MOORE SCHOOL OF BUSINESS
UNIVERSITY OF SOUTH CAROLINA

United Grain Growers: Enterprise Risk Management and Weather Risk[1]

In August of 1999, Mike McAndless, the risk manager of United Grain Growers (UGG), was preparing for a meeting with the firm's chief financial officer, Peter Cox. Mike and Peter had spent considerable time over the past three years with representatives of the Willis Group Ltd., a large international insurance broker, identifying and measuring UGG's major sources of risk. The risk assessment process indicated that, although UGG hedged most of its currency and commodity price risk and purchased insurance against property and liability losses, the firm's earnings still exhibited substantial volatility. This volatility was, in large part, due to the weather. Mike and Peter had to decide whether to retain the risk or shift it to another party using one of two innovative contractual arrangements: weather derivatives or a new type of insurance contract.

COMPANY BACKGROUND

Based in Winnipeg, Manitoba, UGG provides commercial services to farmers and markets agricultural products worldwide. It was founded in 1906 as a farmer-owned cooperative, and became a publicly traded company on the Toronto and Winnipeg stock exchanges in 1993. Exhibit 1 provides information on UGG's stock price since going public.

Although UGG is a public company, it retains some of its farmer cooperative roots. The company has both members and shareholders. An individual can be both a member and a shareholder. At the time of the initial public offering, the members of the cooperative (farmers) automatically became members of the new organization, and they also received limited voting common shares (thus making them both members and shareholders of the new organization). An individual, who is not currently a member, can apply for membership if the individual does a minimum amount of business with the company. The initial public offering, as well as subsequent equity offerings, allowed non-members to become shareholders.

Although a member is not entitled to share in any profit or distribution by the company (unless the member is also a shareholder), members have control rights. Of the 15 people on UGG's board of directors, 12 must be "members" who are elected by delegates representing members from various geographical regions.

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[1] This case was prepared by Scott Harrington and Greg Niehaus of the Moore School of Business at the University of South Carolina. The authors appreciate the encouragement and support from Jim Davis of Willis Group, and the information and time provided by managers at UGG (especially Mike McAndless and Peter Cox) and various employees at Willis, including Michele Bradley, Ken Risko, and John Bugalla. The able and insightful research assistance from Tae Ho also is very much appreciated. Finally, the authors appreciate the travel support from the Spencer Educational Foundation.

Business Segments

UGG is comprised of four main business segments: Grain Handling Services, Crop Production Services, Livestock Services, and Business Communications. As illustrated in Exhibit 2 and discussed below, UGG's four business units help farmers plan, produce, and market their products.

Western Canada is a major producer and exporter of wheat, barley, canola, and other grains and oilseeds. The role of UGG's Grain Handling Services unit (comprised of Farm Sales and Services, Marketing and Transportation Services, and Terminal Services divisions) is to identify sources of grain and oilseeds and deliver them to exporters and to domestic end users, such as food processors. A farmer's production of grain and oilseeds usually is transported to a country elevator, where the product is weighed, graded, blended, purchased, and stored. From the elevator, the product is shipped to a domestic consumer (e.g., a mill) or to an export terminal.

UGG historically owned hundreds of relatively small "country" elevators, which the firm has been replacing with a smaller number of large, high-throughput, more efficient elevators. The map of western Canada in Exhibit 3 identifies the locations of UGG's main elevators and export terminals.

The farming industry in Canada is regulated by several government agencies. The Canadian Wheat Board (CWB) markets human consumable grains on behalf of farmers. About 85 percent of the wheat and 45 percent of the barley produced in Canada is sold through the CWB. The CWB must ensure that the sales it has arranged are available to customers at the agreed upon site and date. Thus, the CWB contracts with companies like UGG to collect, store, and deliver grains. About 60 percent of UGG's grain handling unit's business is on behalf of the CWB. The prices paid to farmers and the prices for storage and transportation of "board grains" are determined by the CWB.

The Canadian Grain Commission regulates grain handling and maintains quality standards for Canadian grain. Firms like UGG must obtain an operating license from the Commission. The Commission also maintains extensive records of the grain that is shipped from country elevators and from export terminals. Exhibit 4 provides data on grain shipments and deliveries for the industry and for UGG from 1981 through 1999.

UGG's competitors in the grain handling business are listed in Exhibit 5 along with approximate market shares in 1999. UGG's market share of approximately 15% makes it the third largest provider of grain handling services in western Canada.

Exhibit 6 provides information on the volume of grain shipped by UGG, as well as UGG's gross margin and earnings on grain shipments. The exhibit also provides information on gross margin and earnings per tonne of grain shipments.

The Crop Production Services unit provides inputs (e.g., seed, fertilizer, and crop protection products) to farmers. In addition, through its Farm Sales and Services division, it provides a range of consulting, agronomic, and financial services to farmers. UGG tries to

differentiate itself from its many competitors by developing distinctive products sold under brand names and by the provision of superior services to farmers.

UGG's third largest unit is Livestock Services, which provides inputs to producers of cattle, hogs, and poultry. This unit also faces competition from a number of other grain and feed companies. UGG's smallest business unit is Farm Business Communications, which provides information needed to run a profitable agribusiness. In addition to publishing periodicals (*Farm Investor Newsletter* and *Disease, Weeds & Insects*), this unit has developed web-based information on weather, market prices, and agribusiness news.

Exhibit 7 illustrates earnings before interest and taxes (EBIT) for each of UGG's business units over time. The two largest lines of business, Grain Handling Services and Crop Production Services, account for over 80% of UGG's earnings in most years. The exhibit also illustrates the substantial earnings volatility in these main business segments.

Financial Results

Exhibit 8 contains information from UGG's balance sheet, income, and cash flow statements. Earnings before interest, taxes, depreciation, and amortization (EBITDA) declined substantially in 1999 relative to the prior years. UGG increased capital expenditures substantially in 1998 and then again in 1999. Most of these expenditures were for large high throughput grain elevators. As a result of the low EBITDA in 1999, UGG's return on equity (defined as net earnings to book value of equity) was just 1.17%. Note as well that in 1999, the percentage of the firm's total assets financed with debt increased to about 30% with the issuance of another $50 million in long-term debt.

CORPORATE RISK MANAGEMENT

Background

For many corporate risk managers, "risk management" refers to the management of so-called "pure risks," e.g., losses from property damage, liability suits, and worker injuries. These risks typically are managed through a combination of loss control (efforts to reduce the likelihood or magnitude of losses) and loss financing through internal retentions or the purchase of insurance.

In the 1980s and 1990s, a different type of risk management – financial risk management – grew in importance at many corporations. Financial risk management typically refers to the management of price risks, e.g., losses from changes in prices, such as exchange rates, interest rates, commodity prices, and credit exposures. These risks usually are managed through derivatives contracts, such as options, forwards, futures, and swaps. In most corporations, financial risks were managed separately from pure risks, and the terminology and methods used by managers of financial risk differed from those used by managers of pure risk.

Enterprise Risk Management

During the latter part of the 1990s, some managers started to question the desirability of managing pure risk and financial risk separately. They also began to consider risk exposures that were not handled by pure risk or financial risk managers. For example, a firm might have operational risks that were being ignored by the risk managers because there was not an established contract (insurance or derivative) that could be used to shift the risk to another party. The idea that a firm should examine all of its risk exposures and deal with them using a consistent framework came to be known as enterprise risk management (ERM). To facilitate communication among different areas within a firm and the adoption of a consistent risk management framework, some firms even established a new position– the chief risk officer.

ENTERPRISE RISK MANAGEMENT AT UGG

Several factors led UGG to investigate enterprise risk management. One factor was that the Toronto Stock Exchange directs the board of directors of all listed corporations to identify the corporation's principal risks and to implement appropriate systems to manage these risks. Other factors included increased requirements for disclosure of risk exposures, increased emphasis on risk management by credit rating agencies, and UGG's perception that equity analysts recommendations were sensitive to earnings results that deviated from forecasts.

Identifying and Quantifying Risk Exposures

UGG started by forming a risk management committee, consisting of the CEO, CFO, risk manager, treasurer, compliance manager (for commodity trading), and manager of corporate audit services. This committee, along with a number of UGG employees, then met with a representative from Willis for a brainstorming session to identify the firm's major risks. This process identified 47 exposure areas, from which six were chosen for further investigation and quantification. The six risks were (1) environmental liability, (2) the effect of weather on grain volume, (3) counterparty risk (suppliers or customers not fulfilling contracts), (4) credit risk, (5) commodity price and basis risk, and (6) inventory risk (damage to products in inventory).

Willis Risk Solutions, a unit of the Willis Group Ltd., took on the task of gathering data and estimating the probability distribution of losses from each of the six risk exposures. These probability distributions were then used to quantify the impact of each source of risk on several measures of UGG's performance, including return on equity, economic value added, and earnings before interest and taxes (EBIT).

Exhibit 9 provides an example of the type of analysis conducted by Willis Risk Solutions. The example is based on UGG's counterparty risk. Based on data provided by UGG and discussions with UGG employees, Willis estimated that the number of counterparty losses per year could be described by a Poisson distribution (see Figure A in Exhibit 9) and that the loss severity on any given loss could be described by a lognormal distribution (see Figure B). Given the probability distributions for the number of losses and for the loss per event, a annual loss distribution from counterparty risk could be estimated (see Figure C). Finally, the

impact of counterparty risk on the probability distributions of various performance measures (e.g., EBIT) could be estimated under the assumption that all other risk factors took on a specific value (see Figure D).[2]

The analysis conducted by Willis Risk Solutions led to the conclusion that, of the six risks originally identified, UGG's main source of unmanaged risk was from the weather. The parties therefore focused their energies on understanding how weather affected UGG's performance. Ken Risko and Michelle Bradley, a statistician and actuary respectively for Willis Risk Solutions, conducted an in-depth regression analysis of how crop yields in each province of western Canada were influenced by temperature and precipitation.

Examples of the regression analysis conducted by Ken and Michelle are presented in Exhibit 10. The table provides the results of estimating a regression equation where the dependent variable is the crop yield (bushels per acre) for either wheat or oats, and the explanatory variables are a time trend (to capture productivity increases over time), the average June temperature, and the average July precipitation. The analysis was conducted using data from 1960 to 1992 for the provinces of Alberta, Manitoba, and Saskatchewan. Similar analysis was also conducted for other grains and seeds.

To illustrate the results, consider the first row of the Exhibit 10. The positive and statistically significant coefficient on the time trend variable indicates that Alberta wheat yields have increased over time. The negative and statistically significant coefficient on the average June temperature variable indicates that wheat yields in Alberta are negatively related to the average June temperature. Finally, the positive coefficient on the average July precipitation variable indicates that crop yields increase on average with rainfall in July. The r-squared indicates that about 68 percent of the annual variation in Alberta wheat yields is explained by these three variables.

The remainder of Exhibit 10 indicates that, in general, crop yields for wheat and oats have increased over time, are negatively related to average June temperature and positively related to average July precipitation. There are, however, some exceptions to these generalizations. The exhibit also indicates that the three variables in the regression equation explain a substantial proportion of the variability in yields in all of the provinces, i.e., the r-squareds generally are high.

The regression results can be used to assess how expected crop yields would be affected by deviations from normal weather conditions. For example, if temperature and precipitation were expected to take on their historical average values (presented in Exhibit 11), then the predicted wheat crop yield for 2000 would be

$$\text{Yield} = 59.88 + .33\,(40) - 0.76\,(56.6) + 0.03\,(205.8) = 36.2 \text{ bushels per acre}$$

If instead the average June temperature was higher than the mean value by one standard deviation (2.2 degrees from Exhibit 11), the Alberta wheat crop yield would be predicted to be

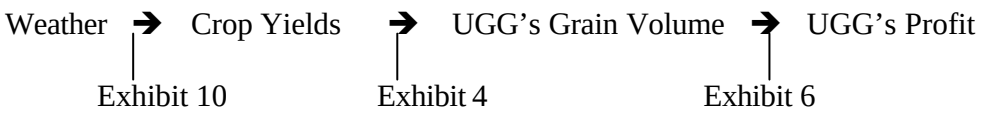
[2] Although not presented here, all of the risk factors could be incorporated simultaneously into the analysis of the performance measures if the correlations between the risk factors were estimated.

Yield = 59.88 + .33 (40) – 0.76 (58.8) + 0.03 (205.8) = 34.6 bushels per acre

Having established a relationship between crop yields and weather, Ken and Michelle then estimated the relationship between crop yields and UGG's grain volume. They first calculated a weighted average crop yield for western Canada using crop yields by grain/seed and by province and the proportions of total production of each grain/seed in each province. The values for this weighted average crop yield are reported in Exhibit 4. They found that UGG's grain volume in year t was highly correlated with overall crop yields in year t-1.

The next step in Ken and Michelle's analysis was to relate UGG's grain volume to UGG's financial results using the information in Exhibit 6. For each tonne of shipments, UGG had gross profit of 21.2 Canadian dollars on average during the 1997-1999 period.

To summarize, Ken and Michelle established a relationship between weather and UGG's gross profit using the following steps and information:



They illustrated their results by graphing UGG's actual gross profit and what gross profit would have been if the effects of weather were removed. Their graph is reproduced as Exhibit 12.

ALTERNATIVE RISK MANAGEMENT APPROACHES

Having quantified their exposure to weather risk, UGG had to decide what to do about it. They explored several options.

Retention

One approach was to continue operating as they had been and not try to reduce their weather exposure. As previously discussed, this approach exposed their profitability to large swings due to weather variation. There were several disadvantages of such volatility.

First, UGG had been and planned to continue making large investments in storage facilities (grain elevators). The ability to finance these capital expenditures from internally generated funds would allow the firm to avoid the costs associated with raising external capital. And, to the extent external capital would be needed, the rate that the firm would have to pay on borrowed funds would likely be higher if they retained the weather risk.

Second, the variability in its cash flows caused UGG to hold extra equity capital as a cushion against unexpected low cash flows in any given year. If the firm could reduce its weather risk, it could increase the proportion of the firm financed with debt without paying higher yields, which in turn would allow it to gain additional interest tax shields.

Third, although much of UGG's current business could be characterized as a commodity business, UGG tried to distinguish itself from competitors by creating products

with brand names and by providing on-going services to customers. Stability in the firm's cash flows would help the firm characterize itself as a company that suppliers and customers could rely on for service and high quality products for many years. Moreover, the importance of supplier and customer relationships was likely to increase in the coming years as the marketplace for agricultural products adjusted to scientific advances. Analysts predicted that over the next decade, food producers would demand specific genetically engineered crops, which in turn would require farmers to plant specific seeds. The coordination of these activities between farmers and food producers would require an information, storage, and transportation network. UGG saw itself as a provider of these intermediary services.

The main advantage of retaining the weather risk was the cost associated with shifting it to someone else. In addition, Mike and Peter were not sure that the capital markets really would reward the firm for eliminating weather risk, given that this was a risk that most investors could easily diversify on their own.

Weather Derivatives

In the late 1990s, weather derivatives were a relatively new risk management tool. These contracts were sold in the over-the-counter (OTC) market by firms such as Enron. A contract could be tailored on a number of dimensions to meet the specific needs of the buyer. For example, the underlying variable determining the payoffs could be one or a combination of weather variables, such as average temperature, rainfall, snowfall, a heat index, or the number of heating or cooling degree days. The payoff structure could resemble a put option, a call option, a swap, or combinations of these structures.

Exhibit 13 provides an example of how UGG could potentially use a weather derivative. Suppose that, based on Willis' analysis of the sensitivity of crop yields to weather and the sensitivity of gross profit to crop yields, UGG's *expected* gross profit exhibited a pattern depicted in Figure A of Exhibit 13. The vertical axis measures expected gross profit and the horizontal axis measures a weather index, which equals a weighted average of various temperature and precipitation measures in western Canada. As the index increases, expected gross profit increases (because crops yields increase, which in turn increases UGG's shipments of grains and seeds). For simplicity, the illustration assumes that the relationship between gross profit and the weather index is linear. Since low values of the weather index correspond to low expected profits for UGG, a derivative contract that would pay UGG money when the index is low would provide a hedge. For example, the put option structure illustrated in Figure B in Exhibit 13 would help to hedge UGG's risk. When the put option payoff from Figure B is added to expected gross profit from Figure A, UGG's expected gross profit would vary with the weather index as depicted in Figure C.

Hedging their weather risk with derivatives was feasible, but it suffered from several difficulties. Although Willis had performed a sophisticated analysis of the effect of weather on UGG's gross profit, the results of this analysis had to be converted into a desired contract structure. That is, the underlying weather index that determined the derivative contract's payoff would need to be specified. Next, the effectiveness of the derivative contract in hedging UGG's risk would have to be assessed. UGG then would have to obtain price quotes in a marketplace that had relatively few participants.

The Insurance Contract Idea

When discussing the weather analysis, Mike McAndless and Peter Cox thought of an alternative way of dealing with the firm's weather risk. They knew that the primary reason weather was important was because weather affected UGG's grain shipments. They therefore wondered whether they could construct an insurance contract that would pay UGG when its grain shipments were abnormally low? The obvious problem with such a contract is the moral hazard problem – UGG's pricing and service also influences its grain shipments. One solution to this problem was to use industry-wide grain shipments as the variable that would trigger payments to UGG. Industry shipments would likely be highly correlated with UGG's shipments, which would imply that the basis risk would be minimal. In addition, because of its relatively low market share, UGG would have minimal effect on the value of industry-wide shipments, which would significantly reduce the moral hazard problem.

Mike and Peter also considered the possibility of integrating grain volume coverage with UGG's other insurance coverage. Currently, UGG purchased a number of different insurance policies for various traditional risk exposures. For example, they purchased a variety of policies to cover their property exposures (e.g., a boiler and machinery policy to cover losses on machinery and equipment) and liability policies to cover their exposure to tort liability (e.g, environmental impairment liability). Each policy had its own retention level and its own coverage limit. By integrating it various coverages under one policy, UGG could replace the individual deductibles and limits with an overall annual aggregate deductible and limit that would apply to all or a subset of losses, including grain volume losses.

Mike called Willis and asked them to investigate the possibility of structuring an insurance contract on industry grain shipments. Willis then contacted several major commercial insurers, including a division of the large reinsurer Swiss Re, called Swiss Re New Markets. Located in New York, this group structured innovative risk financing deals for commercial entities.

In preparation for a meeting with a group from Swiss Re New Markets, Mike and Peter wanted to answer the following questions:

(1) Given that any method of reducing the weather risk exposure will be costly, what are the benefits to the UGG's diversified owners from reducing the weather risk?

(2) Should UGG's rather unique ownership structure influence the decision to reduce the weather risk exposure?

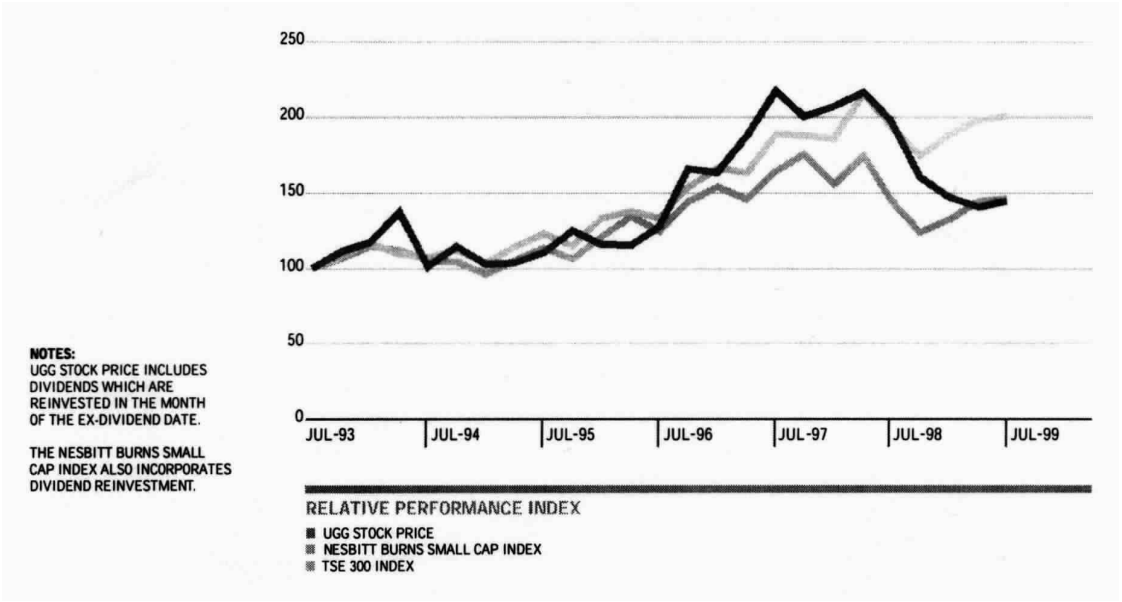
(3) How could they structure a weather derivative to cover the exposure? More specifically, what would be the underlying index? Would they need a separate contract for each crop and each province?

(4) How could they structure an insurance contract to cover the grain volume exposure? More specifically, how would a loss be defined? And, what would be the payment to UGG conditional on a loss?

(5) What are the advantages and disadvantages of integrating the grain volume coverage with the firm's other insurance coverages? That is, instead of having separate policies with separate deductibles and limits for the various exposures (including the grain volume exposure), what are the advantages and disadvantages of bundling all of the firm's exposures in one policy with one deductible and one limit?

(6) Ignoring cost differences, are there any advantages of the insurance contract approach versus the use of weather derivatives?

Exhibit 1



NOTES:
UGG STOCK PRICE INCLUDES DIVIDENDS WHICH ARE REINVESTED IN THE MONTH OF THE EX-DIVIDEND DATE.

THE NESBITT BURNS SMALL CAP INDEX ALSO INCORPORATES DIVIDEND REINVESTMENT.

Exhibit 2

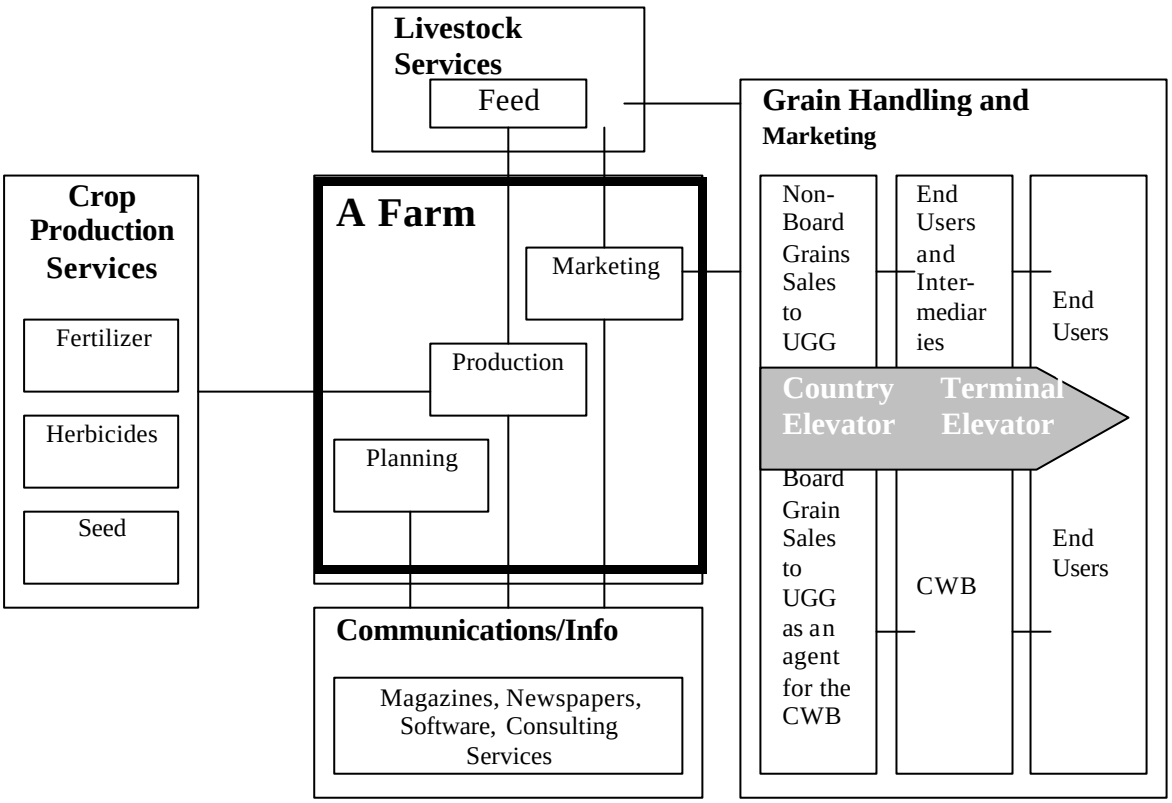

Livestock Services
Feed
Grain Handling and Marketing
Crop Production Services
Fertilizer
Herbicides
Seed
A Farm
Marketing
Production
Planning
Non-Board Grains Sales to UGG
End Users and Inter-mediaries
End Users
Country Elevator
Terminal Elevator
Board Grain Sales to UGG as an agent for the CWB
CWB
End Users
Communications/Info
Magazines, Newspapers, Software, Consulting Services

Exhibit 3

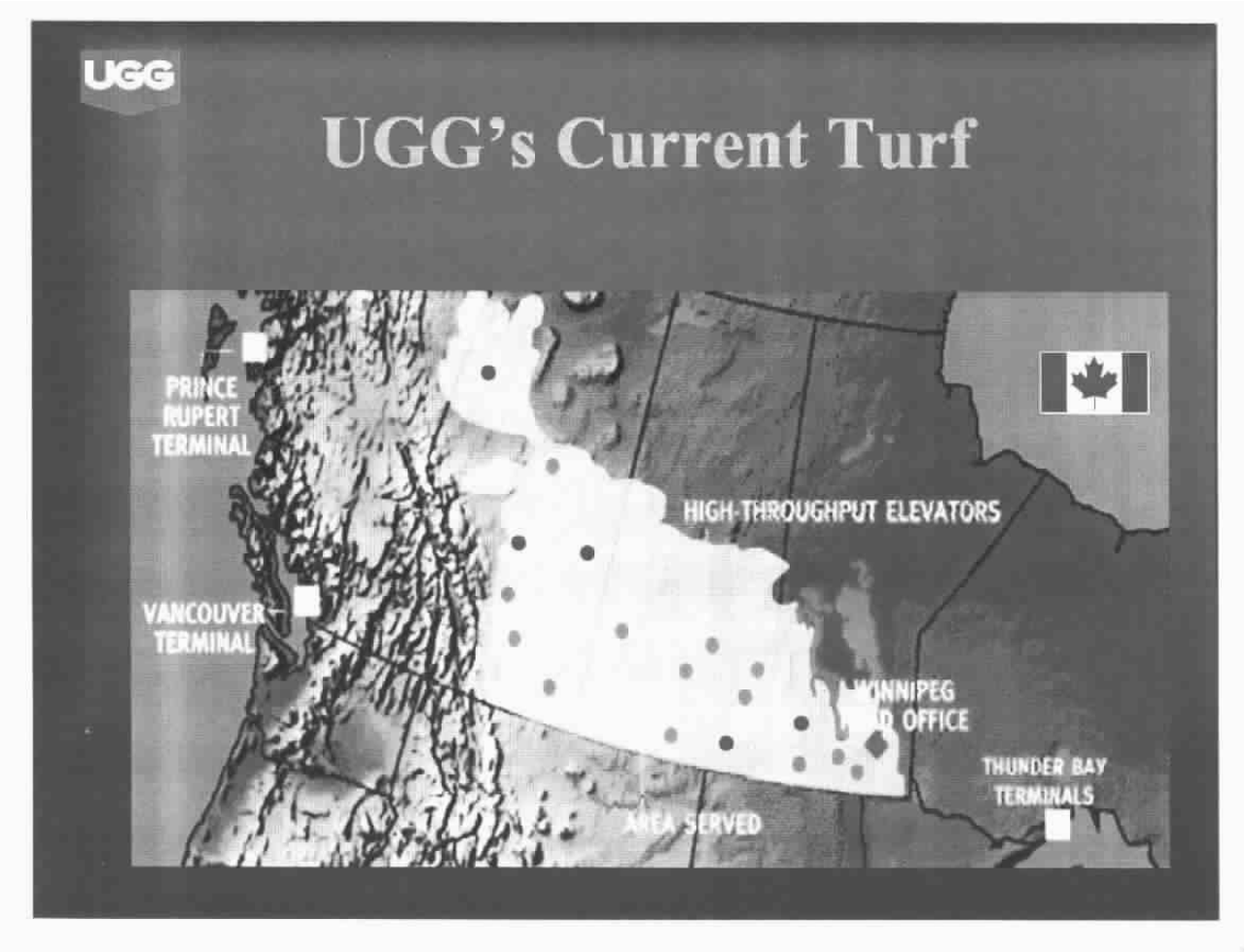

UGG
UGG's Current Turf
PRINCE RUPERT TERMINAL
VANCOUVER TERMINAL
HIGH-THROUGHPUT ELEVATORS
THUNDER BAY TERMINALS
AREA SERVED

Exhibit 4

Data on Industry Grain Volume and UGG's Grain Volume (in tonnes) and the Weighted Average Crop Yields (bushels per acre)

	Industry Shipments	UGG Shipments	Weighted Average Crop Yields in Previous Year
1981	26871	4298	30.9
1982	30392	4842	34.7
1983	33142	5367	37.4
1984	33905	5320	33.3
1985	27183	4020	28.6
1986	27443	4394	32.5
1987	33322	5368	40.0
1988	33435	5072	36.3
1989	23364	3928	26.3
1990	29682	4954	31.3
1991	33376	5498	38.4
1992	34374	5720	37.3
1993	30989	5125	37.0
1994	33489	5503	
1995	35898	6059	
1996	29877	4937	
1997	35663	5591	
1998	33921	5170	
1999	29729	4328	

Exhibit 5

UGG's Competitors in the Grain Handling Business

Organization	Market Share in 1999
Saskatchewan Wheat Pool	25%
Agricore	25%
UGG	15%
James Richardson Int'l	10%
Cargill Ltd	10%
Others	15%

Exhibit 6

Earnings for Grain Handling Segment

For years ended July 31			
	1997	1998	1999
Grain Shipments (tonnes)	5,591	5,170	4,328
Revenue (thousands of C$)	186,121	185,345	162,682
Expenses excluding depreciation	73,108	72,886	69,140
Gross Margin	113,013	112,459	93,542
Depreciation	11,502	9,763	10,082
EBIT	28,403	29,810	14,320
Per Tonne of Grain Shipped			
Gross Margin	20.2	21.8	21.6
EBIT	5.1	5.8	3.3

Exhibit 7

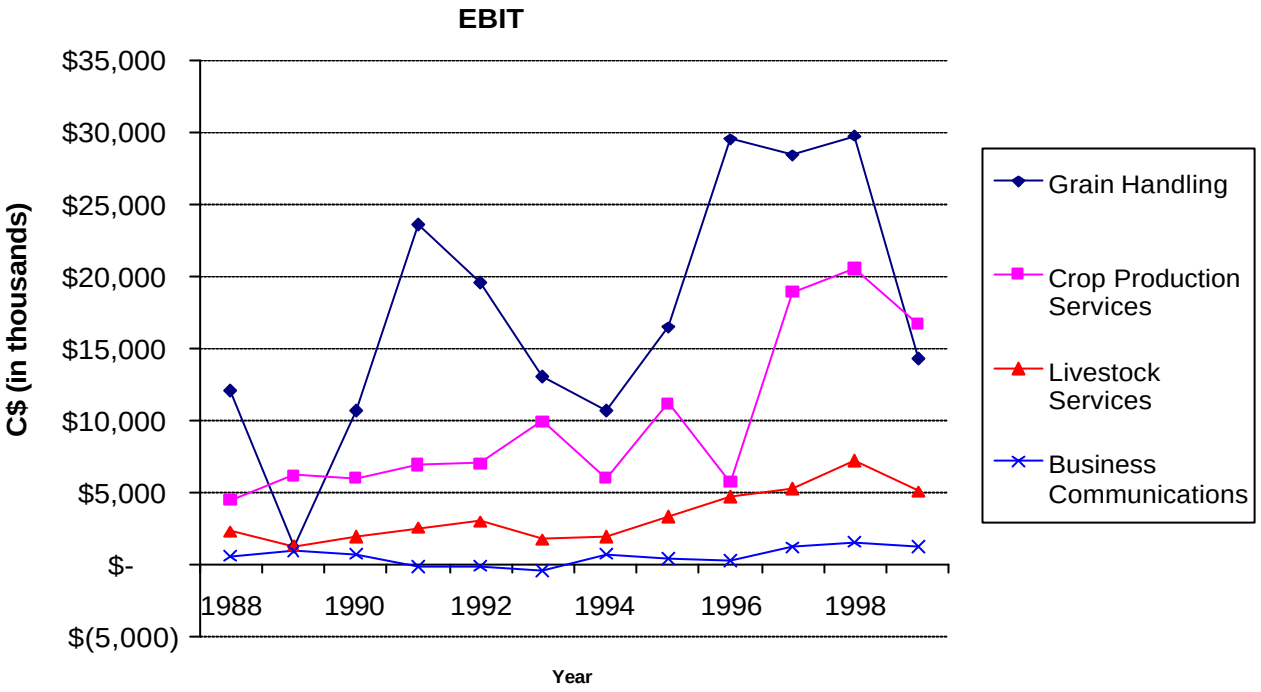

EBIT
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
$(5,000)
C$ (in thousands)
1988
1990
1992
1994
1996
1998
Year
Grain Handling
Crop Production Services
Livestock Services
Business Communications

Exhibit 8

CONSOLIDATED FINANCIAL HIGHLIGHTS

For the years ended July 31	*Restated*					
(in thousands except per share amounts)	1994	1995	1996	1997	1998	**1999**
OPERATING						
Gross profit and revenue from services	$156,030	$185,637	$198,749	$216,260	$224,953	**$209,227**
Earnings before interest, taxes and depreciation	25,538	30,573	40,198	54,788	60,577	**42,423**
Operating income	12,612	15,151	24,090	38,452	43,335	**21,636**
Earnings before income taxes and unusual items	3,772	282	8,065	24,744	31,926	**8,067**
Net earnings	153	-$7,385	5,851	9,059	16,332	**3,575**
Cash flow provided by operations	12,533	16,177	21,322	32,770	35,871	**29,853**
Capital expenditures and business acquisitions	27,725	43,894	26,826	21,904	53,760	**91,002**
FINANCIAL						
Working capital	$75,028	$44,573	$71,557	$101,790	$136,155	**$119,249**
Net investment in capital assets	153,228	182,079	190,308	193,323	226,304	**287,442**
Total assets	564,043	544,284	531,416	489,214	515,209	**554,322**
Shareholders' equity	140,516	130,620	133,694	161,290	234,611	**233,182**
RATIOS						
Total debt to net assets	59.11%	57.72%	55.36%	36.01%	26.24%	**36.76%**
Return on average common equity, before unusual items	0.06%	-2.20%	4.30%	8.51%	8.69%	**1.17%**
PER SHARE						
Earnings (loss), before unusual items (net of taxes)	$0.01	-$0.24	$0.45	$0.89	$0.91	**$0.15**
Cash flow from operations	1.30	1.47	1.94	2.66	2.08	**1.72**

Exhibit 9

Analysis of Counterparty Risk

Figure A

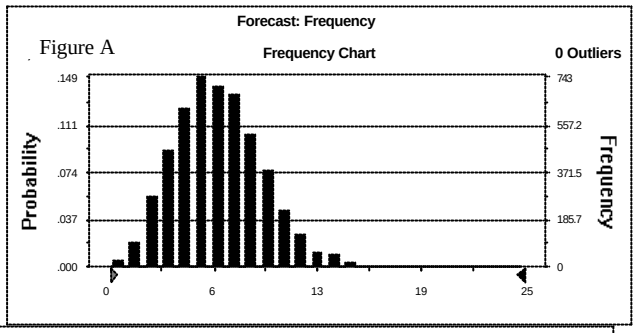


Figure B

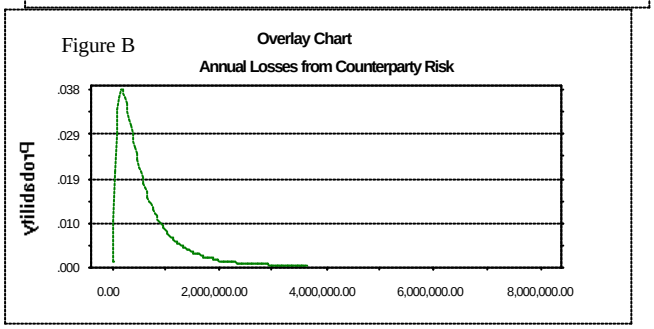


Figure C

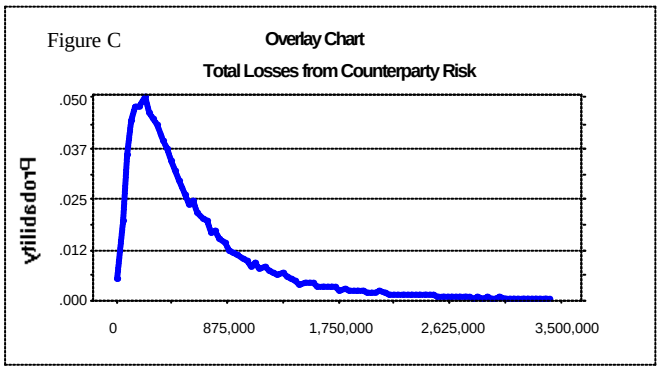


Figure D

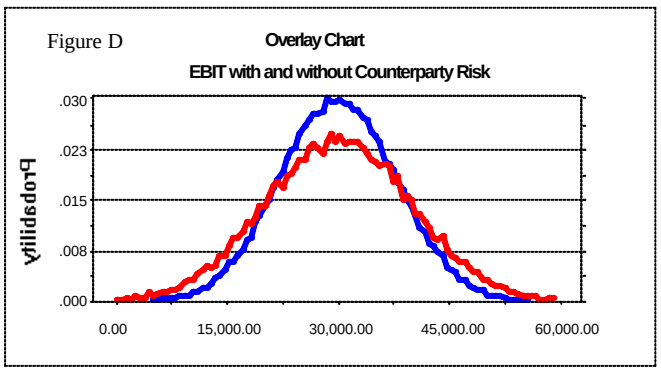


Exhibit 10

Results of Regression Analysis of Crop Yields (bushel per acre)
and Weather Conditions in Two Canadian Provinces using data from 1960-1992;
Temperature is measured in degrees Fahrenheit and precipitation in inches. The time trend variable equals (year-1960); thus, for the year 2000 the time trend equals 40.

Dependent Variable			Explanatory Variables				
Province	Crop		Intercept	Time Trend	Avg June Temp	Avg July Precip	RSQ
Alberta	Wheat	Coef:	59.88	0.33	-0.76	0.03	0.68
		t-stat:	4.49	6.19	-3.19	2.63	
Manitoba	Wheat	Coef:	79.34	0.42	-0.98	0.01	0.65
		t-stat:	5.70	5.94	-4.38	0.95	
Saskatchewan	Wheat	Coef:	55.6	0.19	-0.69	0.05	0.61
		t-stat:	4.02	2.65	-3.01	4.44	
Alberta	Oats	Coef:	43.53	0.69	-0.17	0.05	0.72
		t-stat:	1.89	7.59	-0.41	2.71	
Manitoba	Oats	Coef:	121.02	0.65	-1.50	0.05	0.64
		t-stat:	4.89	5.16	-3.77	2.96	
Saskatchewan	Oats	Coef:	74.07	0.24	-0.76	0.09	0.56
		t-stat:	2.93	1.91	-1.82	4.70	

Exhibit 11

Descriptive Statistics for Variables used in Regression Analysis

	Mean value for Avg June Temp (°F) from 1960-1992	Stdev for Avg June Temp (°F) from 1960-1992	Mean value for Avg July Precipitation (inches) from 1960-1992	Stdev for Avg July Precipitation (inches) from 1960-1992
Alberta	56.6	2.2	205.8	51.0
Manitoba	61.7	3.0	183.1	67.0
Saskatchewan	60.4	2.8	155.1	61.2

	Correlation Coefficients for Avg June Temperature		
	Alberta	Manitoba	Saskatchewan
Alberta	1.00	0.41	0.69
Manitoba		1.00	0.87
Saskatchewan			1.00

	Correlation Coefficients for Avg July Precipitation		
	Alberta	Manitoba	Saskatchewan
Alberta	1.00	0.51	0.74
Manitoba		1.00	0.55
Saskatchewan			1.00

Exhibit 12

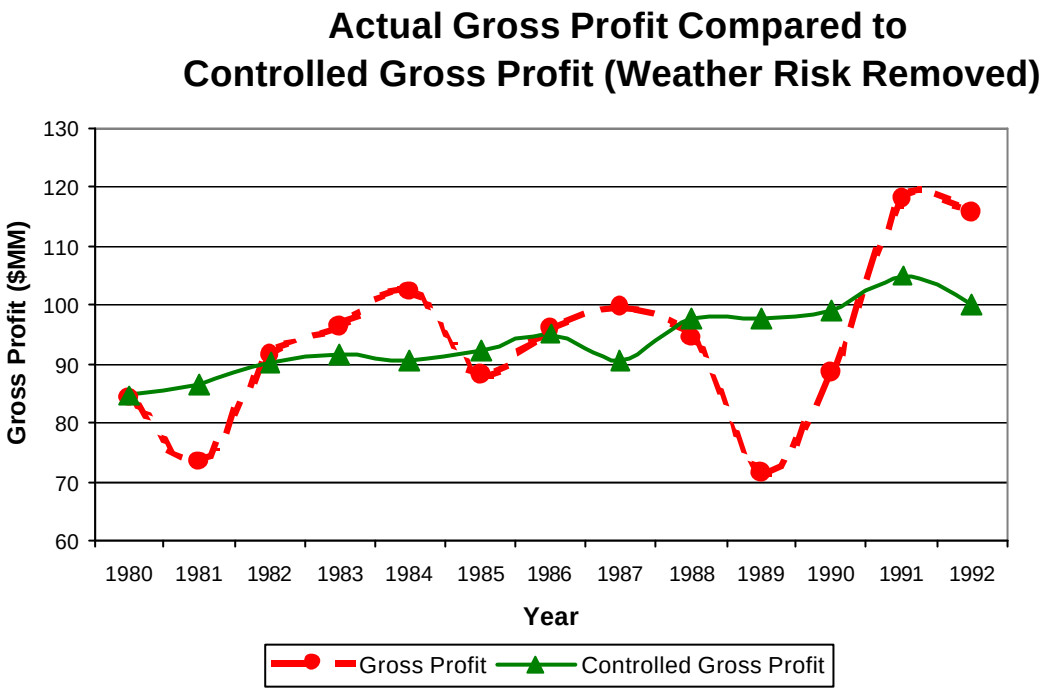

Actual Gross Profit Compared to
Controlled Gross Profit (Weather Risk Removed)
Gross Profit ($MM)
130
120
110
100
90
80
70
60
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year
Gross Profit
Controlled Gross Profit

Exhibit 13

Illustration of a Weather Derivative