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Forecasting Grain Equipment Sales

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FORECASTING GRAIN EQUIPMENT SALES

by

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APPROVAL PAGE

This independent study submitted by RUSSEL R CAMPBELL in partial fulfillment of the requirements for the Degree of Masters of Business Administration from the University of North Dakota is hereby approved by the Faculty Advisor under whom the work has been done. This independent study meets the standards for appearance and conforms to the style and format requirements of the Graduate School of the University of North Dakota.

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Degree: Masters of Business Administration

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ABSTRACT

FORECASTING GRAIN EQUIPMENT SALES

Russel R Campbell B.A. M.S.

The University of North Dakota Graduate Center, 1983

Faculty Advisor - Dr. R. Bertsch

The purpose of the study was to identify and discuss variables that have an effect on the sale of grain handling equipment. A case study format was used to present the analysis. The problem addressed in the study is the inability of the case study company to forecast sales. It was hypothesized that sales could be predicted using data from previous years. Multiple regression was performed using two independent variables: the number of acres of corn harvested for grain, and the government loan rates for on-farm storage facilities, with past sales of the company being the dependent variable. Other variables were discussed but not included in the actual statistical analysis. The study was limited to the state of Iowa for two variables: equipment sales in Iowa and acres of corn harvested for grain in Iowa. This limitation was placed on the study until the practicality of further study was apparent. The findings of the study were that the interest rate variable was not a good indicator of sales and the number of acres harvested was just as good of an indicator by itself as when included with the interest rate variable. The conclusion was drawn that more variables were needed to improve the worth of regression equation.

CHAPTER I

INTRODUCTION

Finding a worthwhile project for the independent study is not an easy task. Sometimes the study is done to please the professor, sometimes to please the student, and sometimes just to fulfill a requirement. In this case the writer was able to find a topic that interested him and might even have some application later on in life. This study will deal will the topic of forecasting sales of grain handling equipment. The first chapter will discuss the purpose and objective of the study, background of the company, statement of the problem, hypothesis, scope of the study, limitations, and a preview of the methodology.

PURPOSE AND OBJECTIVE OF THE STUDY

The purpose of the study is to identify and discuss variables that have an effect on the sale of grain handling equipment. The study will be a case study format. The company used in this case study will be a wholesale distribution company located in central Iowa. The company, Nevada Distributing Company, Inc. of Nevada, Iowa, distributes that type of equipment. This company was selected for several reasons, the foremost being the availability of sales records and industry information. The final objective of the study is to be able to forecast sales, based on the time series and multiple regression analysis of the factors, identified and discussed in this study, that have some ef-

fect on these sales. Some of the factors are not of the quantifiable nature and will only be discussed. Two examples of this type of factor might be the annual rainfall in the territory served by this company or the projected crop yield for next year.

BACKGROUND

This section deals with the background of the company, an introduction to its products, and the philosophy of the management.

Nevada Distributing Company is a wholesale distributing operation, dedicated to selling grain handling and grain drying equipment. It was founded 20 years ago by Spike and Doris Speckeen. In its earlier days its main purpose was to supply products to Speckeen Const., whose owners controlled both companies. There were 3 employees--Spike, Doris, and a foreman. Mr. Speckeen had extensive experience with grain equipment and sales through his 13 years as a salesman with Butler Manufacturing, a large bin company. Mrs. Speckeen's business education was put to use in the partnership immediately as she was in charge of all bookkeeping.

As the construction company grew, so did Nevada Distributing (ND). More dealers were buying products from them, mainly stirators produced by David Mfg. Co. in Mason City, Iowa. The target market today includes construction companies, hardware stores, farm service & co-op organizations,

grain elevators; in short, any outlet that has direct contact with the consumer level of the grain handling and drying equipment market.

Though it started with a very limited product assortment, the growth has been astronomical. Paging through the catalog you will find all of the following: stirators, grain spreaders, grain cleaners, and grain flows from David Mfg. Co. (DMC)--Mason City, Iowa; augers and related equipment from Hutchinson Mfg.--Kansas; electric motors from Baldor--Arkansas; bin ladders from Winfield Mfg.--Winfield, Iowa, private label Nevada Channelock bin floors and supports from Chicago, custom-made bin transitions--Nebraska, as well as galvanized and copper flex tubing, rigid steel tubing, crop drying fans and heaters, bin vents, bin control switches, and moisture testers.

New products are constantly sought and considered, the newest being the flex tubing. The products must be top quality--that is what dealers have come to expect. Product audit is more a continuous process that a regularly scheduled event. A few years ago the company dropped U.S. Motors because of the excessive amount of warranty and repair work needed. It was originally intended as a secondary supplier, but the quality just didn't measure up to standards.

The main pricing objective at ND is to maximize long-run profits, which may mean taking a smaller profit margin

to gain market shares. Prices are generally determined by comparison of competitor's pricing--ND strives to come up with the best price as well as the best product.

If it seems impossible to arrive at a competitive price the manufacturer is usually contacted and made aware of the situation. Together the two companies work out costs, discounts, and programs that will insure profitable sales, beneficial to all parties concerned: manufacturer, distributor, and dealer.

Terms are 2%-ten days, net 30. For many years interest and carrying charges had been at 1 1/2 % per month (18% annually) with a 25 cent minimum, but were increased several years ago to 2% (24% per year) with a 50 cent minimum--due to the economic conditions. The rise in bankruptcies has made everyone more cautious about extending credit, including Nevada Distributing. All dealers undergo a credit analysis to include financial statement review, credit references, and business references. Until the dealer passes the analysis they are handled strictly C.O.D.

The growth of the company and the desire to remain competitive lead the company to open a second warehouse in western Illinois in Rock Falls. This is much more convenient for the dealers in Wisconsin, Illinois, eastern Missouri, and eastern Iowa. If the expansion is successful, a similar project is planned for Lincoln, Nebraska. Being closer to the dealer gives him one more reason to do busi-

ness with ND.

The policy at Nevada Distributing is to earn all cash discounts from its creditors and participate in programs involving prepayment on merchandise and winter discounts. In turn, the dealers are given the opportunity to take advantage of these through the company.

As a distributor ND is in the middle of the indirect channel of distribution from manufacturer to distributor to retailer (dealer) to consumer (farmer). ND purchases products from many areas, as mentioned earlier, and targets a large geographical market. Currently, that area includes Iowa, Nebraska, Kansas, Missouri, Wisconsin, Illinois, Minnesota, and North and South Dakota. There are some sales to outlying states like Colorado, Oregon, Arkansas, Indiana, and Arizona, but they are not actively pursued. The function of inventory and its carrying costs, taxes, insurance, and transportation are the distributor's responsibility.

Transportation is a big part of the channel of distribution. Three truck tractors, nine semi-trailers, and four fork lifts all facilitate materials handling between the two warehouses and the manufacturers. The products are picked up at the factory (except electric motors which are shipped by the manufacturer) and dealers are responsible for picking up material at Nevada or Rock Falls. Merchandise is delivered to dealers when ND's trucks are going in their direction, but merchandise is generally f.o.b.

Nevada; the only exceptions being prepaid shipments that surpass certain poundage requirements and direct delivery of full truckload orders.

Promotion is done very aggressively, but not offensively. The five salesman travel territories divided geographically and the emphasis is on personal selling. Although they call on their customers on a regular basis, most orders come in by phone from the dealers. Personal calls are more for good will, trouble-shooting, and a good means for salesmen to grasp present business direction. When they are required to be in the home office, all personal selling is done by phone. In fact, the sales manager, whose territory is most of Iowa, does 90% of his selling by phone. This policy is reflected in the $1800 monthly phone bills. Trade shows are also a large part of promotion at ND. The salesmen attend approximately 10 farm shows and regional fairs each year in the various states. Advertising is placed in trade journals targeted for farmers in specific states-such as Wallace's Farm Journal, Nebraska Farmer, Kansas Farmer, etc. Some of this is done jointly--for instance, DMC places ads for their products and Nevada Distributing is listed as the contact and the cost of the advertisement is divided evenly--(co-op advertising).

Sales have been tremendous in the past few years. In 1976 total sales--less disc. and returns--was $1,697,147. By 1982, sales had grown to $12,255,214. The outlook

for 1983 is not as good for two reasons: the government farm program and the weather--two factors affecting sales greatly that ND has little control over. Sales data is available by product, by salesman, and by state, making the job of data gathering very easy for this writer.

The large volume of business now handled by ND made it necessary to take some action to alleviate paper work. A Honeywell computer was purchased, but problems developed with the vender and the software company. The system was depreciated under the new tax laws allowing accelerated depreciation. If the company sold the system they would have to pay more in recapture to the IRS than they would receive for the system. A second attempt has been made to purchase a data processing system, however this time the software was selected and modified prior to purchase of the software package and the IBM System 36 hardware. This software package will be used for accounting, inventory control, and order processing. There are plans to add remote terminals at the new warehouse and an IBM Personal Computer for business analysis.

The company feels that the service they provide is enabling the farmer to sell his commodity when the market is right--not being forced to sell at harvest time. For the farmer, one good crop year can more than pay for additional storage facilities.

The future looks bright for Nevada Distributing.

Ideas for continued growth include increasing their dealers in the existing territories through the additional warehouses and adding new products to their product line--giving dealers one more reason to deal with Nevada Distributing.

A great deal of time was spent in this section familiarizing the reader with the company, the product line, and their marketing plan--hopefully giving more insight into the way sales are affected by different factors. These factors will be discussed in a later chapter.

STATEMENT OF THE PROBLEM

The company has experienced rapid growth in the past several years. In most cases the approach to forecasting the sales has been a "let's wait and see" strategy. Looking at Appendix A will demonstrate the volatility and the seasonality of sales. The majority of sales occur during the period from July to October. The monthly sales for 1982 are shown in Appendix A. There are factors that influence sales in addition to ones that businesses normally experience (new products, competition, or consumer preference), such as weather, the current United States Department of Agriculture (USDA) government farm program, and rail boxcar shortages that can cause storage problems for grain elevators. All of these factors together make forecasting sales very difficult! In a later chapter, we will discuss some of these factors and their influence on the sales at Nevada Distributing.

HYPOTHESIS

In the course of this study the writer will discuss factors having an effect on grain handling equipment sales and will try to identify relationships between these factors. The hypothesis is that sales can be forecast using historical data from the identified factors such as USDA on-farm storage facilities loan rates, average price of grain at harvest time, crop yield, past sales from the company, and other factors.

SCOPE OF THE STUDY

It is probably impossible to study all factors affecting sales and impossible to quantify the factors even if that was the purpose. The same holds true for the factors affecting this company. For the purpose of this study, the scope will be limited in several areas. First, even though ND equipment is used for many different types of grain, this analysis will be limited to data concerning corn; the foremost reason being that 95% of ND business is corn related. The second area in which the scope is limited is in territory. Even though the company services more than 9 states, the study will be limited to Iowa. It was felt that including more states in the initial study would not clearly contribute to the analysis, but may be studied at a later date if the relevancy of the factors is confirmed. The last limiting factor is the time frame; the study will be limited to the years 1976

to 1982 due to the availability of data.

LIMITATIONS

The major limitation will be the lack of perfect information, which is to be expected. Realistically, the most probable shortcoming will be the possibility of overlooking the most important factor affecting sales. Even though all factors cannot be identified and discussed within the scope of this study, there is room for improvement in the forecasting technique currently employed by the company. Also the elimination of any factor from further consideration will be an improvement. The limitation of the statistical analysis is inherent in the method--two-way causation, multicollinearity, and auto correlation. Another area of concern might be the personal biases of the researcher and his predisposition.

METHODOLOGY

The information in this section is a preview of Chapter Two of this study. As mentioned previously, the study will be concerned with forecasting sales of grain handling equipment distributed by Nevada Distributing Company. The study will be limited to sales of all equipment in Iowa using past sales data from 1976 through 1982.

Information for the study was obtained from the USDA in Washington D.C.; Iowa State University-Extension Service in Ames, Iowa; and sales data from the case study company, Nevada Distributing Company of Nevada, Iowa.

The analysis portion of the study will include a regression analysis and the initial work for time series analysis of the data.

SUMMARY

In the initial chapter of the study the reader has been exposed to a discussion of the purpose and objective of the study, a rather indepth presentation of the background of the case study company, a statement of the problem, hypothesis, scope of the study, limitations, and a preview of the methodology for the study.

CHAPTER II

METHODOLOGY AND ANALYSIS

The information presented in this chapter is concerned with the method used to perform the analysis of the data in this case study. The areas to be discussed are (1) definition of the target area of study, (2) the overall research design and presentation of rationale for the overall method, (3) discussion of the data, (4) methods of material and data collection, and finally (5) a summary discussion of the data analysis.

DEFINITION OF THE TARGET AREA OF STUDY

This area was discussed in the methodology section of the first chapter. Briefly, the study will be concerned with forecasting sales of Nevada Distributing Company. The company is a wholesale distributor for grain handling equipment in the central midwest part of the United States. Its territory is the state of Iowa and surrounding states. The study will be limited to the sales in Iowa. For this study the sales will be measured in dollars, as opposed to unit sales.

RESEARCH DESIGN

Maybe the hardest part of any research project is determining how you are going to approach the study. In this section the writer will discuss how the project was accomplished.

After determining what the focus of the research

project would be, the researcher interviewed several people that he considered to have more expertise (than himself) in the area. Each person was asked for their opinion as to what factors affected the demand for the grain handling equipment. The responses were generally helpful, some interviewees answered with "lots of luck--it can't be done", but most provided useful inputs.

The first interview was with a USDA employee in Washington D.C., Mr. George Rockwell. He was instrumental in identifying several sources of useful information. The next source of information was the Extension Service at Iowa State University in Ames, Iowa. Both of these agencies will be useful for any additional research in this area. The last area of interviewing was within the industry itself. A sales manager at Hutchinson Manufacturing Company and management personnel at David Manufacturing Company provided their views on the subject. Their approach to forecasting the product demand was based primarily on inputs from Nevada Distributing.

Factors identified through these sources were ones such as USDA (Commodity Credit Corporation) On-Farm Storage Facilities Loan Rates, crop yield figures, and planted/harvested crop acreage figures. Other factors were discussed during the interviews and will be addressed in a later chapter.

The next several paragraphs will discuss the statistical

methods considered for the study. This portion can serve as a review for the reader who is not a statistician.

STATISTICAL ANALYSIS

Most companies make some use of statistical data in sales forecasting. Forecasts by executives are typically made only after reference to past sales patterns. The issue of statistical methods in sales forecasting is not whether they should be used but what statistical techniques are appropriate. Three methods commonly used are simple projection, time series analysis, and regression analysis.

Simple projection is the easiest statistical procedure for forecasting sales. This technique is well illustrated by the company that takes past annual sales and projects the trend for the coming year. It is a technique that will have greater value for shorter-term forecasts. The basic assumption of this technique is that forces operating in the past will persist in the future. Obviously, conditions are never the same in the future, but many factors may be the same, such as the company's marketing mix, productive capacity, and distribution channels. For the purposes of this study, and due to the availability of other data, this technique was not chosen.

Time series analysis consists of chronologically arranged observations of a phenomenon. The time periods may be weekly, monthly, quarterly, or annual data. The objective in time-series analysis is to demonstrate the

relationship between sales (Y) and four separate forces: trend (T), seasonal variation (S), cyclical variation (C), and residual variation (R). The latter term encompasses all forces not previously included in the other three factors. The time series model can be described in multiplicative fashion as follows: $Y = T \times S \times C \times R$.

Predicting future sales through the use of time series has a great deal of appeal to executives. However, time-series analysis as a sales forecasting procedure makes the same tenuous assumption of the simple projection method, that is, past historical patterns will prevail in the future. Neither simple projection nor time-series analysis provide an explanation of what is influencing sales. In order to know the relative impact of the various factors that influence sales, the sales forecaster turns to regression analysis.

The term "regression" refers to the techniques used to derive an equation by which a dependent variable may be estimated from one or more independent variables. The first requirement for the application of regression analysis is the availability of historical data for several time periods, usually years. Given past sales data, the analyst can examine a variety of independent variables that are believed to influence sales. Executive judgment should also play an important part in the selection of the independent variables. This researcher discussed

the selection of the variables with several industry specialists. That information will be discussed in a later paragraph. The formula $Y = a + bX$ used to illustrate simple projection techniques is a linear regression with one independent variable--time. As is true in all regression methods, we are simply demonstrating covariation.

When two or more independent variables are used, we have a linear multiple regression and it is in the following form: $Y = a + b_1 X_1 + b_2 X_2 + * * * b_n X_n$.

In this formula, the b's are the coefficients of regression. They may be interpreted as the average change in the dependent variable (sales) associated with a unit change in the appropriate independent variable, when the other variables are held constant. One definition required at this point is the difference between regression analysis and correlation analysis. Correlation analysis deals with the measurement of the closeness of the relationships that are described in the regression equation. Regression analysis refers to the techniques for the derivation of an equation by which a dependent variable may be estimated from an independent variable(s). Regression emphasizes prediction, while correlation focuses on measuring the strength of the relationship.

The measure used to determine the "closeness of fit" is the coefficient of determination usually denoted by R^2. This coefficient is a measure of the extent to which

the regression line "explains" the original variance observed in the data.[1] This measure is relative however.

The study is intended to be of the descriptive nature--to identify possible factors affecting sales pertaining to the study. The objective in a descriptive study is to learn the who, what, when, where, and how of a topic.[2] In this case study, the objective explained above justifies the amount of time spent on the background of the case company and discussing the factors (independent variables) affecting the sales of the grain handling equipment. The secondary goal of this study is to develop an introductory regression model and time-series study. The statistical portion will be an indicator to see if the research is headed in the right direction.

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[1]Kenneth R. Davis, Marketing Management, John Wiley & Sons, Inc., New York, New York, pp. 190-200.

[2]C. William Emory, Business Research Methods, Richard D. Irwin, Inc., Homewood, Illinois, p. 91.

CHAPTER III

DISCUSSION OF THE FACTORS

AND

FINDINGS OF THE STUDY

Several factors that the researcher and others hypothesized as affecting the grain handling equipment sales were mentioned in an earlier section. Those, and others, will be discussed in this chapter. Some of the factors are unquantifiable, but will still be discussed due to the descriptive nature of the study.

GOVERNMENT FARM PROGRAMS

The Agriculture Stabilization and Conservation Service (ASCS) was established June 5, 1961 by the Secretary of Agriculture. The ASCS is the agency of the USDA that administers specified commodity and related land-use programs designed for voluntary production adjustment, resource protection, and price, market and farm income stabilization. The ASCS organization exists on a state, county, and local community level. In addition, there are three Commodity Offices, located in Kansas City, Minneapolis, and New Orleans that have specific responsibilities concerning the acquisition, handling, storage, and disposal of designated commodities and products held by the Commodity Credit Corporation (CCC).[3] The CCC price support programs act as

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[3]F. L. Garcia, Encyclopedia of Banking and Finance, Seventh Edition, Bankers Publishing Company, Boston, Massachuetts, p. 262.

a safety net when conditions in the farm sector are unfavorable, as they tend to provide a floor price for the commodity. These programs are, for the most part, also what is referred to as an "entitlement"--anyone who meets the legal and regulatory criteria for eligibility is entitled to receive program benefits. Therefore, CCC outlays tend to rise when economic conditions are poor and decrease when economic conditions are favorable to farmers. Further discussion of the organization of the USDA, ASCS, and CCC is beyond this study, but the reader may reference sources cited in this study for additional information.

Land diversion programs to limit crop production have been common since the 1930s. The purpose of these programs has been to reduce acreages planted to create price supports for grain commodities.

Record harvests of corn in 1981 and 1982 have created a glut of grain. The unsold carryover of last year's corn surplus alone is an estimated 3.4 billion bushels. Even as supply ballooned, markets shrank. In 1982, a strong dollar and world recession caused a major decline in farm exports for the first time in 13 years. Farm debt has burgeoned, from $140.8 billion in 1979 to about $215 billion at the start of 1983, while net income fell from $32.4 billion in 1979 to $19.5 billion in 1982. "The farm sector," sums up W.D. Willer, executive vice president of the Decorah (Iowa) State Bank and chairman of the American

Banking Association's agriculture task force, "is in a Depression-type state." [4]

Now, in effect, less may become more for the farmers. Last December the Reagan Administration proposed a novel corrective: a self-imposed grain drain called payment-in-kind (PIK) that rewards farmers in government-owned grain for idling large tracts of productive land. The program, hastily cobbled together to prop up the flagging farm economy, has prompted a response that was beyond anyone's expectations. In April the expectations were that 82.3 million acres of crops would be idled. This amounts to roughly one-third of the land eligible for the program, an area equivalent in square miles to Iowa, Illinois, and half of Indiana.

The PIK program is an attempt to reduce surpluses, drive up depressed grain prices, cut government costs both for price supports and for grain storage, and slash farmer production expenses. To qualify for price supports and cash subsidies, farmers were already required by the government to take 20% of their land out of production. Under PIK, the farmers must idle an additional 10% to 30% of their acreage and can bid to idle all of it. In exchange they receive crops from government storage and are free to sell them on the open market or use them as livestock

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[4]Susan Tifft, "Going Against The Grain", Time, April 4, 1983, p. 29.

feed. The crops will equal 80% to 95% of what the farmers would normally produce on the acres.[5]

The PIK program will temporarily punish those who sell to farmers: seed, fertilizer and chemical suppliers, farm-machinery makers (and distributors), grain handlers, and crop-insurance salesmen. But in the long run, if the farmer doesn't prosper neither does the agri-industry. Reduced plantings and harvestings will cut farmers' use of seed, fertilizer, and pesticides and need for repairs between 12 and 15 percent. Fuel use will drop 8 to 10 percent. Machinery purchases will be much less affected and could be down as little as 2 to 3 percent. Historically, machinery purchases improve as farm income increased.[6]

The 6.2 million acres of Iowa's corn base to be idled under the 1983-84 PIK program will cause an estimated $300 million reduction in agribusiness related activities compared to the 1982-83 season. Gross farm incomes after variable expenses are expected to increase by $920 million. These estimates are based on estimates of 10 million planted acres, 132 bushel per acre yields, and a season average price of $2.72/bu. for 1983-84.[7] For further information

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[5]Ibid. p.29.

[6]"An Initial Assessment Of The Payment-In-Kind Program", United States Department of Agriculture, Economic Research Service, April 1983, p. 3.

[7]Daniel Otto, "Estimated Impacts of the PIK Program on the Rural Economy of Iowa", Cooperative Extension Service at Iowa State University. p. 6.

on the current PIK program reference the sources cited in this study.

WEATHER

This factor alone is probably the easiest, and at the same time the hardest, to deal with in the study. Normally, in the territory serviced by Nevada Distributing Company (seven states) the weather affects certain areas--- counties or groups of counties. Some areas will have bad weather and some will have excellent weather and overall the net effect is the same. However, it is not possible to accurately predict the weather and the only way to include this factor in an analysis would be to average the rainfall, temperature, etc. over an area and predict the effect on a best--worst case basis. It might be possible to include this factor, if data could be assembled, for a county by county forecast, but at this stage of the analysis that would be impractical. Nonetheless weather is a factor to be considered, possibly as a factor in "executive judgement" forecasting.

Many of the predictions of the effect and success of the PIK program were based on a normal year--weatherwise. As luck would have it, the 1983 crop year was first hampered by wet weather, and then by midsummer the worst drought since the "dust bowl" years had settled upon the middle section of the country. This drought did not effect one or two counties but whole states. In Iowa alone 46 of

99 counties were declared disaster areas by the state's governor. In Iowa, the PIK program idled roughly 40% or the corn base, then the drought probably cut that figure in half again. The state of Missouri and western half of Illinois were virtually wiped out. The only thing that could be worse would be the repeat of the "triple whammey" of 1974 when a wet spring followed by a dry summer and early frost cut crop yields by 25%.[e]

CROP MARKET PRICE

This researcher feel that the market price of the grain is very important as a factor affecting the equipment sales. If the market price is high enough at harvest time, then there is no need for the farmer to store his crop. However, due to simple supply and demand this rarely occurs. The price can change drastically. This fall the price was over $3.50 per bushel while last year the price was $2.25. This differential is due to weather, surpluses, government farm programs and who knows what else. The problem is how to include the factor in the regression analysis.

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[e]Wendly L. Wall, "Heat Wave In Corn Belt Threatens To Reduce Harvest As Much As 10%", The Wall Street Journal, August 2, 1983, p. 25.

FINDINGS OF THE STUDY

As stated in the methodology section of this study, regression analysis was performed using the data in the appendicies. Appendix B contains the sales figures for Iowa equipment sales. This was considered the dependent variable and labeled "y" in the equation. Appendix C contains the Iowa corn acreage planted and harvested. The acres-harvested-for-grain figures were used in the analysis because the equipment sales are related to grain storage. This independent variable was labeled as "b_1X_1" in the regression equation. Appendix D contains the interest rates used in the analysis. Several of the annual rates are weighted averages due to the fluctuations in the interest rates and the inability to correlate the sales to specific months. This independent factor was labeled "b_2X_2" in the equation.

A summary of the equation follows:

Y = Iowa Equipment Sales

X_1 = Iowa Corn Acres Harvested

X_2 = CCC Interest Rates

$$Y = a + b_1X_1 + b_2X_2$$

$$Y = 97.52542 - 8.08889\ X_1 + 1.37747\ X_2$$

The multiple correlation coefficient is .66383 when all factors are considered. The standard error of estimate is 2.29164 for both factors.

Stepwise Regression was also performed. This procedure was performed on the third variable first. The multiple correlation coefficient was smaller (.509) and the standard error of the estimate (2.360), which is the amount of error unexplained by regression, was larger. The third variable is not as helpful in predicting "y" in the equation. The analysis of the second variable yielded the following information: standard error of the estimate was 2.292 and the multiple correlation coefficient was .664. Both of these factors are equal to or larger that the figures when both variables are considered.

The following is a summary of the figures presented.

VARIABLES	STANDARD ERROR OF ESTIMATE	MULTIPLE CORRELATION COEFFICIENT
BOTH	2.29164	0.66383
THIRD	2.36000	0.50900
SECOND	2.29200	0.66400

The second variable is helpful in predicting "Y" when both variables are considered. The relative worth of the third variable, the interest rates, is suspect. In the initial evaluation, it appears that a prediction of equipment sales (Y) based on the second factor alone - the acres harvested - would be just as accurate as one using both factors.

CHAPTER IV

SUMMARY AND CONCLUSIONS

SUMMARY

In the course of this study the researcher has tried to analyize the factors effecting the sales of an agriculture related company, specifically a wholesaler dealing with grain handling equipment. The company used in the case study was Nevada Distributing Company in Nevada, Iowa.

The ultimate objective of the study was to be able to predict sales based on historical data. In the course of the study, the drawbacks of this type of analysis were discussed. The study was approached as a descriptive analysis and attempted to identify variables affecting sales of the grain handling equipment. The study also included an indepth description of the case study company and its marketing program.

The problem addressed in the study was the inability of the company's management to forecast sales. It was hypothesized that the sales could be forecast using such factors such as USDA/ASCS/CCC on-farm loan rates, grain prices, and past sales data.

The scope of the study was limited in several ways. The state of Iowa sales data was used because those figures were readily available and easier to isolate. Production figures for corn were used because 95% of the company's

business is related to the corn crop.

The major limitations of the study were the lack of perfect information, the possibility that the most important variable affecting sales was overlooked, and that some of the variables identified were unquantifiable - factors such as weather.

CONCLUSIONS AND IMPLICATIONS FOR FURTHER STUDY

One of the most important conclusions drawn from this study is that the researcher has not identified all of the factors affecting the grain handling equipment sales. However, this does not comes as a surprise. The study does show that the variables included in the study are helpful in predicting the sales volume. The second variable, corn acres harvested for grain; is more useful than the third variable, government on-farm storage facilities loan rates. This might indicate that when the farmer is faced with a large crop, the interest rate for storage facilities has little impact. He is going to buy storage and handling equipment regardless. This might identify another limitation of the study. The fact that all equipment sales, while related to storage, is not dependent on increasing storage facilities. But may in fact, be related to grain handling requirements used to upgrade and replace existing facilities such as augers, cleaners, drying equipment and testers.

Several of the more important variables tend to be unquantifiable--such as weather, the price of grain at harvest, and the government farm programs. It is this researcher's opinion that if these factors could be included in the study a more accurate prediction could be obtained. What is important is that the study has begun an analysis of these factors and shown that one factor has a bearing on the sales (acres harvested) while another does not (interest rates). It is a beginning.

IMPLICATIONS FOR FURTHER STUDY

Several areas need to investigated further. Another factor that should be added to the analysis is the shortage of on-farm facilities. This information is available only through 1979, and is obtained by a USDA census. The more current information needed to complete the study is unavailable at this time. This factor is considered important because if the crop yield can be predicted and the shortage of on-farm storage facilities can be identified, then is would be possible to identify a probable requirement for additional storage--based on different market prices. This points out the need to include the market price in the analysis. The obvious problem is what price would the researcher use in the regression. The different variables used in this analysis are all annual figures. The grain market price changes hourly.

One possible approach is to use a monthly average and use the monthly equipment sales figures. The CCC interest rates are available for each month and could be included in the analysis. In addition, monthly rainfall or other weather factors could be obtained and included.

This researcher feels that the market price of grain is very important as a factor affecting the equipment sales. If the market price is high enough at harvest time, then there is no need for the farmer to store his grain. However, this very rarely happens--if for no other reason than supply and demand.

The complexity of the issue seems to grow when each new variable is introduced. Limitations of the effect of the variables on each other. For example, a low market price is predicted during the harvest season, a large surplus exists, and the interest rates are high. A large government program to reduce the number of acres planted is planned. The sales territory experiences a drought and the crop is reduced further. These factors tend to drive the market price up, but the farmer still has no requirement for storage--he does not have a crop. The ideal situation for the company is a low market price, a bumper crop, a huge surplus, and the absence of a government farm program.

APPENDICES

APPENDIX A

COMPANY SALES DATA

	1976	1977	1978	1979	1980
JAN	100,236	28,167	137,331	192,593	129,579
FEB	19,435	76,171	211,097	284,266	277,264
MAR	217,698	125,216	731,249	754,628	717,763
APR	118,953	180,660	609,191	800,718	931,003
MAY	104,096	341,282	510,237	947,383	772,889
JUN	95,023	275,552	604,527	580,188	700,658
JUL	131,586	177,729	501,066	636,891	550,637
AUG	197,929	874,627	1,554,501	1,104,299	1,035,568
SEP	379,482	801,924	1,680,548	1,596,700	1,671,562
OCT	266,506	625,065	1,370,842	1,158,973	894,366
NOV	66,203	200,994	218,741	509,740	146,398
DEC	19,544	44,206	199,777	78,777	246,869

	1981	1982	1983
JAN	235,313	66,327	127,438
FEB	182,082	132,625	58,585
MAR	302,596	388,994	167,436
APR	378,692	557,773	282,842
MAY	335,497	635,383	253,843
JUN	449,925	684,544	234,293
JUL	561,027	1,062,541	233,719
AUG	1,153,648	2,273,811	
SEP	1,894,930	2,981,195	
OCT	1,450,496	2,521,540	
NOV	484,310	769,549	
DEC	180,932	125,191	

* Company fiscal year - Dec Year One to Nov Year Two

APPENDIX B

IOWA EQUIPMENT SALES

YEARS	SALES	PERCENT TOTAL SALES
1976	1,583,812	78%
1977	2,882,982	75%
1978	5,830,211	68%
1979	6,398,410	69%
1980	5,900,457	70%
1981	5,266,729	87%
1982	9,307,155	72%
1983	NOT AVAILABLE	

SOURCE: COMPANY RECORDS

APPENDIX C

IOWA CORN ACREAGE

YEARS	PLANTED	HARVESTED
1976	13,950,000	12,900,000
1977	13,800,000	12,700,000
1978	13,600,000	12,850,000
1979	13,750,000	13,150,000
1980	14,000,000	13,300,000
1981	14,400,000	13,850,000
1982	13,700,000	13,150,000
1983	9,100,000	8,600,000*

*INDICATED

SOURCE: CROP REPORTING BOARD, SRS, USDA

APPENDIX D

COMMODITY CREDIT CORPORATION
INTEREST RATES CHARGED TO FINANCE
FARM STORAGE AND DRYING EQUIPMENT LOANS

YEARS	INTEREST RATES
1976	7.50 %
1977	7.00 %
1978	7.00 %
1979	10.50 % *
1980	12.75 % *
1981	14.50 %
1982	11.50 % *
1983	9.00 % *

* WEIGHTED AVERAGE

STATISTICAL ANALYSIS

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?
Y

     DATA ID ..... TEST
     NO. OF ROWS ..  7
     NO. OF COL. ..  3
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ROW	IOWA SALES MILLIONS	ACRES MILLIONS	INTEREST RATES %
1976			
1	1.584	12.900	7.500
1977			
2	2.883	12.700	7.000
1978			
3	5.830	12.850	7.000
1979			
4	6.398	13.100	10.500
1980			
5	5.900	13.300	12.750
1981			
6	5.267	13.850	14.500
1982			
7	9.307	13.150	11.500

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What procedure do you want to run?
MULTR
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