Trade Credit and Receivables Management in the Oklahoma Fertilizer Industry

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Introduction

Most farm supply dealers offer various services to farm firms in conjunction with the sale of their products. One such service offered is dealer financing. When the dealer finances a customer, he exchanges merchandise or services for the promise to pay at a future date rather than for cash on the date of purchase. Thus, the dealer becomes a source of working capital for the farmer.

Farmers obtain a substantial amount of operating capital from merchants and dealers. A study based on data from the 1960 Sample Survey of United States Agriculture indicated that nearly 60 percent of the farm operators having unpaid non-real estate debt obtained some portion of their production loans from merchants or dealers [18, p. 15]. Ninety-five percent of the farmers using credit in three counties of Montana used dealer financing [10, p. 31]. A North Dakota study indicated that dealers in that state furnished 41 percent of the farmer's external financing compared to 36 percent and 21 percent for banks and production credit associations, respectively [24, p. 18].

Why Farmers Use Dealer Credit

Farmers finance their input purchases either internally from cash receipts or externally with the use of credit. From 1950 to 1970 gross farm income has risen 72 percent. However, production expenditures increased 110 percent during this same period [26, pp. 45, 56]. This increase in production expenditures relative to gross farm income combined with a continued seasonality in the timing of cash receipts has made it necessary for farmers to obtain additional external financing. Several factors

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may induce farmers to obtain a large proportion of the external short-term financing from input dealers.

First, input dealers often provide a convenient source of borrowed capital for farmers. Their loan is in the form of inputs rather than cash. Thus, the farmer may avoid contacting both the banker and the dealer when purchasing production inputs. The dealer may also be a cheaper source than institutional lenders for production input financing. The farmer usually incurs a cash cost in the form of interest when he borrows from institutional lenders. If an input dealer offers financing, but provides no cash discount for an early payment nor charges a fee, the farmer pays no explicit interest cost when he purchases merchandise with dealer credit. Thus, unless the price of the input includes a hidden price to cover credit costs, dealer financing is cheaper than financing from institutional lenders. However, the dealer may be an expensive source of debt capital for the farmer if he imposes a high finance charge.

Dealers may offer more lenient payment terms or collection policies to farmers than other lenders. This factor was listed by Montana farmers as one of the important reasons for using dealer financing [10, p. 5]. A longer period of time to pay for goods increases the interest savings for the farmer. Thus, if a farmer knows the dealer will not ask for the payment for production inputs until the time when cash receipts are obtained, he is induced to use trade credit rather than financing from other sources.

Finally, the financing obtained from dealers may be an additional source of leverage for farm firms. Leverage (increasing the proportion of debt relative to equity) is valuable because it can enhance the rate of firm growth. The farmer may gain access to a larger amount of debt capital by using a combination of both trade and cash credit to finance production. However, the use of more credit to increase leverage does make the firm more vulnerable by reducing the amount of unused credit held in reserve [2, pp. 1055-1059].

Why Input Dealers Offer Financing

The primary reason input dealers offer financing to farmers is for sales promotion [16, p. 74]. The pressure of competition requires the dealers to promote his products. Financing provides the dealer with one method of differentiating his inputs from the same type of input sold by competitors [25, p. 15]. A more lenient credit policy may increase a dealer's sales quantity in a similar manner as a lower price, without the retaliation from competitors that is prevalent when prices are reduced. Financing may also make possible reduced expenditures for advertising, sales promotion and other services.

Many manufacturers of farm inputs are induced to promote their sales because a large proportion of total costs are incurred as fixed costs [25, p. 15]. If the manufacturer gives a retail dealer time to pay for purchases, the total sales quantity of the input will likely be enhanced. The manufacturer's fixed costs are spread over a larger volume of sales, thus, reducing his average fixed costs and increasing the profit margin per unit on all units sold. If the retail dealer does not have to pay for the financing he obtains from the manufacturer, he is more likely to accept the farmers' credit in exchange for inputs.

Dealer financing can also be used to reduce the seasonality in the timing of input sales. By offering a credit arrangement to induce the farmer to purchase inputs in advance of the time of use rather than during the peak business season, the dealer can more efficiently use hired labor and inventory facilities. Dealers may also accept credit from their customers because they expect to receive additional revenue from the finance charges paid by the buyer.

The Problem: Receivables Cost and Management

Problem Statement

It is evident that dealers finance a significant proportion of their sales. If the returns from financing are greater than the credit costs, the dealer will gain from financing his customers' purchases. However, many input dealers do not know how much financing increases their sales quantity, nor if the returns generated by increased sales are greater than the costs of providing financing [13, p. 153; 3, p. 11]. In addition, most dealers do not know the impact that alternative credit arrangements have upon credit costs in general and receivables investment costs in particular.

Although credit problems are faced by all farm input dealers who finance their sales, increasing concern with trade credit practices and the cost of investing funds in receivables has been expressed by fertilizer industry leaders. The conditions which have induced fertilizer suppliers and dealers to finance an increasing proportion of sales are: (1) excess manufacturing plant capacity, (2) excess inventories, (3) a seasonal demand for fertilizer and (4) competition among dealers for sales [6, p. 22]. Most fertilizer dealers have not calculated the cost of expanding the use of financing or offering more lenient credit terms [6, p. 23]. A study in 1967 suggested that the cost to the fertilizer industry for financing sales interest free was $160 million. This cost was calculated using the average length of repayment at the retail level and assumed a six percent interest rate. The cost did not include collection costs or bad debt losses [8, p. 17].

Objectives

The major objective of this study is to provide input supply firms, particularly fertilizer dealers, with information concerning the cost of alternative financing arrangements which can be used to make receivables management decisions. The specific objectives of the study are:

(1) To specify and describe the alternative credit arrangements presently being offered by Oklahoma fertilizer dealers, and to determine the firm characteristics which are associated with their use.

(2) To analyze the impact of selected variables of the credit arrangement upon the proportion of customer purchases financed and the timing of payments on credit sales, and

(3) Utilizing the information developed in objectives (1) and (2), estimate the interest or opportunity cost of investing a dealer's funds in receivables for alternative financing arrangements.

The purpose of this bulletin is to report the results for objectives (2) and (3). An earlier publication by the authors and a thesis describe the alternative credit policies utilized by the Oklahoma fertilizer dealers (objective 1) [21, 22].

Concepts of Receivables Management

When a dealer finances a customer's purchases, his working capital is tied up in a current asset, either accounts or notes receivable. Through its effect on both the buyer's purchase and payment behavior, the dealer's credit policy decisions will influence the amount of the receivables investment and investment cost.

Credit Policy Decisions

Input supply dealers must make a number of decisions with respect to their credit policy. First, a credit instrument must be chosen to provide evidence of a credit transaction. The instrument used most by input dealers is the open book account. With an open account credit arrangement, the value of inputs sold on credit to each buyer is recorded by the dealer and evidenced by sales invoices, delivery receipts or shipping tickets.

A second credit instrument frequently used to finance a customer's purchase of inputs is the promissory note. A promissory note is the buyer's written promise to pay the dealer a definite sum of money at a specified future time [9, p. 600]. The promissory note may be secured or unsecured. With the secured note, the purchased input or some other asset owned by the buyer is pledged as collateral. Inputs such as fertilizer, which are

expended in the production process before a payment is made by the farmer, are usually purchased with an unsecured promissory note. Other capital inputs such as machinery or equipment may have the specific input pledged as collateral in the secured note.[1]

Once a credit instrument has been chosen, the specific values for the credit policy decision variables associated with each instrument must be specified [20, p. 17; 7, p. 273]. If either note or open-account instruments are used, values must be determined for the following decision variables:

Cash Discount Rate — The percentage reduction in the quoted price of the input granted to the buyer if he pays within a specified number of days after the purchase date.

Cash Discount Period — The number of days between the purchase date and the date in which the customer must pay in order to receive a cash discount.

Level of Collection Effort — Efforts and expenditures incurred by the dealer to collect receivables.

Size of the Credit Line — The upper limit on the dollar amount one customer can purchase on credit terms.

Credit Standards — The minimum level of credit risk acceptable or some other criterion used to judge whether or not to sell to a customer on credit terms.

Additional variables which must be specified for account arrangements include:

Account Due Period — The number of days between the purchase date and the date when full payment for the inputs is due.

Finance Charge Rate — The penalty, expressed as a percentage of the input price per unit of time, the customer must pay if the obligation is not paid by a specified date.

Finance Charge Period — The number of days between the purchase date and the date the finance charge is imposed.

Additional variables which apply only to sales financed with a promissory note are defined as:

Note Issue Period — The number of days between the purchase date and the date the note is issued.

Interest Rate — The annual percentage rate charged on notes from the time notes are issued until the end of the note payment period.

Note Payment Period — The number of days between the date notes are issued and the date notes are due.

[1] The conditional sales contract is another formal credit instrument used to finance the purchase of durable, capital inputs. In this case the seller retains the title to the input until the buyer pays. This type of arrangement is rarely used to finance annual operating inputs such as feed, seed, or fertilizer.

Receivables Management

Proper management of receivables requires an understanding of the impact of different credit arrangements on farmer purchase and payment behavior. In general, economic theory suggests that farmers will purchase inputs as long as the marginal value product of an input exceeds the marginal factor cost including the finance charge [1, p. 508]. Once the input is purchased, the input price is not considered in determining when to pay for the purchase. Thus, the farmer will pay for the input when the cost per dollar of credit from the dealer becomes greater than the cost from other sources such as cash reserves or institutional credit. A more detailed discussion of these concepts including the impact of specific credit decision variables on farmer purchase and payment behavior is contained in Appendix A.

The purchase and payment response of farmers to different credit arrangements determines the revenue and costs associated with dealer financing. The revenues attributable to sales financing include the additional sales revenue made possible by providing the credit service and the financial revenue which may be collected from buyers who use this service. The costs that can be specifically associated with the credit function include collection costs, bad debt losses, credit administrative costs, the value of cash discounts paid, and investment costs. A 1958 study of the credit costs for farm supply cooperatives indicated that the interest cost on the investment in accounts receivable assuming a six percent cost of capital rate amounted to 45 percent of the total credit costs [12, p. 19]. Thus, the major cost associated with dealer financing is the interest or opportunity cost on the funds invested in receivables.

A credit policy decision may affect a number of cost and revenue components simultaneously. For example, a decision to offer a cash discount may reduce the length of time funds are invested in receivables and thus reduce the receivables investment cost. However, another cost, the value of cash discounts paid, will probably increase. Similarly, an increase in the finance charge rate may reduce the receivables investment cost, but it may increase the financial revenue received from finance charges. In this study, the impact of credit policy decisions on the cost of investing funds in accounts and notes receivable will be analyzed. Other credit costs and revenues will not be evaluated.

Receivables Investment Cost

The receivables investment cost per dollar of total sales (cash and credit) depends upon the dealer's cost of capital rate and the average annual investment in receivables (accounts and notes) per dollar of sales.

The annual investment in accounts receivable is a function of two credit performance variables, the proportion of total sales financed with accounts and the average number of days a dollar is invested in accounts receivable as measured by the average collection period.[2] Likewise, the notes receivable investment depends upon the proportion of sales on notes and the note collection period. Thus, the receivables investment cost per dollar of total sales can be estimated by equation (1).

$$(1) \quad I = \Phi \left[\frac{X_a M_a}{365} + \frac{X_n M_n}{365} \right]$$

where:

I = the receivables investment cost per dollar of total sales,

Φ = the annual cost of capital rate expressed as a decimal,

X_a = the proportion of total annual sales financed with accounts,

M_a = the average number of days a dollar is invested in accounts receivable or the account collection period,

X_n = the proportion of total annual sales financed with notes,

M_n = the average number of days a dollar is invested in notes receivable or the note collection period, and

$X_a + X_n$ = proportion of total sales financed or one minus the proportion of sales for cash.

The average length of time a dollar is invested in accounts receivable or the average collection period on account sales can be computed from the distribution of payments for account sales by the age of the account at the time of collection [5, p. 116]. Thus,

$$(2) \quad M_a = \sum_{j=1}^{n} P_j \lambda_j + b\theta$$

where:

M_a = average collection period on account sales (days),

P_j = proportion of account sales paid in the jth payment interval, $j = 1, 2 \ldots . n$,

λ_j = approximate age (expressed in days) of an account paid in the jth payment interval,

[2] It should be emphasized that the proportion of total sales sold or financed with accounts is measured at the time of sale. Percent on account or note as used in this study *does not* refer to the value of account or note receivables on the balance sheet at any specific point in time. Instead it measures the proportion of total sales that are *sold* on an account or note arrangement rather than for cash.

b = proportion of account sales not paid after n payment intervals have elapsed,[3]

θ = number of days from purchase date to the end of the n payment intervals, and

$$\sum_{j=1}^{n} P_j + b = 1.$$

Assuming that the farmer pays for purchases made with a promissory note at the end of the note payment period, the average number of days a dollar is invested in notes receivable is equal to the note payment period specified on the note. Thus,

(3) $M_n = K$

where:

M_n = average collection period on note sales (days) and

K = note payment period (days).

The credit performance variables (X_a, M_a, X_n and M_n) used in the calculation of the receivables investment cost are hypothesized to be a function of the type of credit instrument used and the values of the credit policy decision variables. To calculate the cost of investing funds in receivables, the specific functional relationships between credit policy and performance must be estimated.

Credit Policies and Credit Performance

Data and Procedure

To obtain data to estimate the impact of the credit policy variables upon the credit performance measures, a questionnaire was mailed to each input dealer in Oklahoma who sells dry bulk or liquid mix fertilizer to farmers. The questionnaire was mailed to 295 dealers during March, 1971. A copy of the questionnaire is attached in Appendix B. With the exception of the manufacturer-owned retail outlets, dealers with branch offices were sent only one questionnaire. Each retail outlet owned by a fertilizer manufacturer was mailed a questionnaire.

Usable questionnaires were returned by 101 (34 percent) of the 295 dealers. All firms did not answer each part of the questionnaire. Questions relating to credit policy or arrangements were answered by 100 firms. Ninety-four dealers answered questions relating to both credit arrangements and credit performance. The 101 dealers are located in 41 of the 77 counties in Oklahoma. Fifty-eight of the 101 sample dealers are

[3] It is assumed that the proportion of account sales not paid after n payment intervals have elapsed (b) are written off as bad debts in θ days. Since these sales are invested in receivables for θ days, they are included when calculating the average collection period.

located in the 17 Oklahoma counties with over 12,000 tons of fertilizer sales [19, p. 11]. Only one county with fertilizer sales of over 12,000 tons is not represented among the sample firms.

There were 48 cooperatives, 43 independent dealers and 10 company stores that responded to the questionnaire.[4] The average annual dollar volume of fertilizer sales per firm was approximately $159,956. The annual fertilizer sales for the dealers who offer financing (89 dealers) range from $15,000 to $486,000 and average $170,251.[5]

Using the data obtained from the mailed survey and multiple linear regression, credit performance models are estimated for (1) the average collection period on account sales, (2) the percent of sales on accounts, (3) the percent of sales on notes, and (4) the percent of sales for cash.

The independent variables included in the regression equations are either credit policy variables which can be controlled by the dealer or firm characteristics which can be measured.[6] No explanatory variables concerning the buyer's behavior or environment were observed. Three criteria were used in evaluating the regression equations: (1) Do the signs of the estimated regression coefficients tend to support or reject the hypothesized effect; (2) is the magnitude of the regression coefficient large enough relative to its standard error to support the hypothesis that the regression coefficients are significantly different from zero[7]; and (3) do the R^2, the overall F-test value, the standard error of the estimate and an examination of the residuals indicate that the model can be used for accurate prediction.

A number of other explanatory variables such as credit standards, collection practices, the financial characteristics of the buyers and the cost and availability of other sources of financing would be expected to influence the credit performance measures used as dependent variables in the statistical analysis. Because data on these variables were not available, they were not included in the regression equations. Thus, one would not expect the R^2's to be particularly high. However, the primary purpose of this analysis is to determine the specific impact of credit decision variables on credit performance. This objective can be satisfied by evaluating the signs and significance levels of those credit policy variables used as explanatory variables in the regression analysis.

[4] Company stores included both manufacturer owned retail outlets and lease-agent operations.

[5] For a more complete discussion of the physical and sales characteristics of the sample dealers, see [21].

[6] The mean, standard deviations and ranges for the observed values of dependent variables (credit performance measures) and the independent variables (credit policy variables and firm characteristics) are shown in Appendix C. For a more complete discussion of the alternative credit policies offered by the dealers, see [21, 22].

[7] Only independent variables with regression coefficients significant at the .20 level of probability or less were included in each of the selected models.

Average Collection Period

The impact of the credit policy variables upon the average collection period on account sales (M_a) is estimated using data from 87 dealers who offer account financing. The regression equation for the average collection period is[8]:

$$(4)\quad \hat{M}_a = \underset{(19.0311)^a}{65.0639} + \underset{(.1219)^a}{.7230X_1} - \underset{(28.8120)^b}{58.9239X_4} - \underset{(14.4090)^b}{28.4612X_7} + \underset{(35.0600)^b}{78.4168X_8} - \underset{(13.2436)^d}{20.7516X_9}$$

a if $\alpha \leq .01$
b if $.01 < \alpha \leq .05$
c if $.05 < \alpha \leq .10$
d if $.10 < \alpha \leq .15$

where:

$\hat{M}_a$ = estimated average collection period on accounts receivable (days),[9]

X_1 = *finance charge period* if a finance charge is imposed on late payments, *account due period* otherwise (days),[10]

X_4 = *finance charge rate per month* imposed on *accounts not* paid by the finance charge period (percent),

X_7 = 1 if *cash discount* is offered, 0 otherwise,

X_8 = 1 if *finance charge* is imposed on past due accounts, 0 otherwise, and

X_9 = 1 if dealer uses *note financing*, 0 otherwise.

The selected model has an R^2 of .3726 with an overall F-test value significant at the .0001 probability level. The R^2 value indicates that the credit policy decision variables in the equation explain 37.26 percent of the variation in the dealers' average collection periods. All of the independent variables except X_9 are significantly different from zero at the .01 or .05 probability level. The note financing dummy variable (X_9) is significant at the .12 level. The standard error of the estimate [square root of the residual mean square, (s)] is 58.34. The standard error of the

[8] The standard errors are given in parentheses and the significance levels (α) of the coefficients are denoted by:

[9] The procedure used in calculating the observed average collection period and an example are shown in Appendix D.

[10] In the discussion, the X_1 variable is referred to as the account due period. For definitions of credit policy variables, see the previous section on credit policy decision variables.

estimate (s) expressed as a percentage of the mean response $\overline{M}_a$ (121.05 days) is 48.2 percent.

Based on the partial F-test values and standardized partial regression coefficients [17, p. 396], the account due period (X_1) is the most important credit policy variable explaining variation in the average collection period on accounts receivable. The partial regression coefficient (.7230) indicates that on the average a 10 day increase in the specified account due period would increase the average collection period by 7.230 days given that the other independent variables in the equation are held constant. The positive sign and the magnitude of the coefficient support the hypothesis that the buyer of fertilizer will pay at a later date given a longer interest free period to make the payment.

Since there are dummy variables in the equation (X_7, X_8, and X_9), the constant term (65.0639) is the estimated intercept assuming the dealer does not offer a cash discount, impose a finance charge, or offer note financing. The coefficients for the dummy variables X_7, X_8, X_9 are the deviations from the overall intercept when the dealer offers a cash discount, imposes a finance charge or offers note financing, respectively. The coefficient for the cash discount dummy variable (X_7) indicates that offering a cash discount for early payments decreases the average collection period by 28.4612 days. Offering a cash discount for early payments may be equivalent to imposing a penalty for late payments. Thus, one would expect the average collection period to be shorter for dealers offering cash discounts.

The coefficient for the note dummy variable (X_9) indicates that dealers who offer note financing in addition to account financing have average collection periods 20.7516 days shorter than dealers offering only account financing. Dealers frequently issue interest bearing notes to customers who have past-due accounts. Thus, the note may substitute for a finance charge in encouraging farmers to pay at the end of the account due period.

The coefficient for the finance charge dummy variable (X_8) indicates that dealers who impose a finance charge on accounts not paid by the end of the finance charge period have 78.4168 days longer collection periods than dealers who do not impose a finance charge. However, the coefficient for the *finance charge rate* (X_4) indicates that for the dealers who have a finance charge, each .5 percent increase in the finance charge rate decreases the average collection period by 29.4620 days (58.9239 X .5).

The finance charge rate (X_4) coefficient conforms to the hypothesized relationship. However, the coefficient for the finance charge dummy variable (X_8) needs further elaboration. Theoretically, a farmer will be

encouraged to pay his accounts when a finance charge is imposed if the rate is greater than the farmer's cost of capital from other sources. Based on equation (4), a dealer would need a finance charge rate greater than or equal to 1⅓ percent per month (78.4168/58.9239) in order to have an average collection period less than or equal to the collection period for a dealer not imposing a finance charge.[11]

These finance charge coefficients indicate that the farmer would be willing to pay the dealer an equivalent annual interest rate of approximately 16 percent (1⅓ X 12) rather than borrow from other sources. This high interest rate or opportunity cost suggests that the finance charge coefficients may be biased. Two possible explanations for this bias can be advanced. First, the data suggests that some dealers may *not* be enforcing the finance charge specified in their credit arrangement. Of the 61 dealers imposing a finance charge, 15 indicated that it is imposed before the end of the account due period. For example, one dealer indicated that accounts are due at the time of crop harvest (180 days) but a finance charge is imposed 30 days after the purchase date. If the finance charge is imposed at an early date but an interest payment is not required unless the account remains unpaid beyond the longer account due period, then the finance charge may not be effective in reducing the dealer's average collection period. Another possible explanation for this bias is that some dealers who do not have a finance charge may use strict collection practices or other procedures which were not included in the analysis to encourage farmers to pay on time. For example, a dealer may not sell more fertilizer to a farmer who has not paid a previous account.

An alternative regression model was estimated that included the cash discount rate variable in place of the cash discount dummy variable. The coefficient for the cash discount rate in this alternative model indicates that a one percent higher cash discount rate decreases the average collection period by 8.9468 days. However, this coefficient is significant at the .15 probability level compared to a significant level of .05 for the cash discount dummy variable. Also, the R^2 value is smaller and the standard error of the estimate (s) is larger for the equation which includes the cash discount rate rather than the cash discount dummy variable.

Other credit policy variables such as the cash discount period, the interest rate charged on notes, and the note payment period were deleted from the selected collection period equation because their coefficients were not significantly different from zero at the .20 probability

[11] Approximately 28 percent of the sample dealers with finance charges have finance charge rates grater than 1⅓ percent.

level. None of the independent variables which represent dealer characteristics were significant in the selected collection period equation.[12]

A plot of the residuals (M_a-$\hat{M}_a$) against the predicted values ($\hat{M}_a$) indicates that the error term assumptions do not appear to be invalidated [14, pp. 106-108]. However, a plot of the residuals (M_a-$\hat{M}_a$) against the observed values (M_a) indicates that the smaller observed values for average collection periods are over-predicted and the larger observed values are under-predicted. All residuals for observed collection periods less than 70 days are negative and all but one of the residuals for observed collection periods greater than 155 days are positive. Since the characteristics of the residual plot for this regression equation are also exhibited by a number of the other regression equations, the implications with respect to equation specification, statistical significance and prediction will be discussed later.

Using the estimated empirical relationship between the credit decision variables and the average collection period, the predicted average collection period can be calculated for alternative account credit policies.[13] The account credit policies are classified according to whether or not a finance charge is imposed. Since the finance charge dummy variable coefficient is inconsistent with theory, caution should be used in comparing results between policies that impose a finance charge and those that do not include a finance charge.

Table 1 shows the average collection periods predicted with the selected model for specified account policies that do not include a finance charge (assuming note financing is not available). The estimated average collection period for dealers with 30-day account due periods and

[12] One alternative model did include a dummy variable for cooperatives that was significant at the .01 probability level. However, because of multi-collinearity, its inclusion reduced the significance of several credit policy variables. Since casual forces for the length of the collection period would appear to be the type of credit arrangement offered by a cooperative rather than the cooperative structure per se, the cooperative dummy variable was eliminated from the model.

[13] The values of the credit policy variables used in all predictions of credit performance variables are within the range of the survey data.

Table 1. Estimated Average Collection Period on Accounts Receivable for Selected Account Policies (No Finance Charge)

Account Due Period	No Cash Discount	Cash Discount Offered
	(average collection period in days)	
30 day period	86.75	58.29
60 day period	108.44	79.98
90 day period	130.13	101.67
180 day period	195.20	166.74

not offering a cash discount is 86.75 days. If the dealer were to offer a 180-day account due period,[14] the estimated average collection period is longer (195.2 days). However, for a dealer who offers a cash discount, the estimated average collection period is shorter for all account due periods, compared to the policy when no cash discount is offered.

Table 2 summarizes the effect of alternative finance charge rates upon the estimated average collection period for dealers who impose finance charges. For example, a dealer having a 30-day account due period, no cash discount, and a .5 percent finance charge per month has an estimated average collection period of 135.71 days. However, if the dealer charges 1.0 percent per month, the estimated average collection period decreases to 106.25 days. For the account due period policies shown, only if a dealer imposes a 1.5 percent per month finance charge rate is the estimated average collection period shorter than the estimated collection period for a dealer not imposing a finance charge (See Table 1). The shortest average collection period shown for the account policies is 48.32 days which results from a 30-day account due period combined with a cash discount and a 1.5 percent finance charge rate. The longest (244.16 days) results from a 180-day (crop harvest) account due period, no cash discount and a .5 percent per month (6 percent per year) finance charge rate.

As indicated by equation (4), the average collection period on accounts receivable is 20.75 days shorter for each account policy when note financing is available compared to when note financing is not available. Predicted collection periods for account policies when note financing is available are summarized in Tables III and IV of Appendix E.

Percent Account Model

The selected regression model for the percent of fertilizer sales on account (X_a) is estimated from data for the 89 dealers who offer sales financing. The estimated function is[15]:

[14] To facilitate the empirical analysis, a crop harvest account due period is assumed to be 180 days. This assumption is based on the length of time between fertilizer application and crop harvest for major crops grown in Oklahoma.

[15] The standard errors of the regression coefficients are given in parentheses and the significance levels (α) of the coefficients are denoted by:

a if $\alpha \leq .01$
b if $.01 < \alpha \leq .05$
c if $.05 < \alpha \leq .10$
d if $.10 < \alpha \leq .15$
e if $.15 < \alpha \leq .20$

Table 2. Estimated Average Collection Period on Accounts Receivable for Account Policies (With Finance Charge)

Finance Charge Period and Rate	No Cash Discount	Cash Discount Offered
	(average collection period in days)	
30 day period		
.5%	135.71	107.25
1.0%	106.25	77.79
1.5%	76.78	48.32
60 day period		
.5%	157.40	128.94
1.0%	127.94	99.48
1.5%	98.47	70.01
90 day period		
.5%	179.09	150.63
1.0%	149.63	121.17
1.5%	120.16	91.70
180 day period		
.5%	244.16	215.70
1.0%	214.70	186.24
1.5%	185.23	156.77

$$(5)\quad \hat{X}_a = \underset{(6.0616)^a}{56.7375} + \underset{(.0454)^e}{.0637X_1} + \underset{(.2913)^c}{.5046X_3} \underset{(8.5657)^c}{-15.9373X_7} - \underset{(5.4616)^a}{16.1158X_9} + \underset{(.0234)^b}{.0601X_{12}}$$

where:

$\hat{X}_a$ = the estimated percent of fertilizer sales financed with accounts,

X_1 = *finance charge period* if a finance charge is imposed on late payments, *account due period* otherwise (days),

X_3 = *cash discount period* (days),

X_7 = 1 if cash discount is offered, 0 otherwise,

X_9 = 1 if dealer uses note financing, 0 otherwise,

X_{10} = annual fertilizer sales (1,000 dollars).

The model has an R^2 value of .2205 and the F-test value is significant at the .001 probability level. The standard error of the estimate is 23.86. The standard error (s) is 36.7 percent of the mean percent of sales on accounts.

The signs of the coefficients for all of the credit decision variables included in the equation conform to the hypothesized relationships. The variable most highly correlated with percent of fertilizer sales on account is the note dummy variable (X_9) ($r_{X_a X_9} = .31$). Its partial regression coefficient (significant at the .001 probability level) indicates that dealers who offer note financing in addition to account financing have 16.1158 percent fewer sales on accounts.

The coefficient for the dealer's account due period (X_1) is not highly significant (.16 probability level), but its sign substantiates the hypothesis that dealers with longer account due periods have a larger percent of their sales on accounts. The coefficient (.0637) signifies that a 10 day longer account due period increases the percent of fertilizer sales on account by .637 percent. Thus, given a longer length of time to pay, more farmers may accept the dealer's account financing terms.

The coefficient for the cash discount dummy variable (X_7) is significant at the .08 probability level. Dealers offering cash discounts for early payments have an estimated 15.9372 percent fewer sales on account. Thus, offering a cash discount encourages more farmers to pay the dealer in cash. However, as evidenced by the coefficient for the cash discount period variable (X_3), the longer the length of time the customer can wait to pay and still be eligible to receive the cash discount, the higher the proportion of sales financed or the percent on account.[16] The coefficient is significant at the .06 level and indicates that a one-day increase in the cash discount period increases the percent of sales on account by .5046 percent. Thus, on the average, if a dealer offers a cash discount and the cash discount period is 32 days (15.9372/.5046) or longer, the negative effect of the cash discount dummy variable on the percent of sales on account is offset by the positive effect of the longer account due period.

The partial regression coefficient for the dealer's annual fertilizer sales (significant at the .011 probability level) indicates that each $1,000 increase in fertilizer sales increases the percent on account by .0601 percent. Thus, the larger fertilizer dealers tend to have a larger percent of their sales on account.

Several other models which included different independent variables were estimated for the percent of sales on account. The coefficients for the finance charge variables were not significantly different from zero (probability level was greater than .40) when the variables were added

[16] It should be remembered that the proportion of sales financed or the percent on account includes all sales that are not paid in cash on the purchase date. If the cash discount period extends beyond the purchase date, the dealer must finance the farmer for some period of time even if he pays within the discount period. Thus, purchases paid for after the purchase date (even if within the cash discount period) are actually account rather than cash sales and result in an increase in the receivables investment cost.

to the selected model. The coefficients for the dummy variables representing the type of firm (cooperatives and independent dealers) were also not significant at the .40 probability level. Also, if the cash discount rate variable is substituted for the cash discount dummy variable in the model, the rate variable is less significant in explaining the variation in the percent of sales on accounts. A plot of the residuals (X_a-$\hat{X}_a$) against the observed percent on account (X_a) for each dealer shows a positive linear trend. Thus, the smaller percents on account appear to be over predicted and the larger percents on accounts under predicted.

Table 3 summarizes the predicted percent of fertilizer sales sold on accounts for selected account policies assuming the dealer does not offer note financing and has annual fertilizer sales of $170,000. If the dealer does not offer a cash discount, the percent of sales on accounts is 68.87 percent for a 30-day account due period compared to 78.42 percent for a 180-day account due period. With a 90-day account due period, the percent of sales on account is 56.75 percent if a cash discount is offered for payments on the purchase date compared to 71.89 percent if the cash discount is offered for payments in 30 days.

Table V in Appendix E summarizes the estimated percent of fertilizer sales on accounts when the dealer offers note financing in addition to account financing. The estimated percent of sales on accounts is 16.12 percent smaller for each of the account policies when note financing is available in addition to account financing. However, part of the dealer's sales are financed with notes when note financing is offered.

Percent Note Model

The regression model for the percent of fertilizer sales on notes (X_n) is estimated with two independent variables utilizing data from 32 dealers that offer note financing. All but two of these dealers also offer

Table 3. Estimated Percent of Fertilizer Sales on Accounts for Selected Account Policies (For $170,000 Fertilizer Sales)

Finance Charge Period or Account Due Period	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Percent of Fertilizer Sales on Account)				
30 day period	68.87	52.93	57.97	63.02	68.07
60 day period	70.78	54.84	59.89	64.93	69.98
90 day period	72.69	56.75	61.80	66.84	71.89
180 day period	78.42	62.48	67.53	72.58	77.62

account financing. The estimated function is[17]:

$$(6)\quad \hat{X}_n = \underset{(13.5422)^c}{26.0509} - \underset{(1.050)^a}{3.2426X_5} + \underset{(1.7562)^b}{3.9717X_6}$$

where:

$\hat{X}_n$ = the estimated percent of fertilizer sales financed with notes,

X_5 = *annual interest rate* charged on notes (percent),

X_6 = *note payment period* or average collection period on notes (months).

The model has an R^2 value of .3129 and an F-value of 6.604 which is significant at the .005 probability level. The standard error of the estimate is 18.03. The standard error of the estimate expressed as a percentage of the mean percent of sales on notes is 76.8 percent.

The intercept coefficient indicates that dealers who offer note financing have 26.050 percent of their fertilizer sales on notes given that the note payment period (X_6) and the annual interest rate (X_5) are fixed at zero. The magnitude of the intercept constant is consistent with the average percent of sales on notes calculated for those sample dealers who offer note financing.

Based on the partial F-test values and the standardized regression coefficients, the annual interest rate variable (X_5) is the most important independent variable in the percent note model. Consistent with theoretical expectations, a one percent higher interest rate results in an estimated 3.2426 percent decrease in the percent of sales on notes. The coefficient for the note payment period (X_6) is also consistent with theoretical expectations.[18] A one month longer average note payment period increases the percent of sales financed with notes by 3.9717 percent.

Other models which included additional credit policy variables and variables representing firm characteristics were estimated for the percent of sales on notes. Given that the interest rate (X_5) and the note payment period (X_6) variables are in the estimated equations, the coefficients for

[17] The standard errors of the coefficients are given in parentheses and the significance levels (α) of the coefficients are denoted by:

a if $\alpha \leq .01$
b if $.01 < \alpha \leq .05$
c if $.05 < \alpha \leq .10$

[18] If the interest rate on the note is less than the farmer's cost of capital rate from other sources, he will use the note financing arrangement. Thus, a longer note payment period would increase the period of time that the cost savings can be obtained. For a more detailed discussion of the impact of note policy variables on farmer payment behavior, see Appendix A.

these other independent variables are not significant at the .20 probability level.

A plot of the residuals ($X_n - \hat{X}_n$) against the predicted percent on notes ($\hat{X}_n$) suggests that some abnormality may be present. The magnitudes of the residuals appear to increase at higher predicted values. The residual plot suggests that the assumption that the error terms have a constant variance independent of the values of X_5 and X_6 may be violated [11, p. 90]. Thus, the estimated partial regression coefficients may be unbiased but do not have the least variance [14, pp. 208-209]. The Durbin Watson d statistic indicates that the errors are random and are not significantly serially correlated. An examination of the residuals ($X_n - \hat{X}_n$) plotted against the observed values for percent on notes (X_n) indicates that all observed values greater than 50 percent are under predicted.

Using the selected regression equation (equation 6), the percent of fertilizer sales financed with notes are estimated for alternative note payment periods and note interest rate charges. A summary of these estimates is shown in Table 4. If the note payment period is six months and the note interest rate is eight percent, the estimated percent of sales on notes is 23.94 percent. The percent of sales on notes for interest rates less than eight percent and note payment periods greater than six months is greater than 24 percent. For interest rates greater than eight percent and note payment periods less than six months, the percent of sales on notes is less than 24 percent.

Percent Cash Model

The regression model for the percent of fertilizer sales sold for cash on the purchase date (Y_c) is estimated with data from the 89 dealers that sell on credit. The estimated function is[19]:

$$
\begin{aligned}
(7)\quad \hat{Y}_c = {} & 41.4608 && - && .0543X_1 && - && .5354X_3 \\
& (5.4868)^a && && (.0411)^e && && (.2637)^b \\
& +16.6152X_7 && - && 8.918X_9 && - && .0581X_{10} \\
& (7.7536)^b && && (4.9437)^c && && (.0212)^a
\end{aligned}
$$

[19] The standard errors of the regression coefficients are in parentheses and the significance levels (α) are denoted by:

a if $\alpha \leq .01$
b if $.01 < \alpha \leq .05$
c if $.05 < \alpha \leq .10$
d if $.10 < \alpha \leq .15$
e if $.15 < \alpha \leq .20$

Table 4. Estimated Percent of Fertilizer Sales on Notes for Note Policies

Note Payment Period	Annual Interest Rate Charged (Percent)				
	0	6	8	10	12
	(Percent of Fertilizer Sales on Notes)				
4 months	41.94	22.48	16.00	9.51	3.03
6 months	49.88	30.42	23.94	17.46	10.96
8 months	57.82	38.37	31.88	25.40	18.91

where:

$\hat{Y}_c$ = estimated percent of fertilizer sales sold for cash on the purchase date.

X_1 = *finance charge period* if a finance charge is imposed on late payments, *account due period* otherwise (days),

X_3 = *cash discount period* (days),

X_7 = 1 if cash discount is offered, 0 otherwise,

X_9 = 1 if the dealer uses note financing, 0 otherwise,

X_{10} = annual fertilizer sales (1,000 dollars).

The model has an R^2 value of .1800 and the overall F-value is significant at the .005 level. The standard error of the estimate (s) is 21.59. The standard error of the estimate expressed as a percentage of the mean response is 85.4 percent.

All of the coefficients for the independent variables are consistent with the hypothesized effect. As indicated by the coefficient for the cash discount dummy variable (X_7), dealers that offer a cash discount have an estimated 16.6152 percent larger percent of sales for cash, given that the cash discount period is the purchase date (zero days). However, for each one day increase in the cash discount period (X_3), the percent of sales sold for cash (on the purchase date) decreases by .5354 percent. If the cash discount period is longer than 31 days (16.6152/.5354) beyond the purchase date, the positive effect of offering a cash discount upon percent cash is offset by the negative effect of the longer cash discount period.

If the dealer offers note financing (X_9) in addition to account financing, the percent of sales for cash is decreased by 8.9184 percent. As indicated by the coefficient for the account due period (X_1), a 10 day longer length of time for the buyer to pay his account results in an estimated .543 percent decrease in the percent of sales for cash. The coefficient for the fertilizer sales variable (X_{10}) suggests that larger firms have a smaller

percent of their sales for cash than smaller firms. Each 1,000 dollar increase in fertilizer sales reduces the percent cash by .0581 percent.

A plot of the residuals (Y_c-$\hat{Y}_c$) against the predictions ($\hat{Y}_c$) for percent cash using the selected equation suggests that the distribution of errors does not have a constant variance (heteroscedasticity). Thus, the estimated partial regression coefficients may not have the least variance. The assumption of independent errors does not appear to be violated based on the Durbin-Watson d statistic for the model. A plot of the residuals (Y_c-$\hat{Y}_c$) against the observed percent cash ($\hat{Y}_c$) shows an upward sloping linear trend. The higher observed values for the percent of sales for cash tend to be under predicted and the lower observations under predicted.

Table 5 summarizes the percent of fertilizer sales for cash for dealers that offer only account financing (do not offer note financing), assuming the dealer's annual fertilizer sales is $170,000. The predictions range from 21.81 percent for a 180 day account due period and no cash discount to 46.57 percent for a 30 day account due period with a cash discount offered for payments on the purchase date. Assuming that note financing is not offered, the percent of sales for cash and the percent of sales on accounts should add to approximately 100 percent. As indicated by Tables 3 and 5 the sums of the percent of sales on accounts and for cash range from 98.82 to 100.91 percent.

Table VI in Appendix E summarizes the estimated percent of fertilizer sales for cash assuming note financing is offered (in addition to account financing) and the dealer's annual fertilizer sales is $170,000. As noted in the regression equation, the percent of sales sold for cash is 8.92 percent smaller for each account policy when note financing is offered compared to when note financing is not available. Thus, assuming values for other variables do not change, a larger percent of total sales are financed (accounts and notes) when both account and

Table 5. Estimated Percent of Fertilizer Sales for Cash for Selected Account Policies (For $170,000 Fertilizer Sales)

Finance Charge Period or Account Due Period	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Percent of Fertilizer Sales for Cash)				
30 day period	29.95	46.57	41.22	35.86	30.51
60 day period	28.33	44.94	39.59	34.23	28.88
90 day period	26.70	43.31	37.96	32.60	27.25
180 day period	21.81	38.43	33.07	27.72	22.36

note financing is offered compared to when only account financing is offered.

When note financing is available, the sum of the estimated percent of sales on notes, on accounts, and for cash should be approximately 100 percent. If the note policy is an eight percent interest rate and a six month note payment period, the sum of the estimated percent of sales on accounts, on notes and for cash is approximately 98 percent for all alternative account policies.[20] However, for all other specified note policies, Table VII of Appendix E indicates that the sums range from 76.82 percent to 133.66 percent. A possible explanation for these wide deviations from 100 percent is that none of the account policy variables which were statistically significant in the percent note regression equation were significant in the percent account or percent cash equations. Thus, a predicted increase in the percent of sales on notes due to a change in a note policy variable is not offset by a change in the predicted percent cash or percent on accounts.

Credit Policies and Investment Cost

Using the investment cost equation [equation (1)] and the estimated empirical relationships between the credit policy and credit performance variables, the receivables investment cost per dollar of fertilizer sales can be calculated for (1) those dealers having only open-account credit instruments and (2) those dealers having both open-account and promissory-note instruments. Table 6 summarizes the specific values of the credit policy variables for which the estimated receivables investment costs will be calculated.

[20] Eight percent is approximately the average interest rate charged on notes and six months is the average payment period for the survey firms who offered notes.

Table 6. Specified Values of the Credit Policy Variables Used to Calculate the Receivables Investment Cost

Policy Variables	Unit	Specified Values
Account Variables		
Account Due Period	days	30,60,90,180
Cash Discount Offered		0,1
Cash Discount Period	days	0,10,20,30
Finance Charge Imposed		0,1
Finance Charge Rate	percent/mo.	.5,1.0,1.5
Note Variables		
Interest Rate Charged	percent/yr.	8
Note Payment Period	months	6

Because the dealer's annual fertilizer sales is a significant independent variable in the percent account and percent note regression equations, the investment costs are first calculated assuming the annual fertilizer sales is $170,000. The costs for three representative arrangements are then calculated for sales levels of $60,000 and $280,000.[21]

An eight percent cost of capital rate is used in the initial calculations. The investment costs are also calculated for three representative arrangements with a six and ten percent rate. These rates may represent the interest rate for borrowing funds from a lender, the rate of return on an alternative investment or some weighted combination of the two.

The standard errors of the estimates and the R^2 values for the credit performance equations suggest that the cost estimates for a particular policy may be biased. However, specific credit policy variables were statistically significant in explaining differences in credit performance measures for different policies. Consequently, differences in investment costs between policies can be attributable to these differences in credit policy variables.

Account Policies

If a dealer offers only account financing arrangements, estimates of only the account performance variables of equation (1) [percent on account (X_a) and average collection period (M_a)] are needed to calculate the receivables investment cost. The accounts receivable investment cost per dollar of fertilizer sales are shown in Table 7 for account policies which do not include a finance charge and in Table 8 for those that have a finance charge. As indicated by comparing Tables 1, 2 and 3 with Tables 7 and 8, the credit policies which generate the lowest average

[21] The mean fertilizer sales for the 89 dealers that offer financing is approximately $170,000 and the standard deviation is approximately $110,000.

Table 7. Estimated Accounts Receivable Investment Cost Per Dollar of Fertilizer Sales for Selected Account Policies (No Finance Charge) $170,000 Fertilizer Sales, Eight Percent Cost of Capital Rate

Account Due Period	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Cost in Cents per Dollar of Fertilizer Sales)				
30 day period	1.31	.68	.74	.80	.87
60 day period	1.68	.96	1.05	1.14	1.23
90 day period	2.07	1.26	1.38	1.49	1.60
180 day period	3.36	2.28	2.47	2.65	2.84

collection period and the smallest percent of sales on account produce the smallest accounts receivable investment cost. Assuming an eight percent cost of capital rate and $170,000 fertilizer sales, the dealers not imposing a finance charge (Table 7) have investment costs that range from a low of .68 cents (30-day account due period and a cash discount for payments made on the purchase date) to a high of 3.36 cents (180-day account due period with no cash discount offered) per dollar of fertilizer sales.

For dealers imposing a finance charge (Table 8), the cost per dollar of sales range from .56 cents (30-day account due period, cash discount offered for payments on the purchase date and a 1.5 percent per month finance charge rate) to 4.20 cents (180-day account due period, no cash discount, and a .5 percent finance charge rate per month). Although these costs may appear to be small, a dealer with $170,000 of fertilizer sales and an investment cost of 4.20 cents per dollar of sales would incur interest or opportunity costs on accounts receivable investment equal to approximately $7,140 per year.

The average annual investment in accounts receivable would be approximately $89,250 (7140/.08) for this credit arrangement. In contrast, the least cost credit policy with a .56 cents investment cost per dollar of fertilizer sales would result in an average annual total interest cost of only $952 and an average investment in receivables of $11,900.

Table 8. Estimated Accounts Receivable Investment Cost Per Dollar of Fertilizer Sales for Selected Account Policies (Finance Charge) $170,000 Fertilizer Sales, Eight Percent Cost of Capital Rate

Finance Charge Period and Rate	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Cost in Cents per Dollar of Fertilizer Sales)				
30 day period					
.5%	2.05	1.24	1.36	1.48	1.60
1.0%	1.60	.90	.99	1.07	1.16
1.5%	1.16	.56	.61	.67	.72
60 day period					
.5%	2.44	1.58	1.69	1.84	1.98
1.0%	1.98	1.20	1.31	1.42	1.53
1.5%	1.53	.84	.92	1.00	1.07
90 day period					
.5%	2.85	1.87	2.04	2.21	2.37
1.0%	2.38	1.51	1.64	1.78	1.91
1.5%	1.91	1.14	1.24	1.34	1.44
180 day period					
.5%	4.20	2.95	3.19	3.43	3.67
1.0%	3.69	2.55	2.76	2.96	3.17
1.5%	3.18	2.15	2.32	2.49	2.67

Account-Note Policies

If a dealer finances his sales with open-accounts and promissory notes, he has funds tied up in both accounts and notes receivable. Thus, both the account and note performance variables of equation (1) must be utilized to estimate the receivables (account and note) investment cost. The account and note receivable investment costs are estimatd for alternative account policies assuming the note policy includes a six-month note payment period and an eight percent annual interest rate charge. With this note policy, 23.94 percent of fertilizer sales are on notes and the *notes receivable* investment cost per dollar of total sales is .96 cents.[22] If note financing is offered, the *accounts receivable* investment costs per dollar of sales range from .30 to 2.38 cents when an account finance charge *is not imposed* (See Table IX, Appendix E), and from .22 to 3.05 cents when an account finance charge *is* imposed (See Table X, Appendix E). The *combined (note and account) receivables* investment costs per dollar of sales for alternative account policies and the assumed note policy are summarized in Tables 9 and 10. These calculations assume an eight percent cost of capital rate and $170,000 of annual fertilizer sales.

As shown in Table 9, the combined receivables investment costs for policies without finance charges on accounts range from 1.26 cents (30 day account due period and cash discount for payments on the purchase date) to 3.34 cents (180 day account due period and no cash discount)

[22] The notes receivable investment costs for other note policies are shown in Table VIII of Appendix E. These costs range from .08 cents per dollar of fertilizer sales for a four month note payment period and twelve percent annual interest rate (assuming an eight percent cost of capital rate) to 3.08 cents per dollar of sales for an eight month note payment period and a zero annual interest rate. The combined receivables investment cost is not estimated for other note policies because the percent of sales for cash, on accounts, and notes for these policies deviates considerably from 100 percent (See Appendix Table VII).

Table 9. Estimated Combined Receivable Investment Cost (Notes and Accounts) Per Dollar of Fertilizer Sales for Account-Note Policies (No Finance Charge) $170,000 Fertilizer Sales, Eight Percent Cost of Capital Rate[1]

Account Due Period	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Cost in Cents per Dollar of Fertilizer Sales)				
30 day period	1.72	1.26	1.30	1.35	1.39
60 day period	2.01	1.46	1.53	1.59	1.66
90 day period	2.32	1.68	1.77	1.86	1.95
180 day period	3.34	2.44	2.61	2.77	2.93

[1] The note policy is a six month note payment period and an eight percent annual interest rate.

per dollar of sales. These costs can be compared to the investment cost estimates when note financing is not available (Table 7). If the dealer's account due period is 30, 60, or 90 days, the receivables investment cost per dollar of fertilizer sales is smaller for policies that offer only account financing than for policies which include both accounts and notes. If the account due period is 180 days, the investment cost is smaller for the account only policies than for account-note policies only if a cash discount is offered.

If the account due period is 180 days and no cash discount is offered, the account-note policy costs slightly less than the policy with only accounts.

As shown in Table 10, the combined (accounts and notes) receivables investment cost per dollar of fertilizer sales when a finance charge is imposed range from 1.18 cents (30 day account due period, cash discount for payments on the purchase date and a 1.5 percent finance charge rate) to 4.01 cents (180 day account due period, no cash discount, .5 percent finance charge rate). If a finance charge is imposed, the cost for policies with 30, 60, or 90 day finance charge periods is lower for *account only policies* (Table 8) than for the *account-note policies* (Table 10).

Table 10. Estimated Combined Receivable Investment Cost (Notes and Accounts) Per Dollar of Fertilizer Sales, Account-Note Policies (With Finance Charges) $170,000 Fertilizer Sales, Eight Percent Cost of Capital Rate[1]

Finance Charge Period and Rate	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Cost in Cents per Dollar of Fertilizer Sales)				
30 day period					
.5%	2.29	1.66	1.75	1.85	1.94
1.0%	1.94	1.28	1.33	1.37	1.42
1.5%	1.61	1.18	1.21	1.24	1.27
60 day period					
.5%	2.60	1.88	2.00	2.12	2.24
1.0%	2.24	1.63	1.71	1.80	1.89
1.5%	1.89	1.38	1.43	1.49	1.54
90 day period					
.5%	2.92	2.12	2.26	2.40	2.55
1.0%	2.56	1.85	1.98	2.08	2.19
1.5%	2.19	1.59	1.67	1.75	1.83
180 day period					
.5%	4.01	2.94	3.16	3.37	3.59
1.0%	3.61	2.64	2.82	3.01	3.19
1.5%	3.21	2.34	2.49	2.64	2.79

[1] The note policy is a six month note payment period and an eight percent annual interest rate.

Also, if the account due period is 180 days, and if the finance charge rate is one percent or higher and a cash discount is offered, the cost estimates are lower for account only policies. However, for dealers with 180 day account due periods and .5 percent finance charge rates, the account-note policy results in a slightly lower cost than a policy with only accounts.

If the cost for a note policy with a note payment period shorter than six months and an interest rate greater than eight percent could be accurately estimated, the receivables investment cost may also be less for account-note financing than for only account policies when the account due period is less than 180 days.

Alternative Cost of Capital Rates

The dealer's cost of capital rate is an important exogenous variable in the investment cost function [Equation (1)]. Table 11 summarizes the effect of alternative cost of capital rates on the cost per dollar of fertilizer sales and the total accounts receivable investment cost for three alternative account policies. Assuming $170,000 fertilizer sales and an eight percent cost of capital rate, the cost per dollar of fertilizer sales is approximately 1.16 cents if a dealer offers a 30-day finance charge period, imposes a 1.5 percent per month finance charge, and offers no cash discount. This account policy (arrangement #1 in Table 11) results in an average annual investment of $24,631 and an annual investment *cost* of $1,970 ($24,631 X .08). However, if the dealer has a ten percent cost of capital rate, the cost per dollar of sales is 1.45 cents and the annual investment cost is $2,463. The estimated investment cost per dollar of sales for the same account policy is only .87 cents if the dealer's cost of capital rate is six percent per year resulting in an annual investment cost of $1,478.

The effects of a lower or higher cost of capital rate upon the investment cost for other account policies are similar. In general, for a given policy, a change in the cost of capital rate from eight percent to six percent or ten percent results in a 25 percent decrease or increase in the cost estimates respectively. Thus, the investment cost per dollar of sales for a 90 day account due period, a one percent finance charge rate and a cash discount for payments made on the purchase date (arrangement #2 in Table 11) is 1.13, 1.51, and 1.88 cents for 6, 8, and 10 percent cost of capital rates, respectively. Similarly, the total annual accounts receivable investment cost also increases or decreases as the cost of capital rate increases or decreases, respectively (Table 11).

Table 11. Estimated Accounts Receivable Investment Cost Per Dollar of Fertilizer Sales, Total Cost, and Total Investment for Selected Account Arrangements, Fertilizer Sales and Cost of Capital Rates

Fertilizer Sales and Cost of Capital Rate	Arrangements[1] #1 Cost/$	#1 Total Cost	#1 Average Investment	#2 Cost/$	#2 Total Cost	#2 Average Investment	#3 Cost/$	#3 Total Cost	#3 Average Investment
	¢	$	$	¢	$	$	¢	$	$
$ 60,000									
6%	.7853	471	7,858	.9983	599	9,990	1.8078	1,085	18,078
8%	1.0478	629	7,858	1.3317	799	9,990	2.4104	1,446	18,078
10%	1.3098	786	7,858	1.6650	999	9,990	3.0130	1,808	18,078
$170,000									
6%	.8693	1,478	24,631	1.1306	1,922	32,028	1.9888	3,381	56,355
8%	1.1591	1,970	24,631	1.5071	2,562	32,028	2.6518	4,508	56,355
10%	1.4489	2,463	24,631	1.8841	3,203	32,028	3.3147	5,635	56,355
$280,000									
6%	.9528	2,668	44,465	1.2625	3,535	58,912	2.1702	6,077	101,276
8%	1.2704	3,557	44,465	1.6832	4,713	58,912	2.8936	8,102	101,276
10%	1.5880	4,447	44,465	2.1039	5,891	58,912	3.6170	10,128	101,276

[1] Arrangements
#1 30 day Finance Charge Period, 1.5% Finance Charge Rate, No Cash Discount.
#2 90 day Finance Charge Period, 1.0% Finance Charge Rate, Cash Discount Period is Purchase Date.
#3 180 day Account Due Period, Cash Discount Period is 20 days, No Finance Charge.

Alternative Fertilizer Sales Levels

Since the level of fertilizer sales is a significant variable (with a positive coefficient) in explaining the percent of sales on account [equation (5)], the average annual investment in receivables, the cost per dollar of fertilizer sales and the investment cost for a given account policy and cost of capital rate are smaller for dealers with sales less than $170,000 and larger for sales levels greater than $170,000. The specific effect of the level of annual fertilizer sales on investment costs is also shown in Table 11. Assuming an eight percent cost of capital rate, a dealer with $60,000 annual sales offering account arrangement #1 has a cost per dollar of fertilizer sales of 1.05 cents compared to 1.16 cents for a dealer with $170,000 sales.

The difference in the cost per dollar of sales is small (.11 cents), but the average investment of $7,858 and the total annual cost of $629 for the dealer with only $60,000 sales is much smaller than the $24,631 investment and the $1,970 cost for a $170,000 sales dealer. In contrast, a larger dealer with $280,000 fertilizer sales has a 1.27 cents investment cost per dollar of sales, a $44,465 average annual investment and a $3,557 total investment cost. For arrangement #1, a $110,000 change in the sales level changes the investment cost per dollar by approximately 9.6 percent for any given cost of capital rate. For arrangements #2 and #3, the cost per dollar of fertilizer sales increases or decreases by approximately 11.64 percent and 9.1 percent, respectively, given a $110,000 increase or decrease respectively in the sales level.

Changes in Credit Policy and Break-Even Sales

The receivables investment cost analysis indicates that there are substantial differences in the investment cost per dollar of fertilizer sales among alternative credit arrangements. If other credit costs are added to the investment costs, the differences are likely to be even greater. Thus, dealers who have high cost credit arrangements could likely achieve substantial savings if they would change to a less lenient credit arrangement. However, whether or not a change in the credit policy is desirable depends on the impact of that change on sales and profits as well as on credit costs. A less lenient credit policy (a shorter account due period, higher finance charge, etc.) will likely result in lower credit costs, but unless the dealer's competitors also adopt shorter terms, the dealer may lose a part of his market share of sales.

Break-Even Analysis

A break-even analysis can be used to determine the level of fertilizer sales needed to maintain constant firm profits when a dealer makes a

change in his credit policy. The break-even sales level is calculated by the following formula:

$$(8)\quad S_b = \frac{S_i\ (\Pi)}{\Pi + (I_1 - I_2) + (V_1 - V_2)}$$

where:

S_b = the break-even sales with the new credit policy ($),

S_i = the current sales with the present credit policy ($),

Π = the current profit margin per dollar of sales after deducting all costs including I_1 and V_1 ($),

I_1 = the estimated receivables investment cost per dollar of fertilizer sales for the present credit policy ($),

I_2 = the estimated receivables investment cost per dollar of fertilizer sales with the new credit policy ($),

V_1 = other variable costs (production, marketing and credit) per dollar of sales for the present credit policy ($),

V_2 = other variable costs (production, marketing and credit) per dollar of sales for the new credit policy ($).

The values for S_i, Π, I_1, and V_1 are assumed to be known by the dealer. The estimated change in the dealer's receivables investment cost associated with a change in his credit policy is I_1-I_2. The change in other variable costs due to a change in his credit policy is V_1-V_2. The impact of a change in the credit decision variables upon other credit costs or upon the variable production and marketing cost is not empirically estimated here. It is assumed for the break-even analysis that V_1-V_2 = 0. However, these possible cost changes should not be ignored when evaluating a change in credit policy. For account only policies, the receivable investment cost for the new policy (I_2) is a function of the estimated percent of sales on accounts, the estimated average collection period on account sales and the dealer's cost of capital rate. Thus,

$$(9)\quad I_2 = \Phi\left[\frac{X_a M_a}{365}\right] = \Phi\left[\frac{(Z_a + .000000601 S_b) M_a}{365}\right]$$

where:

Φ = the dealer's annual cost of capital rate,

X_a = the estimated proportion of fertilizer sales on account for the new credit policy,

M_a = the estimated average collection period for the new credit policy (days),

Z_a = the estimated proportion of sales on account excluding the effect of the level of fertilizer sales for the new credit policy,

$.000000601S_b$ = the coefficient for the level of fertilizer sales (in the percent account equation) times the break-even level of fertilizer sales.

Regression equations (4) and (5) can be used to estimate M_a and X_a, respectively, for the new account policy. Then equation (9) can be substituted for I_2 in the break-even sales equation [equation (8)]. The break-even sales (S_b) can be determined by solving equation (8) using the quadratic formula.[23]

An Example

For illustrative purposes the break-even analysis will be applied to changes from a high cost to a lower cost account policy. Assume that the dealer's initial level of fertilizer sales (S_i) is $170,000 and his present profit margin (Π) is five (.05) cents on each dollar of sales. Thus, the annual profit on fertilizer sales is $8,500. If the dealer presently offers his customers a 180 day account due period, no cash discount, and imposes a 1.0 percent finance charge on accounts unpaid after 180 days, his average collection period is approximately 215 days, and 78 percent of his sales are on accounts (See Table 12). Assuming the dealer's cost of capital rate is eight percent, the receivables investment cost per dollar of fertilizer sales for this policy is estimated to be 3.69 cents.[24] The break-even level of sales and the sales reductions that could occur and still maintain a profit of $8,500 if the dealer reduced his account due period to 90, 60, or 30 days are shown in Table 12.

By changing his credit policy to a 90 day account due period, the dealer's receivables investment cost per dollar of sales decreases from 3.69 cents to 2.31 cents. Assuming other costs do not change, the annual sales could decrease from $170,000 to approximately $132,927 (a $37,073 decrease) and net profit would remain at $8,500.[25] Due to the decline in the investment cost per dollar of sales, the profit margin has increased from 5 to 6.38 cents (5 + 3.69 — 2.31) per dollar of sales. If the dealer were to change from the 180 day finance charge period to 60 day or 30 day

[23] The break-even sales level could also be determined for account-note policies by substituting the receivables investment cost for both accounts and notes for I_2 in equation (8).

[24] The percent of sales on account, the average collection period and the investment cost for the initial credit policy are assumed to be those values estimated with the regression equations and cost equations for that specified policy.

[25] If other variable costs per dollar of sales (V) increase (decrease) due to a change in credit policy, the break-even sales level would be larger (smaller) than $132,927.

Table 12. Estimated Average Collection Period, Percent of Sales on Accounts, Investment Cost Per Dollar of Sales, Break-Even Sales and Sales Reductions for Changes in the Length of the Account Due Period[1]

Account Policy	Average Collection Period	Percent of Sales on Accounts	Investment Cost Per Dollar of Sales	Break-Even Sales	Sales Reduction
	(days)	(%)	(¢)	($)	($)
Initial Policy					
180 Day Account Due Period, 1% Finance Charge Rate	214.70	78.42	3.69	-	-
New Policy					
90 Day Account Due Period, 1% Finance Charge Rate	149.63	70.46	2.31	132,927	37,073
60 Day Account Due Period, 1% Finance Charge Rate	127.94	68.09	1.91	125,341	44,659
30 Day Account Due Period, 1% Finance Charge Rate	106.25	65.79	1.53	118,864	51,136

[1] The initial fertilizer sales level is $170,000, the initial profit margin is five cents per dollar of sales and the annual cost of capital rate is eight percent.

terms, sales could fall by $44,659 and $51,136, respectively, with no change in net profit.

As indicated in equation (8), the break-even sales reductions that can occur depend on the dealers initial profit margin. Suppose a dealer presently offers a 180 day finance charge period and charges one percent per month on accounts not paid after 180 days. Table 13 illustrates the break-even sales for a change to a 90 day finance charge period assuming three alternative initial profit margins—three, five, and seven cents per dollar of sales. The sales reduction that can occur assuming a three cent initial profit margin and a $170,000 initial sales level is $53,942 compared to only $27,813 for a seven cent profit margin. Thus, given the same change in credit policy, dealers with small profit margins can sacrifice more sales and maintain constant profit than can dealers with larger profit margins.

Table 13. Break-Even Sales and the Sales Reduction for a Change in the Account Policy from a 180 Day Account Due Period to a 90 Day Account Due Period Assuming Alternative Initial Profit Margins[1]

Initial Profit Margin	Break-Even Sales	Sales Reduction
(cents)	($)	($)
3	116,058	53,942
5	133,927	37,073
7	142,187	27,813

[1] The initial and new policy include a 1.0 percent finance charge rate. The initial level of fertilizer sales is $170,000 and the annual cost of capital rate is eight percent.

Conclusions

Receivables Management

The empirical results of this study indicate that the account policies of Oklahoma fertilizer dealers with $170,000 of sales result in estimated annual investments in accounts receivable ranging from $11,900 to $89,-250. Assuming a cost of capital rate of eight percent, the estimated annual receivables investment costs range from $952 to $7,140. For dealers with fertilizer sales larger than $170,000 and cost of capital rates higher than eight percent, the investment costs are even greater. Changes in selected credit policy decision variables were shown to be effective in reducing the proportion of fertilizer sales financed and the average number of days the financed sales are invested in receivables. Reductions in these credit performance measures will reduce the dealers receivables investment cost per dollar of sales and the total annual receivables investment cost.

The most important credit policy variable affecting the number of days sales are invested in accounts receivable (average account collection period) is the account due period. A change from a 180 day (crop harvest) to a 30 day account due period results in up to a 108 day decrease in the average collection period. Offering a cash discount, imposing a higher finance charge rate, or offering note financing also significantly reduces the average collection period on accounts.

The credit policy variable which has the largest impact on the proportion of fertilizer sales sold with account financing terms is the cash discount policy. Offering a cash discount for payments on the purchase date reduces the percent of fertilizer sales on account by over 16 percent. However, offering a cash discount for payments received within 20 days after the purchase date reduces the percent of sales on account by only

six percent. The availability of note financing also significantly reduces the percent of sales on accounts, but this decrease is offset by an increase in the percent of sales on notes. A decrease in the length of the account due period also reduces the percent of sales on accounts.

Although the direct impact of a change in the credit policy upon fertilizer sales was not estimated, the break-even analysis indicated that substantial sales reductions can occur without decreasing the dealer's profit. For example, changing from a 180 day to a 30 day account due period resulted in an investment cost savings of 2.16 cents per dollar of sales. Thus, assuming the initial fertilizer sales is $170,000, and assuming the initial profit margin is five cents per dollar of sales and the initial receivables investment cost is 3.69 cents per dollar of sales, the dealer's annual fertilizer sales could decrease by over $51,000 without changing his net profit.

Methodological Issues

The accuracy of the receivables investment cost analysis depends upon the correct specification and measurement of the factors which affect the receivables investment cost, and the precision of the estimated empirical relationship between the decision variables and the performance measures.

Many factors which may have an impact on the customers' purchase and payment behavior were not observed in this study. The farmer's personal and financial characteristics and the cost and availability of other sources of financing will have a major impact on input purchase and payment decisions. Also, some of the credit policy decision variables such as collection standards were omitted from the empirical analysis because of difficulty in measurement and quantification. The dealer's collection practices and standards may have a substantial impact on the proportion of sales financed and the timing of collections.

Data obtained from mail questionnaires are frequently subject to errors of observation and measurement. Some of the stated credit policies may not be enforced by the dealers. For example, dealers may not collect finance charges on account sales not paid by the time specified in their credit policy. Also, cash discounts may be given to farmers who pay after the cash discount period specified in the dealer's credit policy. Some of the dealers may have reported the sales paid for within a few days after the purchase date as cash sales. Thus, the observed values for the percent of sales financed with accounts may be under reported. Also, only one parameter of the distribution of account sales paid after various lengths of time, the mean age of account sales at the time of collection, was utilized to measure the timing of payments for credit sales.

The multiple regression coefficients for the selected models indicated that several credit policy variables significantly explain part of the variation in the dealer's average collection periods, percent of sales on accounts, percent of sales on notes, and percent of sales for cash. However, as indicated by the low R^2 values and the examination of the residuals, a large proportion of the variation in the credit performance measures was not explained by the credit policy decision variables. The examination of the residuals indicates that the small observed values for the credit performance measures are over predicted and the large observed values are under predicted. Thus, use of the predicted values in the investment cost equations likely yield estimated costs that have a narrower range than the actual range in investment costs. The omission of credit policy variables which have an impact on the credit performance measures may have introduced some bias in the regression estimates. The errors of measurement and observation in significant credit policy variables introduce additional bias into the credit performance models. However, even if the predictions of the values for the credit performance measures and the resulting costs are biased, the estimates are useful in explaining the impact of differences in credit policies upon credit performance and receivable investment costs.

Further Research

This study emphasized the importance of the receivables investment cost in the evaluation of alternative dealer credit policies. Further theoretical and empirical analysis is needed to determine the impact of changes in the credit policy upon the dealer's revenue, other credit costs, and other operating costs.

A change in credit terms will likely influence two components of the dealer's revenue—his rate of sales and his financial revenue. The impact of the credit policy upon the rate of sales would need to be distinguished from the effects of price and offering other services. Uncertainty concerning the reactions of both buyers and rival competitors to changes in credit policy would complicate the analysis. Probability distributions for the quantity of a farm input demanded by farmers for alternative sets of credit terms would provide more information for decision making than a single estimated value. Little work has been done concerning the amount of revenue received by dealers from finance or interest charges collected on customer accounts and notes outstanding. Financial revenue would offset part of the additional cost of having operating funds tied up in receivables for longer lengths of time.

Additional research effort is needed to determine the impact of alternative credit policies upon the other credit costs. The collection

costs, bad debt losses and the value of cash discounts given as well as the investment costs are related to the length of time credit sales remain unpaid. To estimate these costs, distributions of the dealer's collections at various lengths of time under alternative credit policies similar to the distribution used to compute the average collection periods for this study would be useful. Using past payment performance experience, a probability distribution of collections could be estimated. For a complete analysis of the effect of alternative credit policies on firm profit, the impact of the credit decision on other managerial decisions such as the optimum inventory policy should also be considered.

Additional theoretical and empirical inquiries concerning the impact of the farmer's personal characteristics and financial success upon his purchase and payment decisions would provide useful information for future studies of receivables management. Development of probability distributions from both sales and collections data concerning the farmer's past purchase and payment experience under alternative conditions would be useful. The relationship between the farmer's personal and financial traits and his payment performance would also provide valuable data for studies which deal with the screening of credit customers and credit line determination.

Finally, this study has not considered the legal aspects of credit policies. The recent changes in the law dealing with credit policy disclosures and restrictions on finance charge rates have important implications for credit policy decisions. Additional research effort in this area would provide important information for managers of farm input supply firms.

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APPENDIX A

Farmer Purchase and Payment Behavior

The cost of the financing offered by an input dealer has an impact on both the farmer's purchase and payment behavior. For the farmer the relevant input purchase price is the cash price per unit (the price if the input is paid for on the purchase date) plus the difference between the price of the input on the date of payment and the price per unit on the purchase date, or the marginal finance cost. Consistent with economic rationale, the magnitude of the marginal finance cost will have an impact on the farmer's decisions regarding the quantity of an input to purchase and the choice among dealers selling the input.

Once a purchase is made, a farmer will repay the input dealer when the cost per dollar of financing from the dealer for an additional unit of time becomes greater than the cost of capital rate from other sources [15, p. 85]. To compare the cost of dealer financing to the farmer's cost of capital from other sources, the dealers finance cost per dollar must be translated into an equivalent annual interest rate. Thus,

(1) $i = {}^{f}/_{t}$

where:

i = the equivalent annual interest rate,

f = the finance cost per dollar, and

t = the proportion of a year financed,

$$= \frac{\text{number of days of financing}}{360}$$

The equivalent annual interest rate for dealer financing is the ratio of the finance cost per dollar to the proportion of a year financed.

The farmer's cost of capital rate depends on the cost of capital from all alternative sources. If a farmer uses his own cash reserves to pay for inputs, he sacrifices the yield these funds could earn from other investments. This yield is defined as an opportunity cost. If funds are borrowed from an institutional lender, a cash cost in the form of interest paid to the lender is incurred [15, p. 55]. For the purposes of this analysis of farmer payment behavior, we will assume that the cost of capital rate for all alternative sources is equal to an eight percent rate of interest.

The cost of dealer financing and the resulting farmer payment behavior depend upon the type of credit arrangement used to finance the sales transactions [15, pp. 91-95]. When sales are financed with an open book account, the cost depends primarily upon four of the credit policy decision variables—the account due period, the cash discount rate, the cash discount period, and the finance charge rate.[1] When a note is used as the credit instrument, the price the farmer pays for financing depends upon the cash discount rate, the cash discount period, the time notes are issued, the annual interest rate charged and the note payment period.

First, assume an input dealer offers the farmer a 30-day account due period with no cash discount offered for early payments nor a finance charge imposed for late payments. Also, assume the farmer's annual cost of capital rate is eight percent. The price the farmer pays for inputs is the same on the purchase date as on the payment date. The finance cost per dollar (f) is zero assuming the dealer does not have an interest charge hidden in the price of the inputs [15, p. 92].

Since the farmer would have to pay eight percent per year for financing from other sources, he will take advantage of the free financing from the dealer for at least 30 days. In fact, the farmer does not pay a direct interest cost for using the dealer's funds *longer* than 30 days. However,

[1] Lindsay and Sametz [15] discuss the impact of three credit policy terms exclusive of the finance charge rate on pp. 91-95.

after the 30-day period, the dealer may mail due notices or take other action to encourage payment of the overdue account. Failure to pay near the end of the account due period may raise questions about the farmer's ability to pay and may cause both supply firms and other lenders to be less willing to finance his purchases in the future [15, pp. 94-95]. Thus, the existence of an account due period may create a psychological barrier which encourages the farmer to pay within that period. If the dealer offers a longer account due period, the farmer will likely wait for a longer period of time to pay.

Most dealers do not rely upon the account due period alone to provide the incentive for a farmer to pay on account. A cash discount is often offered to encourage an early payment for inputs. Assume the dealer offers a one percent cash discount rate with a 10-day discount period. If the farmer pays after the discount period, he pays one cent more than the 99 cents he could have paid for each dollar's worth of inputs paid for during the discount period. Thus, the finance cost per dollar (f) is .0101 (.01/.99) for the one percent cash discount. A 1.01 percent finance cost does not seem high until it is translated into an equivalent annual interest rate (see Figure 1, Curve AHPEC). If the inputs are paid for within the 10-day discount period (OB), the equivalent annual interest rate is zero. But, if the farmer pays on the 20th day after the purchase date, the finance cost per dollar is 1.01 percent of the input price. Since he receives 10 days (20-10) of financing, the annual interest rate is 36.46 percent (H) ($i = f/t = .0101/.0277$). If the farmer waits 30 days to pay, he is paying 1.01 cents per dollar for 20 (30-10) days of financing. Thus, the annual interest rate is 18.2 percent (P) ($i = f/t = .0101/.0555$). Since the absolute size of the cash discount foregone does not change, payments further from the end of the cash discount period result in a lower equivalent annual interest rate.

If the farmer pays the dealer within the 10-day period (OB), he will need to use funds from other sources which cost eight percent per year (line DEF). Payment at the 30-day account due date would result in an 18 percent equivalent annual interest rate. Thus, the farmer would prefer to borrow from other sources at eight percent and pay within the cash discount period rather than pay the dealer for the 30 days of financing. Only, if financing could be obtained from the dealer for more than 55 days (E), would the equivalent annual interest rate of dealer credit be less than the cost of capital rate. Unless the dealer offers an additional incentive to pay, a farmer who forfeits the cash discount will likely wait for more than 55 days to pay in order to minimize his finance cost.

In general, a higher cash discount rate, assuming a 10-day cash discount period, would increase the equivalent annual interest rate of foregoing the cash discount for all alternative payment dates. Thus, more

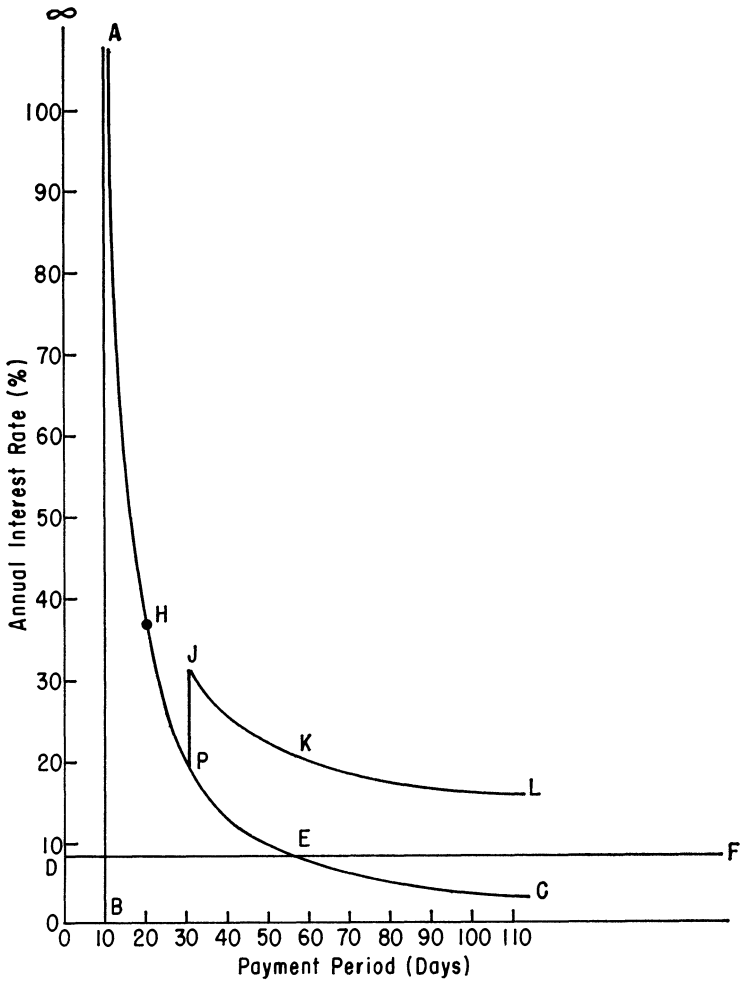

Figure 1. Equivalent Annual Interest Rates for Cash Discount—Finance Charge Arrangements.

incentive would be provided for the farmer to pay the dealer within 10 days. A cash discount period longer than 10 days would shift Curve AHPEC of Figure 1 to the right. Thus, a farmer formerly paying late may now pay within the longer cash discount period. However, farmers formerly paying within 10 days will wait until the end of the longer cash discount period to pay.

Because the equivalent annual interest rate of foregoing the cash discount decreases for later payment dates, the dealer may provide an

additional incentive for paying within the account due period. Thus, he may impose a finance charge on payments made after the account due date. Assume a one percent per month (12 percent per year) finance charge rate is imposed on payments made after 30 days.[2] If a cash discount of one percent for a payment within 10 days is also offered, the equivalent annual interest rates for alternative payment dates are shown by Curve AHPJKL in Figure 1.

A payment on the eleventh day after purchase has an equivalent annual interest rate greater than 360 percent. For later payments, up to and including the 30th day, the rate decreases along the Curve AHP to 18.2 percent. For payments after the 30th day, the annual interest rate is the sum of the finance charge rate of 12.1 percent ($f/t = \frac{.0101}{30/360}$)[3] plus the equivalent annual interest rate associated with foregoing the one percent cash discount ($f/t = .0101/t$, t = proportion of the year financed). The total equivalent annual interest rate for dealer financing after 30 days is shown in Figure 1 by Curve JKL. The Curve JKL is obtained by adding 12.1 percent to Curve PEC.

Assuming the cost of capital rate from alternative sources is eight percent (line DEF), a farmer's finance cost would be minimized by paying for inputs exactly 10 days after the purchase date. A farmer would not pay before 10 days (OB), because the financing from the dealer is free during this period. After the 10th day the cost of capital from other sources (8 percent) is always less than the annual interest payable to the dealer. If payment does not occur on the 10th day, the annual interest rate declines for later payment dates, but remains greater than the 12.1 percent finance charge rate.

A second type of credit instrument used by dealers to finance their customers' purchases is the promissory note. The note may be issued on the purchase date or after the sale has been carried as an open account for a specified time. Thus, the note may serve as an inducement to pay an open account because the purchaser must sign a written statement of obligation. The finance cost to the farmer is usually specified on the note as an annual interest rate. Also, the length of time from the date the note is issued until repayment by the farmer is usually specified. The interest rate on a note serves the same purpose as a finance charge on an open account. However, the farmer may be more likely to pay the interest if he has signed a promissory note.

[2] It is assumed that this rate is continuous with respect to time. That is, a farmer paying one day after the 30-day period pays 1/30 of one percent of the purchase price as a finance charge.

[3] The finance cost per dollar is one percent of the quoted input price but 1.01 percent of the input price on the purchase date.

The farmer's payment decision is less complex when his purchases are financed with a note rather than an open account. If notes are issued on the purchase date, the farmer will utilize dealer financing only if the annual cost of capital from other sources is greater than the annual interest rate specified on the note. Otherwise, he will pay on the purchase date. If a farmer utilizes the dealer's note financing arrangement, he usually will not pay the note until the end of the note payment period.

APPENDIX B

Confidential

Credit Policy Questionnaire for Fertilizer Dealers

A. General Characteristics of Your Firm.

1. Indicate by checking the appropriate blank what type of firm you operate.
   ____ Cooperative
   ____ Independent dealer
   ____ Company Store (owned by fertilizer supplier)
   ____ Lease-Agent Operation (lease facilities from fertilizer supplier)
   ____ Other (specify) _____
2. What was your total dollar sales of all products and services from all operations during the last fiscal year? $_____
   Specify your fiscal year _____
3. What was your total dollar sales from *fertilizer* and services associated with the sale of fertilizer to farmers during the last fiscal year. $_____ If you cannot estimate the dollar sales of fertilizer, approximately what percent of your total dollar sales of all products (question 2) does fertilizer represent?
   _____%
4. What services were offered to farmers who bought fertilizer during the last fiscal year? Check the column on the left if the service was offered. Check in columns on the right if the service was offered with a charge or at no charge to the buyer.

Offered	Service	Charge	No Charge
	Applicator Furnished		
	Complete Custom Application		
	Fertilizer Delivery Service		
	Loading after Hours or on Sunday		
	Special Field Help		
	Soil Testing		
	Educational Meetings		
	Farm Planning Programs		
xxx	Other Services (specify below)	xxx	xxx

B. The following questions refer to your credit arrangements offered to farmers who buy fertilizer. Answer each question considering only *fertilizer sales during the last fiscal year.*

1. Why were credit terms offered to farmers by your firm or fertilizer supplier? Rank (1st, 2nd, 3rd, 4th, 5th, etc.) the following reasons for offering credit terms.

Rank	*Reason*
_____	To maintain or increase your market share of sales.
_____	To increase net profit.
_____	To make money on finance charges.
_____	Convenience to buyers.
_____	To increase fertilizer sales in the off season.
	Other reasons (specify)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

2. What has happened to your firm's net profit due to selling fertilizer on credit? Check appropriate answer and give reasons.

_____ Increased net profit of the firm.
_____ Decreased net profit of the firm.
_____ Had relatively little effect on net profit of the firm.
Reasons: _____
_____

3. Approximately what percent of your total fertilizer sales during the last fiscal year was sold with each of the following terms?
   _____% sold for cash at the time of purchase or delivery.
   _____% sold on credit on *your firm's* open account.
   _____% sold on credit on the *fertilizer suppliers* open account.
   _____% sold on credit with a promissory note held by *your firm.*
   _____% sold with a promissory note held by the *fertilizer supplier.*
   _____% sold with a promissory note held by *local bank.*
   _____% sold with some other type of credit arrangement (specify).
4. If *cash discounts* (not volume discounts) were offered for payments made at the time of purchase or within a specified number of days after the purchase, *indicate the percent cash discount offered with each of the following terms.*
   _____% cash discount was offered for payment made on the day of purchase or delivery.
   _____% cash discount was offered for payment made within 30 days from date of sale.
   _____% cash discount was offered for payment made within _____ days (indicate other times not stated above) from date of sale.
5. If fertilizer sales are made on your firm's or the fertilizer supplier's open account, answer questions 5a, 5b, and 5c. If not, go to question 6.
   a. What percent of fertilizer sales made on *open account* are *due* in the following time intervals.
      _____% due within 30 days from date of sale.
      _____% due from 30 to 90 days from date of sale.
      _____% due at time of crop harvest.
      _____% due at some other time (specify) _____
      _____
      _____
      _____
      _____
   b. What percent of fertilizer sales made on *open account* are *paid* in the following time intervals? Estimate from past experience with your customers payment practices.
      _____% are paid within 30 days from date of sale.
      _____% are paid from 30 to 90 days from date of sale.
      _____% are paid from 90 days to six months from date of sale.

_____% are paid from six months to one year from date of sale.

_____% are paid after one year from date of sale.

_____% are not paid or are written off as a bad debt.

c. If there are *finance charges* on *open accounts,* indicate the monthly rate and when it goes into effect.

_____% per month is charged on accounts not paid within _____ days from date of sale.

6. If *promissory notes* were issued by your firm or the fertilizer supplier to finance your fertilizer sales to farmers, answer questions 6a, 6b, and 6c.

a. What annual percentage rate is charged on promissory notes?

_____% is charged on notes held by your firm.

_____% is charged on notes held by the fertilizer supplier.

b. At what time are most promissory notes issued? Check appropriate answer.

_____ on the date of sale.

_____ after the sale has been carried on an open account for approximately _____ days.

c. What is the average number of months the promissory notes are outstanding?

Notes held by your firm are outstanding for approximately _____ months.

Notes held by the fertilizer supplier are outstanding for approximately _____ months.

7. Check which of the following statements are required of new customers.

____ Formal credit application.

____ Financial statement.

____ Some other statement regarding the financial condition of the buyer. (Specify).

_____

_____

_____

8. Check the types of collection practices your firm uses to collect payments of accounts or notes.

____ Written notices once a month.

____ Written notices when account is due.

____ Personal visits after account is due.

____ Other means of collection (specify).

_____

_____

9. Please make any additional remarks about your credit arrangements. Also, indicate if credit terms are different than those previously stated for different types of fertilizer.

APPENDIX C

Means, Standard Deviations and Ranges for Dependent Variables

Appendix Table I Means, Standard Deviations, and Ranges for Observations on the Dependent Variables of the Regression Analysis[1]

Dependent Variable	Units	Mean	Standard Deviation	Ranges
M_a— Average Collection Period	days	121.05	71.49	31.5-279.5
X_a — Percent of Fertilizer Sales on Accounts	percent	65.04	26.24	0-100
X_n — Percent of Fertilizer Sales on Notes	percent	23.47	21.04	1-85
Y_c — Percent of Fertilizer Sales for cash	percent	25.29	23.16	0-90

[1] Statistics are computed for average collection period from 87 dealers, percent account and percent cash from 89 dealers and percent note from 32 dealers.

Appendix Table II Means, Standard Deviations, and Range for Independent Variables, 89 Dealers and Dealers Having the Variable

	Independent Variable	Unit	Mean	Standard Deviation	Range	Number of Dealers	Mean	Range	Standard Deviation
			For 89 Dealers			For Dealers Having the Variables			
	Account Due Period or								
X_1	Finance Charge Period	days	87.19	61.45	0-180	87	89.20	30-180	60.69
X_2	Cash Discount Rate	%	.98	1.29	0-5	36	2.42	2-5	.77
X_3	Cash Discount Period	days	9.44	14.64	0-60	36	23.33	0-60	14.34
X_4	Finance Charge Rate	%/mo.	.84	.53	0-1.5	67	1.12	.5-1.5	.25
X_5	Interest Rate	%/yr.	3.01	4.44	0-12	32	8.38	0-12	3.11
X_6	Note Payment Period	months	2.22	3.18	0-10	32	6.19	3-10	1.86
X_7	Cash Discount[1]	(0,1)	.40	.49	(0,1)	36	1	1	_
X_8	Finance Charge[1]	(0,1)	.75	.43	(0,1)	67	1	1	_
X_9	Notes[1]	(0,1)	.36	.48	(0,1)	32	1	1	_
X_{10}	Fertilizer Sales	$1000	170.25	110.18	15.31-486.6	89	170.25	15.31-486.6	110.18
X_{11}	Cooperative[1]	(0,1)	.44	.50	(0,1)	39	1	1	_
X_{12}	Independent Dealer[1]	(0,1)	.45	.50	(0,1)	40	1	1	_

[1] Dummy variable.

APPENDIX D

Observed Average Collection Period

The age distribution of accounts receivable at the time when cash payments are received is used to calculate the average collection period on accounts. Thus,

$$(1) \quad M_a = \sum_{j=1}^{5} P_j\lambda_j + b\theta$$

where:

M_a = average collection period on account sales (days),

P_j = proportion of *account sales* paid in the jth payment interval (decimal), j=1, 2 . . . . 5.

λ_j = the approximate age of account at time of collection for the jth payment interval (days),

b = proportion of account sales not paid after five payment intervals have elapsed (bad debts),

θ = number of days from the purchase date to the end of the fifth payment interval,

$$\sum_{j=1}^{5} P_j + b = 1.$$

Since the proportion of accounts written off as bad debts (b) are invested in receivables for θ days, these sales are included in the calculation of the average collection period. Sales for cash on the purchase date are not included in the calculation of the average collection period.

The assumed age of accounts at the time of collection (λ_j) for each jth payment interval is shown below.

Payment Interval	Age at Time of Collection (λ_j)
1st 1-30 days	30 days
2nd 31-90 days	60 days
3rd 91-180 days	135 days
4th 181-365 days	270 days
5th > 365 days	365 days

The approximate age of accounts paid in the second, third, and fourth payment interval is assumed to be the median day of that interval. It is also assumed that all payments made during the first interval are paid on the 30th day, and all accounts paid after one year are paid in 365 days from the purchase date. Sales not paid for during the five payment intervals are assumed to be invested in recievables for 365 days.

To illustrate the calculation of the average collection period on accounts, assume that 20 percent of the account sales are paid within 30

days, 25 percent from 31-90 days, 30 percent from 91-180 days, 20 percent from 181-365 days, 3 percent in greater than 365 days, and 2 percent of the account sales are written off as bad debts. The average collection period for this payment distribution can be calculated as:

$$.20\,(30) + .25\,(60) + .30\,(135) + .20\,(270) + .03\,(365) + .02\,(365) = 133.75 \text{ days.}$$

APPENDIX E

Predicted Credit Performance for Account and Note Financing Arrangements

Tables III, IV, V, and VI illustrate the estimated values for the average collection periods, percent on account and percent for cash for dealers who offer both account and note financing. The sums of the percent cash, percent account, and percent note deviate substantially from 100 percent for all account policies when the annual interest rate on notes and the note payment period is different than 8 percent or 6 months, respectively.

The sums of the estimated percent of sales financed and the estimated percent of sales for cash for alternative account and note policies are summarized in Table VII. The estimated notes receivable investment costs for note policies and the estimated accounts receivable investment costs for account policies (assuming notes are offered) are shown in Tables VIII, IX and X.

Appendix Table III Estimated Average Collection Period on Accounts Receivable for Selected Account-Note Policies (No Finance Charge)

Account Due Period	No Cash Discount	Cash Discount Offered
	(Average Collection Period in Days)	
30 day period	66.00	37.54
60 day period	87.69	59.23
90 day period	109.38	80.92
180 day period	177.45	145.99

Appendix Table IV Estimated Average Collection Period on Accounts Receivable for Selected Account-Note Policies (With Finance Charge)

Finance Charge Period and Rate	No Cash Discount	Cash Discount Offered
	(Average Collection Period in Days)	
30 day period		
.5%	114.96	86.50
1.0%	85.50	49.24
1.5%	56.03	27.57
60 day period		
.5%	136.65	108.19
1.0%	107.19	78.73
1.5%	77.72	49.26
90 day period		
.5%	158.34	129.88
1.0%	128.88	100.41
1.5%	99.41	70.95
180 day period		
.5%	223.41	194.95
1.0%	193.95	165.48
1.5%	164.48	136.02

Appendix Table V Estimated Percent of Fertilizer Sales on Accounts for Selected Account-Note Policies (For $170,000 Fertilizer Sales)

Finance Charge Period or Account Due Period	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Percent of Fertilizer Sales on Account)				
30 day period	52.75	36.81	41.86	46.90	51.95
60 day period	54.66	38.72	43.77	48.82	53.86
90 day period	56.57	40.63	45.68	50.73	55.77
180 day period	62.30	46.37	51.41	56.46	61.51

Appendix Table VI Estimated Percent of Fertilizer Sales for Cash for Selected Account-Note Policies (For $170,000 Fertilizer Sales)

Finance Charge Period or Account Due Period	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Percent of Fertilizer Sales on Account)				
30 day period	21.04	37.65	32.30	26.94	21.59
60 day period	19.41	35.99	30.67	25.31	19.86
90 day period	17.78	34.36	29.04	23.69	18.33
180 day period	12.89	29.47	24.15	18.80	13.44

Appendix Table VII Estimated Sum of Percent of Fertilizer Sales for Cash on Accounts and Notes for Selected Account-Note Policies (For $170,000 Fertilizer Sales)

Account Policy	Note Policy (Percent)								
	0 4 months	0 6 months	0 8 months	8 4 months	8 6 months	8 8 months	12 4 months	12 6 months	12 8 months
	(Sum of the Percent of Sales on Account, on Notes and for Cash)								
30-day Account Due Period No Cash Discount	115.47	123.67	131.61	89.79	97.73	105.67	76.82	84.75	92.70
30-day Account Due Period Cash Discount on Purchase Date	116.40	124.44	132.38	90.46	98.40	106.34	77.49	85.42	93.37
90-day Account Due Period Cash Discount Within 10 Days	116.66	124.60	132.54	90.72	98.66	106.60	77.75	85.68	93.63
180-day Account Due Period Cash Discount on Purchase Date	117.78	125.72	133.66	91.84	99.79	107.72	78.87	86.80	94.75

[1] Note policies include the annual interest rate charge and the note payment period in months.

Appendix Table VIII Estimated Notes Receivable Investment Cost Per Dollar of Fertilizer Sales for Alternative Note Policies, Eight Percent Cost of Capital Rate

Note Payment Period	Annual Interest Rate Charged (Percent)				
	0	6	8	10	12
	(Cost in cents per dollar of sales)				
4 months	1.12	.60	.43	.25	.08
6 months	2.00	1.22	.96	.70	.44
8 months	3.08	2.04	1.70	1.35	1.01

Appendix Table IX Estimated Accounts Receivable Investment Cost Per Dollar of Fertilizer Sales for Selected Account-Note Policies (No Finance Charge) $170,000 Fertilizer Sales, Eight Percent Cost of Capital Rate

Account Due Period	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Cost in cents per dollar of fertilizer sales)				
30 days	.76	.30	.34	.39	.43
60 days	1.05	.50	.57	.63	.70
90 days	1.36	.72	.81	.90	.99
180 days	2.38	1.48	1.65	1.81	1.97

Appendix Table X Estimated Accounts Receivable Investment Cost Per Dollar of Fertilizer Sales for Selected Account-Note Policies (With Finance Charge) $170,000 Fertilizer Sales, Eight Percent Cost of Capital Rate

Finance Charge Period and Rate	No Cash Discount	Cash Discount Period			
		Purchase Date	10 Days	20 Days	30 Days
	(Cost in cents per dollar of fertilizer sales)				
30 day period					
.5%	1.33	.70	.79	.89	.98
1.0%	.98	.32	.37	.41	.46
1.5%	.65	.22	.25	.28	.31
60 day period					
.5%	1.64	.92	1.04	1.16	1.28
1.0%	1.28	.67	.75	.84	.93
1.5%	.93	.42	.47	.53	.58
90 day period					
.5%	1.96	1.16	1.30	1.44	1.59
1.0%	1.60	.89	1.01	1.12	1.23
1.5%	1.23	.63	.71	.79	.87
180 day period					
.5%	3.05	1.98	2.20	2.41	2.63
1.0%	2.65	1.68	1.86	2.05	2.23
1.5%	2.25	1.38	1.53	1.68	1.83


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