The Agricultural Lending Decision: A Multiattribute Analysis

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The Agricultural Lending Decision: A Multiattribute Analysis

Abstract
The role of commercial bank lending in financing the farm production sector is an issue of growing importance. During the past several years, farm operators have become more capital intensive, thus requiring more loans to fund not only seasonal plantings but also capital expansion. While one area of research (Linsj Penson; Hesser 'and Schuh) has focused on the determinants of aggregate loan demand, subsequent work (Boehlje and Fisherj Boehlje, Harris and Hoskins) has concentrated on such demand in local financial markets. Despite this research on financial market behavior, relatively little has been done to model and empirically test the decision process of individual lending officers in this market. Existing studies (i.e., Barry, Baker, and Sanint; Sonka, Dixon, and Jones) have concentrated primarily on credit analysis of farm firms. The objective of this paper is to expand on existing research by incorporating the interacting effects of credit considerations, market conditions, collateral and pricing into the decision process of the individual loan officer when faced with an array of farm loan situations.

Disciplines

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The Agricultural Lending Decision: A Multiattribute Analysis

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No. 130
The role of commercial bank lending in financing the farm production sector is an issue of growing importance. During the past several years, farm operators have become more capital intensive, thus requiring more loans to fund not only seasonal plantings but also capital expansion. While one area of research (Lins; Penson; Hesser and Schuh) has focused on the determinants of aggregate loan demand, subsequent work (Boehlje and Fisher; Boehlje, Harris and Hoskins) has concentrated on such demand in local financial markets. Despite this research on financial market behavior, relatively little has been done to model and empirically test the decision process of individual lending officers in this market. Existing studies (i.e., Barry, Baker, and Sanint; Sonka, Dixon, and Jones) have concentrated primarily on credit analysis of farm firms. The objective of this paper is to expand on existing research by incorporating the interacting effects of credit considerations, market conditions, collateral and pricing into the decision process of the individual loan officer when faced with an array of farm loan situations. A sample of agricultural loan officers were asked to evaluate hypothetical situations derived from the theoretical model described in the next section. These simulated loans were generated from a set of factorially designed combinations of decision variables. Conjoint measurement is then employed to empirically analyze this decision process.

Theoretical Model

This paper studies the determinants of lenders' ranking of loans. Since the loan size is controlled, the following discussion will focus on the loan of a dollar. By suitable scaling, the utility model will apply to any pool of loan applications, each for a dollar. The characteristics of the loan examined in
this study are: collateral, yield, farm management, repayment ability, market conditions, and loan purpose.

Denote by $c$ the collateral on the loan, and by $r$, the yield. Let $x$ be the cash payments from the borrower to the lender over the period of the loan. Then the return to the lender, $R$, can take either one of two forms. First, the loan does not perform, in which case the lender gets the collateral plus whatever cash payments, $x$, occur prior to default. Otherwise, the loan performs, and the lender gets back his principal 1 and interest $r$. Thus, the return function for the lender, $R(x)$, equals the minimum of $c + x$ and $1 + r$. This is depicted in Figure 1. Note the crucial value of $x = 1 + r - c$; at this value, a loan is just on the verge of performing.

Now if $x$ were certain it would be an easy matter for the bank to rank loans: good loans perform, bad loans do not. In most cases, however, $x$ is random. Indeed, the randomness of $x$ is typically contingent on the remaining four features: farm management, the borrowing farm's repayment ability, market conditions, and loan purpose.

Let $z_1 =$ management capability of the borrowing farmer; $z_2 =$ repayment ability of the farmer; $z_3 =$ market conditions facing the farmer; $z_4 =$ compliance of the loan with the lender's loan policy. The conditional probability relationship for $x$ given levels of the $z$'s will be denoted by $f(x/z_1,z_2,z_3,z_4)$. The $z$'s are measured in such a way that an increase in any $z$ should shift the conditional probability to the right. Better farm management, for instance, should raise the probability that a loan will perform. This is depicted in Figure 2. To avoid trivialities, we assume that there is always some probability of non-performance. Denoting by $F(x/z_1,z_2,z_3,z_4)$, the cumulative probability distribution, then, $1 > F(1+r-c/z_1,z_2,z_3,z_4) > 0$. 
To simplify the notation, let $Z$ represent the vector consisting of the 4 $z$'s. If $Z'$ is greater than $Z$ in at least one component, and at least as great
as \( Z \) in all components, then \( F(x/Z) < F(x/Z') \), where \( F \) is the cumulative conditional probability function. For example, in Figure 2, \( F(x_0/Z) \) is positive, while \( F(x_0/Z') \) is zero.

Finally, the attitude of the lender towards risk must be considered. If the lender's utility function is linear, \( U(R) = R \) for return \( R \), then the lender is risk-neutral. The expected utility of a loan to a risk-neutral lender \( E(R/Z) \) is given by:

\[
E(R/Z) = \int_0^{1+r-c} (c+x)f(x/Z)dx + \int_{1+r-c}^{\infty} (1+r)f(x/Z)dx
\]

The first term on the right-hand side of (1) is the expected value of the collateral, that is, the collateral times the probability of collecting the collateral when the loan does not perform. The second term is the expected default value of the farm project, given that the project does not perform as a loan and hence the lender collects all the proceeds prior to default. The third term is the expected value of the loan, given that it does perform, that is the principal plus interest times the probability of receiving them.

Mathematically one can show that increases in any of the 6 features increase the expected return to the lender; that is

\[
\frac{\partial E(R/Z)}{\partial y_i} > 0 \text{ for } y_i = c, r, z_1, z_2, z_3, z_4.
\]
This is illustrated by a special case in the Appendix.

**Empirical Methodology**

As specified in the previous section, the agricultural lending officer examines multiple attributes of a potential farm loan. In this evaluation process, the relationships among the attributes and their effects on loan desirability are complex as shown in Equation 1. An important question, therefore, in the analysis of the loan evaluation process concerns the relative effects of various criteria on the loan application and the degree to which tradeoffs are made among criteria by the agricultural lending officer.

Due to the complexity of the lender's expected utility function (1), it is difficult for the loan officer to express it directly. Consequently, an appropriate methodology used in this study is conjoint measurement, which concerns the modeling of utility-based decisions. Conjoint measurement procedures are designed to decompose an individual's utility responses to multiattribute stimuli so that the effects of stimulus attributes on the ultimate decision can be analyzed.2

The development of the critical loan variables, as specified in the previous section, was based on existing literature and interviews with senior lending personnel. These variables and their respective treatment levels are shown in Table 1.

Considerable research (Barry, Baker and Sanint; Hanson and Thompson; Patrick and Eisgruber) has examined farm management ability. Capable management is obviously preferred. Those areas of farming that have exhibited a vulnerability to cyclical fluctuations in demand, such as live cattle and hogs, are likely to be less attractive to the lender than those with greater stability.
Loan purpose also exerts an influence on the evaluation process. Banks maintain both external and internal loan policies. A typical external policy is to focus on economically productive loans which promote growth and viability in the bank's agricultural market area. This external goal is supplemented by internal objectives which include the generation of a loan portfolio that is not only profitable but also is consistent with the bank's overall strategy. Since banks are not observed to be single period profit maximizers, a productive loan can be considered as one in which a long-term profitable relationship with a borrowing farmer is established or maintained.

Repayment of principal is defined in terms of the ability of the borrowing farmer to meet his debt service requirements which include both interest and principal. Gabriel and Baker employ a similar definition when examining financial risk and how it is affected by changes in business risk. Repayment ability has been examined within more restrictive analytical models (Hanson and Thompson; Sonka, Dixon and Jones). Specific repayment alternatives are more likely affected by the nature of the farmer's financing need. The many alternative borrowing farm situations are difficult to assess effectively and hence are not tested in this study. Therefore, a more general definition is employed.

All-in-yield terms, which include both the base rate, as well as possible, compensating balances, and required collateral compose the pricing component of the decision process. Compensating balances may be considered as part of the loan-price vector even though they are virtually non-existent in agricultural lending. Finally, the excess of the market value of pledged security over the loan amount, coupled with the liquidity of the collateral, determines the lender's margin of safety in case of default. Attractive collateral must first be liquidated quickly without depressing prices. In addition, the greater the
fluctuation in its market value, the less desirable is collateral to the lender. Therefore, preference would be for greater liquidity and certainty of value.

Each attribute was measured on three levels (see Table 1), resulting in a total of 27 combinations based on a fractional factorial design (see Addelman). The fractional factorial design was constructed so that all two-way interaction effects among price, management, and collateral could be estimated. The remaining interaction terms were confounded.

The six-attribute preference model related to the fractional factorial design is as follows:

$$U_{miprcy} = \bar{X} + M_m + I_i + P_p + R_r + C_c + Y_y + M_Y y_m + M_C c_y + Y_C y_c$$ (3)

where $U_{miprcy}$ = overall utility the respondent derives from the alternative that is characterized as having levels $m, i, p, r, c, y$ for attributes $M$ (management), $I$ (industry market conditions), $P$ (loan purpose), $R$ (repayment), $C$ (collateral), and $Y$ (all-in-yield pricing). $\bar{X}$ equals the mean utility of the set of alternatives. The remaining variables measure the effect of each of the loan attributes. For example, $M_m$ refers to the main part-worth of level $m$ of variable $M$. The last three terms measure the respective interaction part-worths. For example, $M_Y y_m$ reflected the $M$ by $Y$ interaction part-worths.

OLS regression with effects coding, which is similar to dummy variable regression procedures for conjoint analysis, has been described in detail by Moore. For each attribute, coded vectors similar to dummy variables are formed except that the coding is 1, 0, -1. For each coded vector, category membership is identified by assigning 1's with all others (except the last category) being assigned 0's. The last category is assigned -1's. Since each
factor has 3 levels in this study, 2 effect coded vectors are used to represent each factor.

The regression equation corresponding to the conjoint measurement model in equation (3) is:

\[ Y = \beta_0 + \sum_{i=1}^{12} \beta_i X_i + \beta_{13} X_1 X_9 + \beta_{14} X_1 X_{10} + \beta_{15} X_2 X_9 + \beta_{16} X_2 X_{10} + \beta_{17} X_1 X_{11} + \beta_{18} X_1 X_{12} + \beta_{19} X_2 X_{11} + \beta_{20} X_2 X_{12} + \beta_{21} X_9 X_{11} + \beta_{22} X_9 X_{12} + \beta_{23} X_{10} X_{11} + \beta_{24} X_{10} X_{12} \]  

where \( \beta_0 = \bar{X} \) (the mean utility of the set of alternatives) and the \( x \)'s represent the treatment effects of the effects coded attributes.\(^5\)

Using effects coding, \( \beta_0 \) in equation (4) equals the grand mean of the dependent variable. Each of the slope variables is equal to the deviation from the mean of the group assigned 1's in the vector with which it relates to the grand mean. Therefore, each of these coefficients reflects a treatment effect or part-worth. Due to the need to use a fractional factorial design, the tested interaction effects in equation (3) were among the yield and collateral terms and the management variable as a summary measure of the credit consideration. To test whether non-zero interactions are sufficiently large to be attributed to other than random fluctuation is determined by using the standard hierarchical F-test of the significance of the increase in \( R^2 \) due to the inclusion of the interaction terms in the estimate. If the increment over the main effects component of the model in the proportion of variance accounted for by the interaction is not significant, it is sufficient to examine the main effects.
Empirical Analysis

A. Sample and Measurement Procedure

A total of 44 agricultural lending officers from 39 midwestern banks of varying size and location were selected to participate in this study. The tests were conducted by mailing the card deck representing the 27 loan situations to each of the loan officers along with instructions regarding the required task.

All 44 subjects were given an identical deck of cards containing descriptions of hypothetical loans in terms of the six attributes, which were based upon the fractional factorial design.

The frame of reference to be used by the loan officer was that an application for an agricultural loan was being considered.

The subjects were told that the hypothetical loans differed only with respect to the 6 attributes and were identical in all other factors. Based on previous research, these other conditions include loan size, maturity, bank portfolio conditions, and whether the borrowers were existing versus new customers.

The subjects were instructed to sort the cards in order of preference from the most preferred loan situation to the least preferred loan situation. Standard sorting instructions were given to the subjects.

B. Aggregate Results

Based on equation (4), OLS regression was used to estimate the aggregate utility model. These pooled regression results are presented in Table 2. With an $R^2$ of .743 for the main effects model, the explanatory results indicate a highly acceptable amount of homogeneity among the participants. All of the main effects coefficients are significant at the .01 level. Furthermore, none of the two-way interactions among management collateral and price are statistically significant. Consequently, only the main effects are interpreted and discussed.
Using the coefficients for equation (4), the part-worths of equation (3) can be calculated. Table 3 shows the resulting part-worths and aggregate utility functions. Both the relative magnitude and direction of the aggregate functions can be observed.

The direction of the utility functions are consistent with expectations as specified. However, the results also suggest that the participating lending officers tended to weigh more heavily the negative influence of all the decision variables. For example, it appears that poor farm management has a greater negative influence on the loan decision than the opposing effect of good management. Such results could reflect organizational factors generally applicable to banking. First, the default of a major loan is more costly than the opportunity cost of denying a good loan. Less obvious, but probably equally as important, career rewards and penalties for agricultural lenders may be asymmetrically biased toward the avoidance of problem loans. If so, the loan officer would attempt to avoid mistakes even though possibly excellent loan prospects may be denied. Third, given the limited return for loans tied only to a debt rate, the loan officer must find a means to reject loan applications; thus, a negative variable takes on additional importance. Also, given that a majority of the information from the farm borrower is positive, a negative factor takes on added importance. Finally, avoiding non-productive loans is a prime item on a good amount of agricultural loan officers' experience and training. Such training may enforce a better understanding of denying loan applications than accepting them. While these reasons have not been empirically validated, they are consistent with the role of negative information in other negotiating contexts.

The range of the part-worths for each attribute can be interpreted as an index of the relative importance of the attribute as a determinant of the
utility of the stimuli. Examination of the part-worth ranges in Table 3 indicates the farm management variable is the most important attribute although it is not dominant. Repayment assurance and collateral are next in the influencing of the preference of the loan officers for specific credit situations. Both loan policy and yield are considerably less important.

The relative magnitudes of the part-worths can be examined in terms of potential backoffs in the loan decision. For example, the influence of poor management can be offset by high repayment assurance and collateral. However, conversely, excellent management is not enough to compensate for insufficient evidence of good repayment ability and collateral. The nature of these relationships confirms the lack of importance of pricing in this decision process. The role of yield has little influence on the outcome of individual decision processes, which is similar to the conclusion reached by Barry, Baker and Sanint. Finally, market condition is the least important decision variable. While stability of the agricultural market is preferred, the results suggest that the current state of the agricultural market was not important in how the loan officers ranked the remaining decision variables.

Summary

The principal interest of this paper has been to examine the agricultural lending process using a more complete set of decision variables. The empirical testing of a model of a lender's multiattribute utility function confirmed the hypothesized relationships. Furthermore, the main effects model was sufficient to explain the decision process.

Two specific results are pertinent to future research into this process. First, the role of management which had been examined in more restrictive models
in previous research is confirmed by the results of this study. However, important insight is provided into the interaction among a more complete set of decision variables for agricultural lending than is normally accorded in agricultural finance texts. In this context, there was a lack of responsiveness of loan interest rate to varying levels of the credit risk considerations. These results could be explained by a combination of plausible reasons. Given the strong influence of other decision variables such as farm management ability and repayment potential, the interest rate is locked in. Furthermore, the range of yield alternatives is relatively narrow. While yield may have been more of a factor in the decision if the range was wider, competition among financial institutions tends to restrict such a range. Second, loan officers appeared to have placed a greater emphasis on the negative effect of these variables which suggests a prior inclination to deny the farm loan application. While several reasons for this were suggested, this remains an area of future research.
Footnotes

1. Obviously, if the lender's utility function is strictly concave, and $U(R)$ exhibits a positive but diminishing marginal utility, risk aversion can be illustrated. However, even with this alternative function, it continues to be explicitly conditional of $Z$ and implicitly on $c$ and $v$.

2. Recent empirical research indicates conjoint measurements are characterized by high predictive utility and measurement stability (for example, see Moore).

3. A fractional factorial design was necessary to make the number of treatment combinations small enough to be manageable. A full factorial design would have consisted of $3^6$ or 729 combinations.

The loan officers' preference ratings consisted of rank order judgments. The dependent variable, therefore, was measured on an ordinal scale. Recent evidence indicates metric analysis of variance or ordinary least squares (OLS) regression procedures are robust in conjoint measurement applications. Consequently, ordinary least squares (OLS) regression analysis using effects coding was used to estimate the part-worth functions in this study.

4. As recommended by Blom, the rank order data for the dependent variable were normalized by means of a probit transformation. This transformation results in the rectangular rank order frequency distribution being converted to a more bell-shaped frequency distribution. The probit transformation equation used was (Blom):
\[ P_i = \frac{R_i - 3/8}{n + 1/4} \]

where:

- \( P_i \) = Probit transformation of the \( i \)th rank
- \( R_i \) = Inverse cumulative normal function
- \( R_i \) = The \( i \)th rank with 27 representing the first choice
- \( n \) = Number of stimuli ranked (\( n=27 \))

5. The variables \( x_1 \) through \( x_{12} \) are defined as follows:

\[
\begin{align*}
    x_1 &= M_2 \\
    x_2 &= M_3 \\
    x_3 &= I_2 \\
    x_4 &= I_3 \\
    x_5 &= P_2 \\
    x_6 &= P_3 \\
    x_7 &= R_2 \\
    x_8 &= R_3 \\
    x_9 &= C_2 \\
    x_{10} &= C_3 \\
    x_{11} &= Y_2 \\
    x_{12} &= Y_3
\end{align*}
\]

The treatment combinations are effect coded which results in two coded vectors per attribute. For example, \( x_1 \) and \( x_2 \) are used to reflect the \( M \) treatment levels where:

- \( x_1 = 0 \) and \( x_2 = 1 \) to represent \( M_3 \) treatment level.
- \( x_1 = 1 \) and \( x_2 = 0 \) to represent \( M_2 \) treatment level.
- \( x_1 = -1 \) and \( x_2 = -1 \) to represent \( M_1 \) treatment level.

6. In pooled conjoint measurement, the response data are pooled across respondents and one aggregate utility estimate is obtained. If all the respondents evaluate identical stimulus objects, this pooled estimate can be interpreted as an average utility estimate for the group. A potential shortcoming of this procedure, however, is the "majority fallacy", which is caused by heterogeneity of individual responses. However, when the group to be aggregated is relatively homogeneous, the predictive validity problem is reduced considerably (Moore). Since the primary purpose of this study involves the
question of how commercial lending officers in general evaluate loan applications, and since this group represents a relatively homogeneous group of decision makers, aggregate conjoint analysis procedures were used. The question of a potential "majority fallacy" was examined by evaluating the coefficient of determination of the estimate, by testing the predictive validity of the model for a sub-group of the respondents, and by examining subsample multiattribute utility function differences.

7. The predictive validity of the model was tested by using the aggregate model to calculate predicted utilities (predicted probit values) of the nine stimulus profiles ranked by each respondent in the re-test. For each individual, these predicted utilities were correlated with the actual utilities (actual probit values were calculated by assuming the top ranked card had an ordinal value $R_1$ of 27). The average of the 23 correlation coefficients, which was calculated using standard $Z$-transformation procedures, compares favorably with previous research concerning the predictive validity of multiattribute models (Moore [26]).
References


Appendix

Let $f(x/z)$ be a uniform density, with only changes in a single one of the $z$'s being considered. In particular

$$f(x/z) = \frac{1}{1+a} \text{ for } z \leq x \leq 1+a+z,$$

$$0 \text{ otherwise.}$$

Then $F(x/z) = 0$ for $x < z$

$$\frac{x-z}{1+a} \text{ for } z \leq x \leq 1+a+z$$

$$1 \text{ for } 1+a+z < x.$$

Computing the expected return according to (1), we have

$$E(R) = \frac{1+r-c}{1+a} + \int_{z}^{1+r-c-z} \frac{x}{1+a} \, dx + (1-\frac{1+r-c-z}{1+a})(1+r) = (2)$$

$$\frac{(1+r)^2 - (z+c)^2}{2(1+a)} + (1-\frac{1+r-c-z}{1+a})(1+r).$$

Taking derivatives with respect to $c$, $r$, and $z$, we have

$$\frac{\partial E(R)}{\partial c} = \frac{1+r-c-z}{1+a} > 0$$

$$\frac{\partial E(R)}{\partial r} = \frac{a+c+z-r}{1+a} > 0$$

$$\frac{\partial E(R)}{\partial z} = \frac{1+r-c-z}{1+a} > 0,$$

thus verifying (2) in this case.


<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision Variables for Agricultural Lending Model</td>
</tr>
</tbody>
</table>

1. Borrowing Farm’s Management

- **High Character and Ability**
- **Average Character and Ability**
- **Low Character and Ability**

2. Industry Market Conditions

- **High Rate of Change**
- **Average Rate of Change**
- **Low Rate of Change**

3. Loan Purpose

- **Highly Productive Loan—Full Compliance with Loan Policy**
- **Average Productive Loan—Full Compliance with Loan Policy**
- **Speculative Loan—Marginal Compliance with Loan Policy**

4. Repayment

- **Highly Assured Source of Repayment—Good Track Record**
- **Average Assurance of Source of Repayment—Average Track Record**
- **Uncertain Source of Repayment—No Track Record**

5. Collateral

- **Highly Liquid with Certain Value**
- **Average Liquidity and Average Certainty of Value**
- **Illiquid and Uncertain Value**

6. Pricing (all in yield)

- **Prime Plus 4 Points**
- **Prime Plus 2 Points**
- **Prime**
### Table 2
Multiple Regression Results

<table>
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<tr>
<th>Explanatory Variables</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
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<td>$X_1$</td>
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<tr>
<td>$X_9X_{12}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$X_{10}X_{11}$</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>$X_{10}X_{12}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td>270.50687</td>
<td>1163</td>
<td>.2326</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1076.5408</td>
<td>1187</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R² (Main Effects Model) = .74279
R² (Full Model) = .74873

<sup>a</sup>p < .01

<sup>b</sup>Twenty-seven observations were obtained from each respondent resulting in a total of 1188 observations.
Table 3: Part-Worth Estimates

<table>
<thead>
<tr>
<th>Equation(4) Explanatory Variables</th>
<th>Partial Regression Coefficient</th>
<th>MAIN EFFECTS</th>
<th>Part-Worths</th>
<th>Part-Worth Range</th>
<th>Importance Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(X_1)</td>
<td>0.117</td>
<td>5.864</td>
<td>-.732(M(_1))</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>(X_2)</td>
<td>0.615</td>
<td>30.888</td>
<td>0.117(M(_2))</td>
<td>1.347</td>
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<tr>
<td>Market Variables</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(X_3)</td>
<td>0.004</td>
<td>0.190</td>
<td>-.105(l(_1))</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>(X_4)</td>
<td>0.101</td>
<td>5.094</td>
<td>0.004(l(_1))</td>
<td>0.206</td>
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<tr>
<td>Purpose Variables</td>
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</tr>
<tr>
<td>(X_5)</td>
<td>0.178</td>
<td>8.942</td>
<td>-.387(p(_1))</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>(X_6)</td>
<td>0.209</td>
<td>10.500</td>
<td>0.178(p(_2))</td>
<td>0.596</td>
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<tr>
<td>Repayment Variables</td>
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<tr>
<td>(X_7)</td>
<td>0.084</td>
<td>4.230</td>
<td>-.543(R(_1))</td>
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<td>2</td>
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<tr>
<td>(X_8)</td>
<td>0.459</td>
<td>23.060</td>
<td>0.084(R(_1))</td>
<td>1.002</td>
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<tr>
<td>Collateral Variables</td>
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</tr>
<tr>
<td>(X_9)</td>
<td>0.101</td>
<td>5.067</td>
<td>-.422(C(_1))</td>
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<tr>
<td>(X_{10})</td>
<td>0.321</td>
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<td>0.101(C(_2))</td>
<td>0.743</td>
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<tr>
<td>Yield Variables</td>
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</tr>
<tr>
<td>(X_{11})</td>
<td>0.061</td>
<td>3.044</td>
<td>-.145(Y(_1))</td>
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<tr>
<td>(X_{12})</td>
<td>0.084</td>
<td>4.207</td>
<td>0.061(Y(_2))</td>
<td>0.229</td>
<td></td>
</tr>
</tbody>
</table>

aPart-Worth Values: The part-worth values corresponding levels two and three of each attribute are equal to the partial regression coefficients corresponding to each of those attribute levels. The part-worth values for the level one of each attribute are calculated as follows: \(M_1=-(M_2+M_3)\); \(I_1=-(I_2+I_3)\); \(P_1=-(P_2+P_3)\); \(R_1=-(R_2+R_3)\); \(C_1=-(C_2+C_3)\); \(Y_1=-(Y_2+Y_3)\).