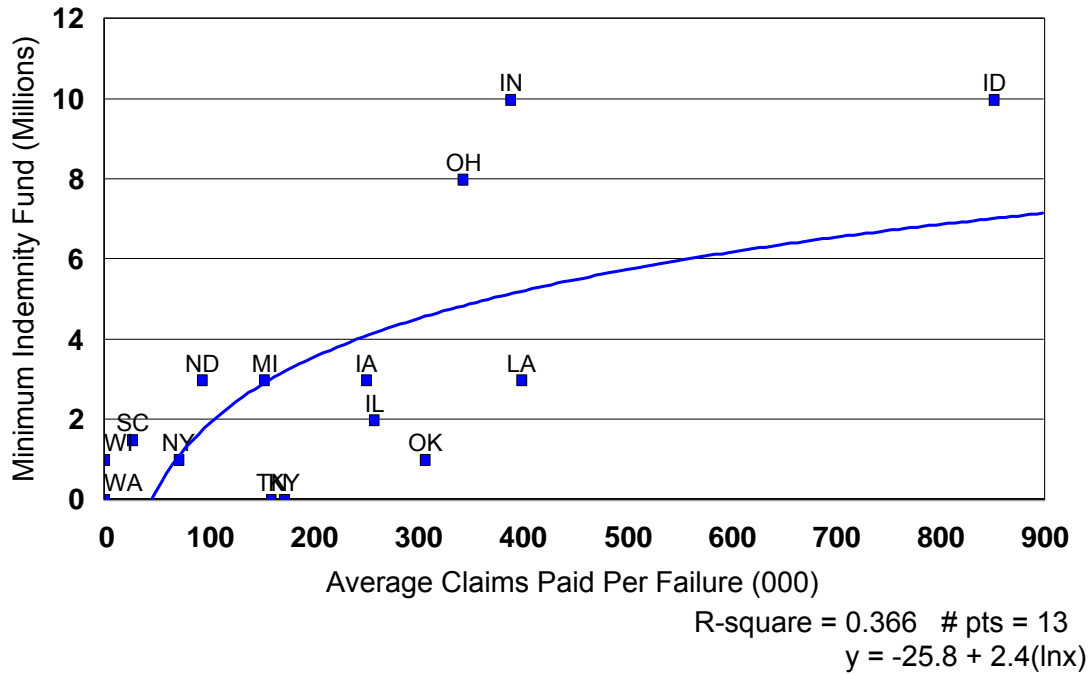   Fargo.

Appendix

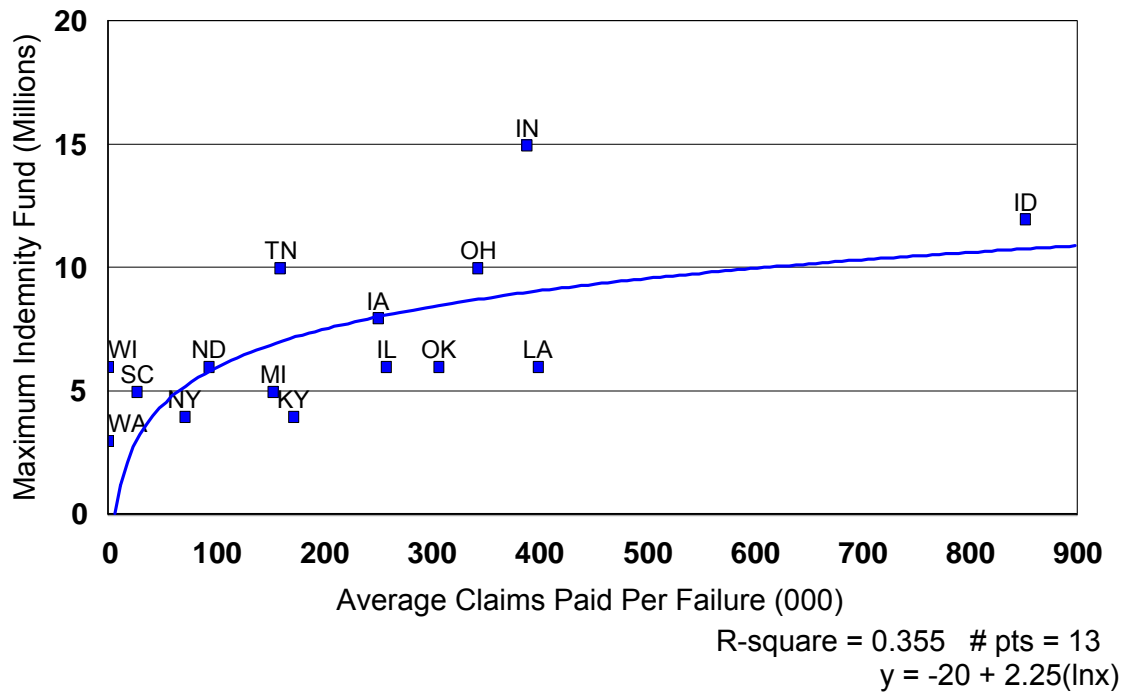Figure A1. Relationship Between Average Claims Paid per Failure and Minimum Indemnity Fund.

Figure A2. Relationship Between Average Claims Paid per Failure and Maximum Indemnity Fund.

Appendix Table B1. NORTH DAKOTA PUBLIC SERVICE COMMISSION
Grain Warehouse/Grain Buyer Insolvencies – 2007 through Current
Updated February 2013 – Page 1

Licensee Location(s) License Type Case Filed Case Closed	Total Claims Filed	Valid Cash Claims Filed	Valid CSC I-Fund Claims Filed	Invalid Claims Filed	Grain Proceeds	Bond on File & Bond Proceeds Used	Interest Earned on Trust Account	Valid Cash Claim Payments (% Payment)	Interest Paid To Cash Claimants [5]	CSC I-Fund Claim Payments (80%)	Total Claims Paid & Expenses Reimbursed [6]
Minnesota Grain, Inc., Rhame, ND (GW) March 2007 February 2009	$930,365.67	$323,117.58	$137,893.69	$467,920.69	$0	$100,000 Entire Bond	$1,429.19	$101,429.19 31%		$110,314.95	$211,744.14
Specialty Export Productions, Inc., Hatton & East Fairview, ND (GW) August 2007 September 2008	$190,485.55	$188,019.22	$0	$2,466.33	$61,463.92	$200,000 $142,243.17	$450.69	$195,991.24 100%		$0	$195,991.24 $8,166.54
Northwood Mills, LLLP, Northwood, ND (GW) January 2009 October 2009	$880,009.90	$880,009.90 11 Claims	$0	$19,477.95	$0	$50,000 $50,000	$129.05	$50,129.05 5.8%	$0	$0	$50,129.05 $0
Sustainable Systems, LLC dba Montola, Culbertson, MT (RGB) March 2009 December 2009	$617,663.45 19 Claims	$561,629.40 19 Claims	$0	$54,095.83	$0	$130,000 $130,000	$241.66	$130,241.66 77% + 23% [7]	$241.66	$0	$130,241.66 $1,307.11 [8]
VeraSun Hankinson, LLC, Hankinson, ND (GW) March 2009 September 2011	$132,784.85 2 Claims	$132,784.85	$0	$0	$0	$380,000 $3,908.83 [9]	$0	N/A	N/A	$0	N/A $3,908.83

GW – Grain Warehouse   RGB – Roving Grain Buyer   CSC – I Fund – Credit-Sale Contract Indemnity Fund (provides maximum payment of 80% not to exceed $280,000 for each insolvency)

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[5] If funds are available, cash claimants can be paid interest at the weighted average prime rate charged by the Bank of North Dakota since the date of insolvency.

[6] The statute provides for the reimbursement of expenses incurred by the Commission in the administration of the insolvency.

[7] The Montana Dept. of Agriculture liquidated available assets. ND claimants received 77% of each valid claim from the Montana liquidation proceeds, 23% from ND trust fund proceeds, and a proportionate share of interest earned on the ND trust fund.

[8] The Montana Dept. of Agriculture reimbursed the Commission for the insolvency expenses incurred.

[9] Two claims were filed and eventually withdrawn by the claimants. The Commission was reimbursed for its insolvency expenses from the bond proceeds.

Appendix Table B1. (continued) NORTH DAKOTA PUBLIC SERVICE COMMISSION
Grain Warehouse/Grain Buyer Insolvencies – 2007 through Current
Updated February 2013 – Page 2

| Licensee Location(s) License Type Case Filed Case Closed	Total Claims Filed	Valid Cash Claims Filed	Valid CSC I-Fund Claims Filed	Invalid Claims Filed	Grain Proceeds	Bond on File & Bond Proceeds Used	Interest Earned on Trust Account	Valid Cash Claim Payments (% Payment)	Interest Paid To Cash Claimants	CSC I-Fund Claim Payments (80%)	Total Claims Paid & Expenses Reimbursed
Organic Grain & Milling, Inc., Clyde, ND (GW) June 2010 September 2011	$193,467.24	$17,276.88 1 Claim	$160,829.65 4 Claims	$8,276.62 1 Claim	$28,148.74 [10]	$62,500 $0	$41.43	$17,276.88 100%	$531.05	$128,663.72	$147,607.24 $1,135.60
Grabanski Grain, LLC, Grafton, ND (GW) July 2010 May 2013	$848,296.08	$184,964.03 7 Claims	$409,002.41 7 Claims	$266,329.68	0	$340,000 $201,376.20		$184,964.03 100% + interest	$12,984.47	$327,201.92 + ½ expenses = ($330,629.62)	$532,005.82 $6,855.40[11]
Mitchell Feeds, Inc., Fargo, ND (RGB) February 2011						$70,000 bond on file					
Anderson Seed Co., Inc., Durbin & Selz, ND (GW) February 2012	$4.1 Million [11]	2.233 Million	$809,000			$280,000 bond on file					
Falkirk Farmers Elevator Co, Falkirk, ND (GW) October 2012	$2 Million [11]	1.7 Million	$279,000 7 Claims	1 Claim		$380,000 bond on file					
Earth Harvest Mills, Inc., Harvey, ND (GW) February 2013	$4.3 Million [11]	$81,000 7 Claims	2.4 Million 18 Claims			$50,000 bond on file				$948,952.69 [10]	

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[10] The unused proceeds, totaling $9,246.64, were returned to Organic Grain & Milling, Inc.

[11] Insolvency expenses totaled $6,855.40 with ½ paid from the trust fund and ½ paid from the CSC I-Fund.

[10.] Two claimants in the Earth Harvest Mills, Inc. insolvency exceeded the $280,000 Indemnity Fund Cap.

[11] Additional claims information was added for Anderson Seed, Falkirk Farmers Elevator and Earth Harvest Mills (ND PSC 2013a, 2013b, 2014).
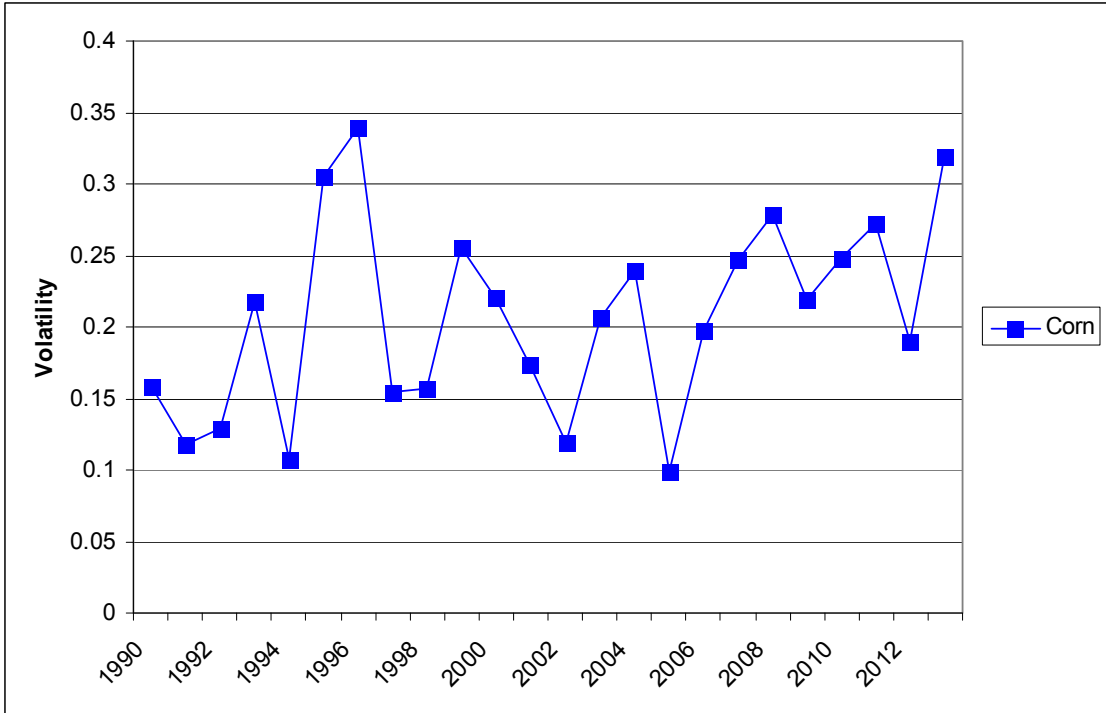
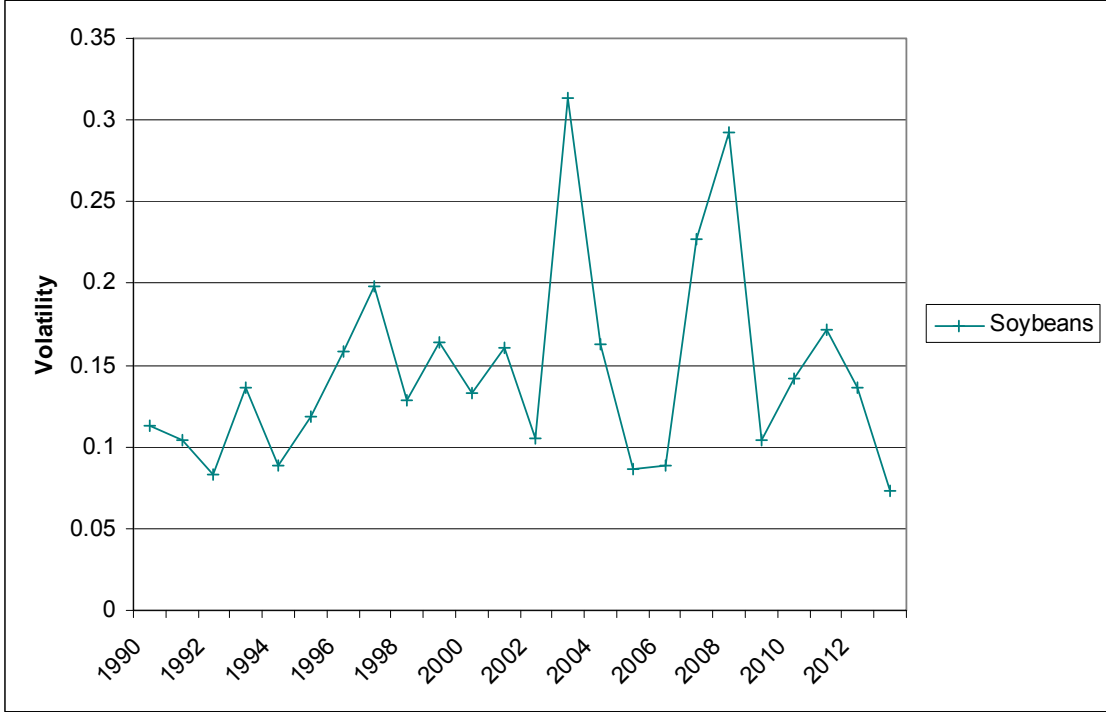**Appendix C. Volatility of Monthly Prices by Crop**
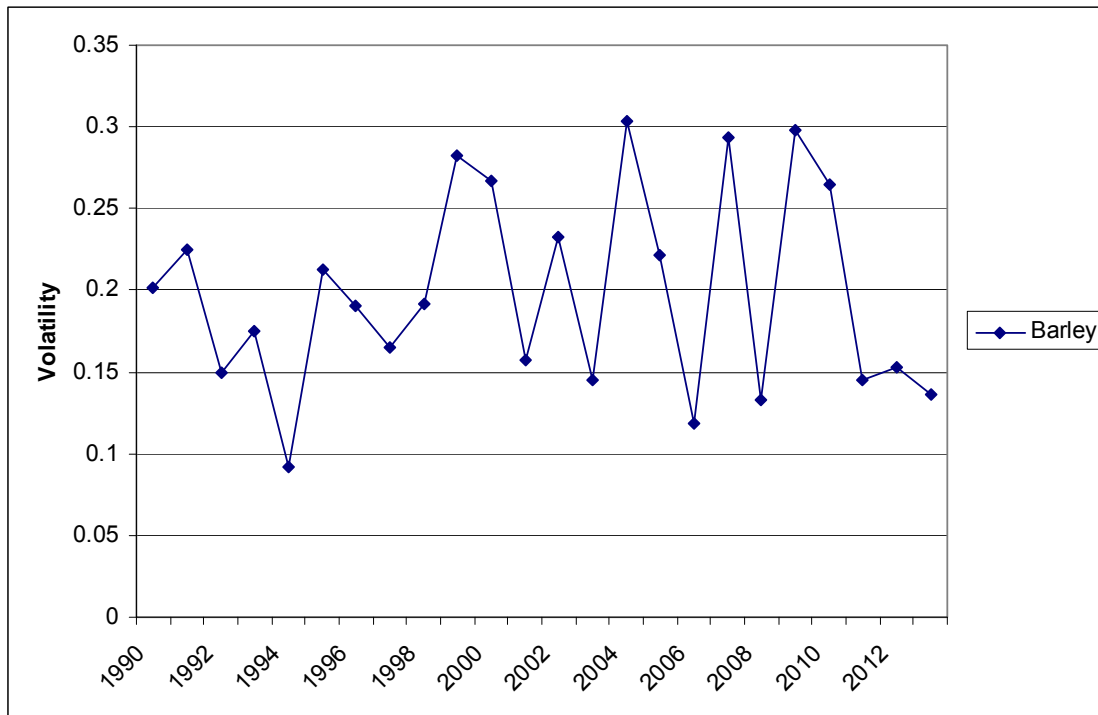
Appendix Figure C1. Volatility of Monthly Prices Received by Growers, Barley, North Dakota, 1990-2013.
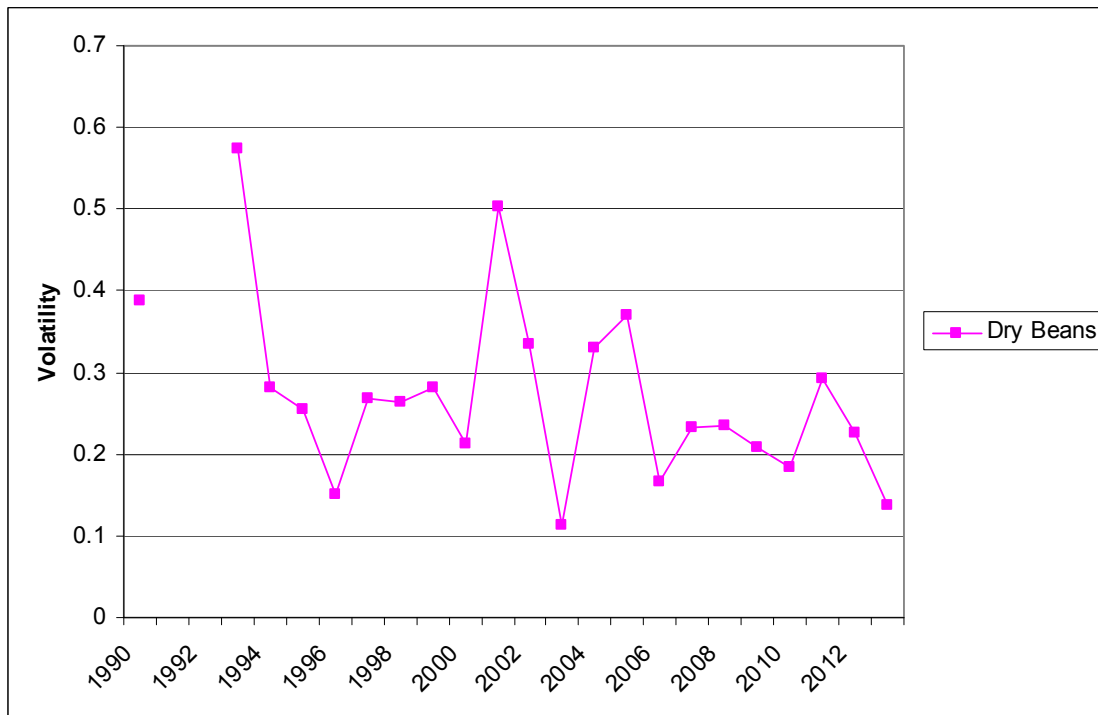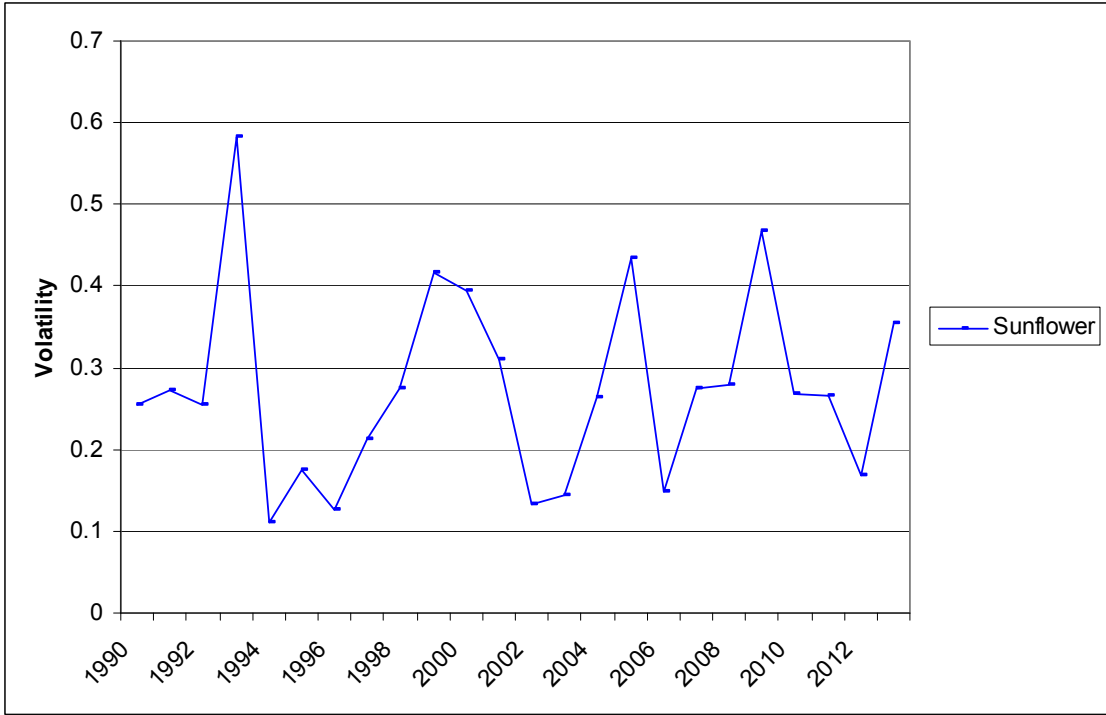

Appendix Figure C2. Volatility of Monthly Prices Received by Growers, Dry Beans, North Dakota, 1990-2013.
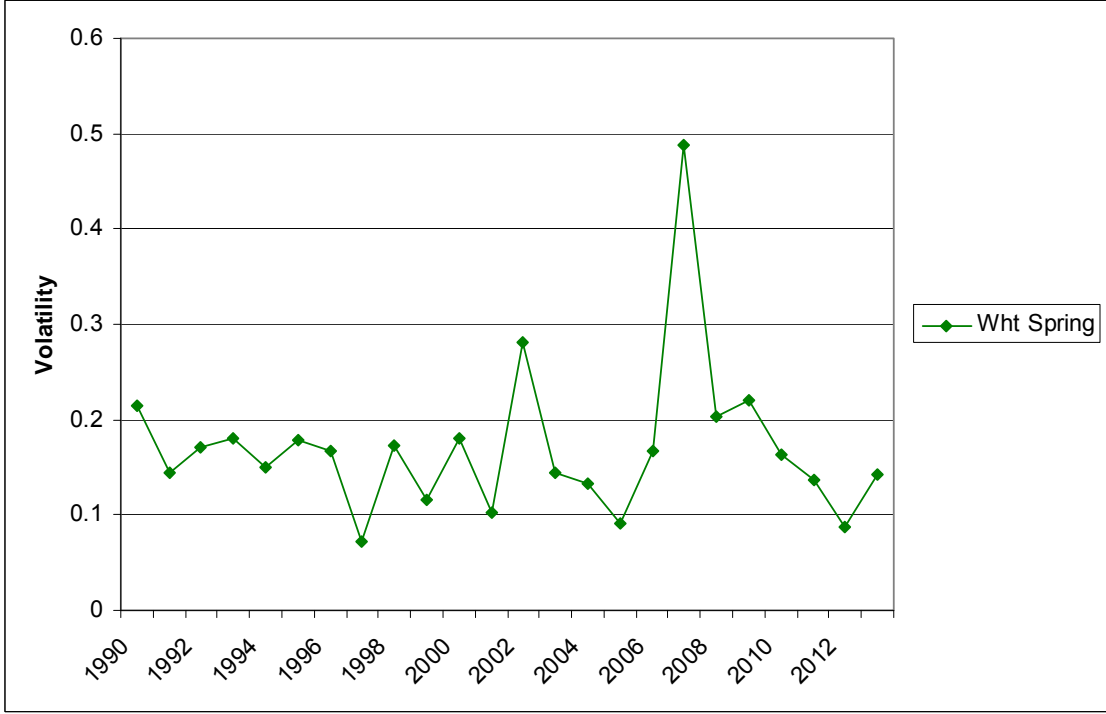
Appendix Figure C3. Volatility of Monthly Prices Received by Growers, Corn, North Dakota, 1990-2013.
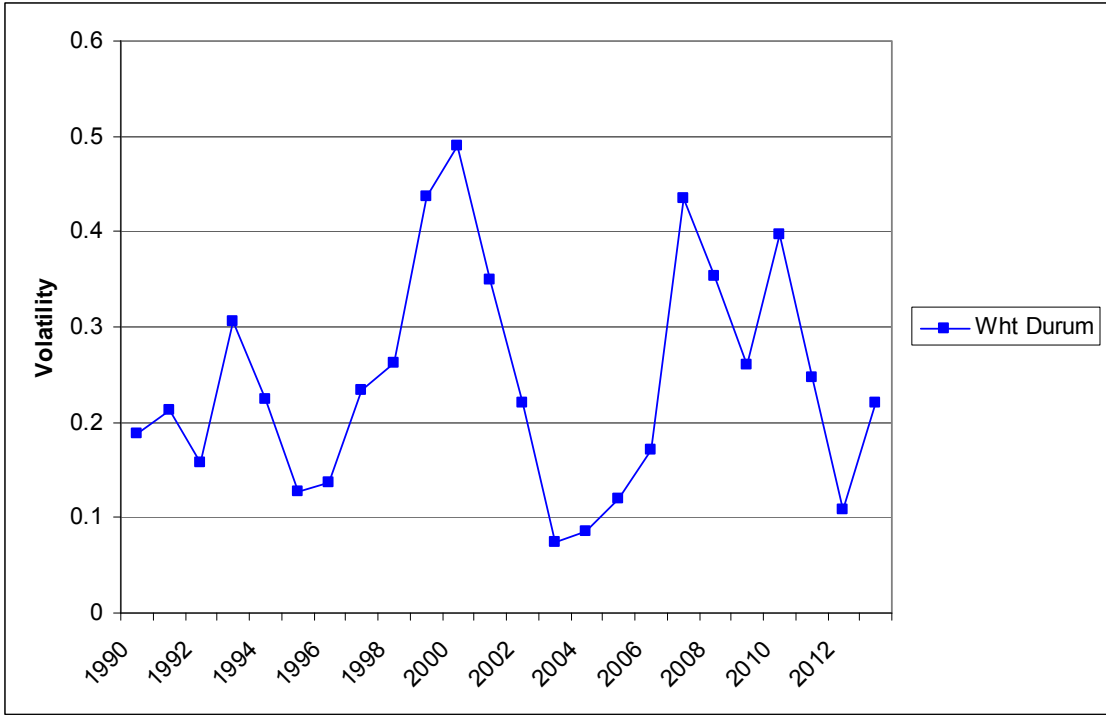

Appendix Figure C4. Volatility of Monthly Prices Received by Growers, Soybeans, North Dakota, 1990-2013.

Appendix Figure C5. Volatility of Monthly Prices Received by Growers, Sunflowers, North Dakota, 1990-2013.

Appendix Figure C6. Volatility of Monthly Prices Received by Growers, Hard Red Spring Wheat, North Dakota, 1990-2013.

Appendix Figure C7. Volatility of Monthly Prices Received by Growers, Durum Wheat, North Dakota, 1990-2013.

Appendix D. Simulation Model Description and Assumptions

A stochastic simulation model for a grain merchandiser (co-op and corporate) was modeled to illustrate the effect of certain stresses on profitability. A stochastic simulation model from McKee, Wilson and Dahl (forthcoming) was adapted for a co-op and corporate structure representative of a North Dakota firm. This model simulated profitability of a North Dakota cooperative or corporate firm where distributions for volume handled and gross margins were random.

Volumes handled for corn, soybeans and wheat were defined as representative of a North Dakota shuttle elevator handling 17 million bushels per year, on average, but ranging from 15.3 to 18.7 million bushels per year. Volumes per crop were estimated as the proportion of grain handled by elevators in Crop Reporting District 5 (CRD5) for corn (48%), soybeans (34%) and wheat (19%), respectively, and were estimated from Vachal and Benson (2013) for 2012/13.[12] Distributions for the gross margins were determined based on industry contacts.

Appendix Table D1. Parameters for Gross Margin Distributions for a Representative North Dakota Elevator.			
	Minimum	Most Likely	Maximum
Corn	$0.10	$0.25	$0.40
Soybeans	$0.12	$0.30	$0.60
Wheat	$-0.20	$0.35	$2.00

Rail costs (tariff and fuel service charges) were assumed to be contained in the gross margin calculations. However, shuttle premiums were modeled based on the secondary car markets for daily car values (DCV). These DCVs were either added to the gross margins, if DCVs were negative, or subtracted from gross margins, if DCVs were positive, implying a high cost for shuttle rail freight. Distributions for DCVs were estimated from Tradewest Brokerage Co. (Various) from 2006 to 2014. Primary car values were obtained from BNSF (2014), and distributions were estimated from 2006 to 2014.

The model was run representing both a cooperative firm, and a corporate firm. Three cases were simulated. The first assumed that a cooperative elevator managed freight as part of its operations, so freight was assumed to be limited in variability (co-op-fixed). The second represented a corporate elevator that also was assumed to manage freight operations, so freight was limited in variability (corporate-fixed). The third assumed a cooperative elevator where freight was not covered and had to be procured for all shipments in the secondary market (co-op-risky). Freight was assumed to be from loglogistic distributions for all three models. However,

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[12] Volumes of corn and soybeans shipped from CRD5 are only reported in Vachal and Benson (Various) for the most recent year available, 2012/13. Volumes for state level shipments of corn, soybeans and wheat since 2006/07 2012/13 reveal large shifts in shipments from wheat toward corn and soybeans.

for the co-op-fixed and corporate fixed models, distributions had means of .01 c/bu. and a standard deviation of .026 c/bu. The third case, co-op-risky, had a mean of .01 c/bu. and a standard deviation of .14 c/bu. This result was derived utilizing fitting weekly observations for secondary market values for freight from 2006 to 2014 (Tradewest Brokerage Co., Various).

The models were simulated 10,000 times, at which time results converged to within stopping criteria. Then, year 1 distributions for freight were stressed, assuming that values were in the top 90% of the assumed distributions.