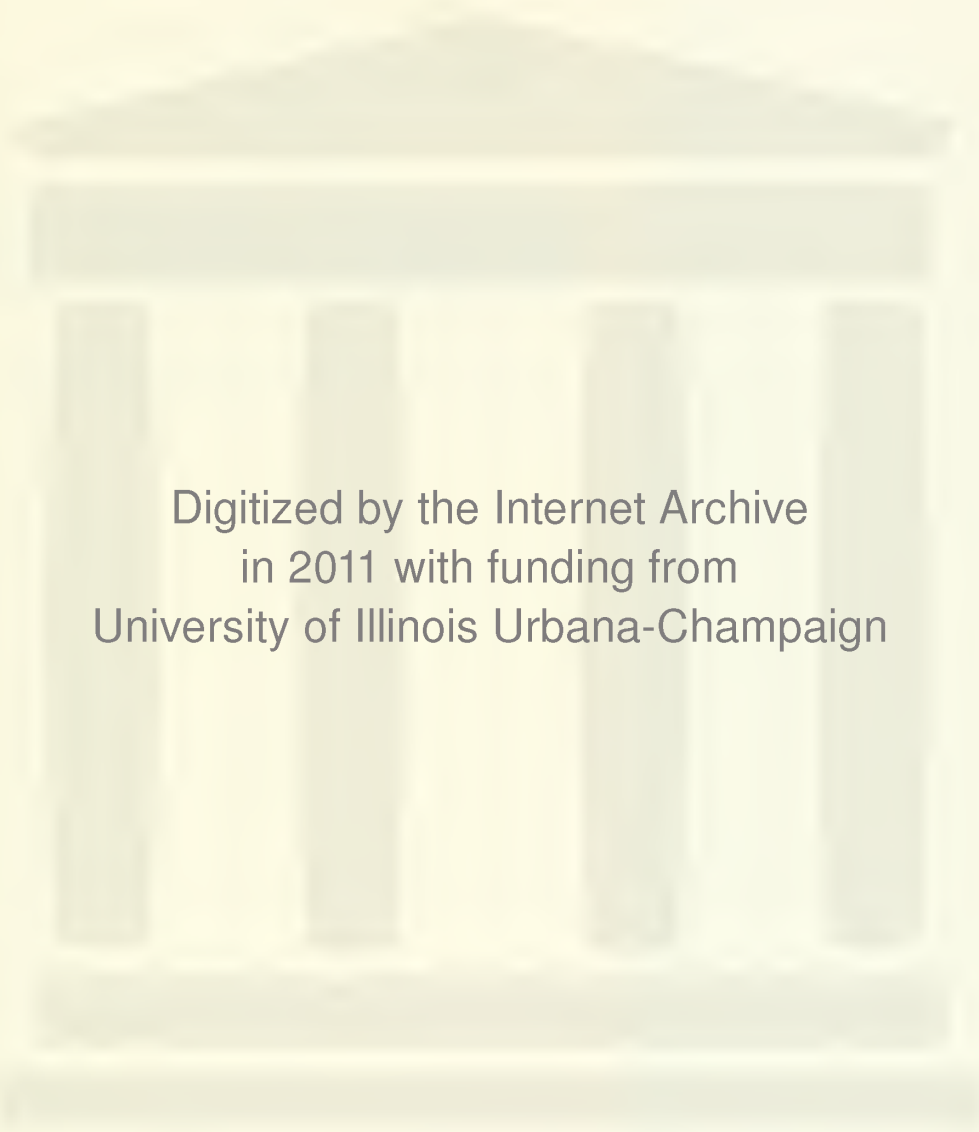

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A Commercial Loan Risk Classification System

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ABSTRACT

Cash flow components are used in a statistical model to predict loan risk ratings. The risk ratings were assigned by a large regional bank staff. In general, the statistical model tended to underestimate the risk ratings of the low risk loans and to overstate the ratings of the higher risk loans. The predictive accuracy of the statistical model was tested using a holdout sample. Using cash flow components and qualitative information, the model was 64 percent accurate in predicting the loan ratings assigned by the bank. Additionally, 98 percent of the predicted ratings were either correct or within one rating class of the actual rating when the second highest probability was the correct rating.

A COMMERCIAL LOAN RISK CLASSIFICATION SYSTEM[1]

The purpose of this study is to provide a research based educational reference to aid lending officers, credit analysts and loan review committee members to understand and evaluate expert systems that are designed to classify loan applicants. The study is subdivided into two phases. Phase I uses cash flow components in a polytomous probit model to develop a loan risk classification system. Phase II uses information learned in Phase I to create an educational version of an expert system that evaluates the risk characteristics of commercial loan applicants. This paper is designed to provide an overview of the progress that has been accomplished in Phase I.

One objective of the paper is to review the loan risk classification literature which serves as a basis for the findings presented in this paper. A second objective is to present a cash flow model that provides the inputs used in a statistical classification system. The third objective is to present and interpret the results of an empirical study that classifies and predicts the risk ratings of industrial commercial loans.

LITERATURE

Orgler [1970] developed a multiple regression model for classifying loan risk. The objective of the model was to use one financial ratio, net working capital/total current assets, and five dummy variables to predict if bank examiner ratings of a loan are good, bad or marginal. The dummy variables related to each loan were: (1) unsecured or secured, (2) past due or current in payment, (3) clean

audit opinion or not, (4) net loss or net profit and (5) criticized or not criticized by the examiner in the last period. The model quite accurately predicted the ratings of 56 of the 59 good loans correctly; was reasonably accurate in predicting marginal loans, 123/135, and not too accurate for bad loans, 60/106. Haslem and Longbrake [1972] were critical of Orgler using outside examiner ratings rather than using the rating of an insider, such as the lending officer. Also Haslem and Longbrake objected to the use of past information to explain a current rating. However, they did not offer an alternative.

The two recent loan risk classification studies are by Dietrich and Kaplan (DK) [1979] and Marais, Patell and Wolfson (MPW) [1984]. An objective of these studies is to develop statistical models for classifying loan risk that are based on accounting information. Both studies developed polytomous probit models which generated conditional probabilities for determining the risk rating of each loan.

The DK analysis was based on 140 companies whose financial data were on Compustat. Of the 140 companies used in determining the parameters, approximately 78 percent (109/140) were classified by the bank as being current, Category I, which means normal acceptable banking risk as defined by the Office of the Comptroller of the Currency (OCC). They found three variables--debt/equity, fixed charge coverage and number of consecutive years of sales decline--classified 85 percent of all loans correctly. However, they found the loans not rated current by the bank were correctly classified less than 60 percent of the time, while the classification accuracy of the Category I loans was 93 percent. A validation test provided similar test results.

The study by MPW was based on financial data from 205 public companies and 716 private companies. They started with 20 financial variables and six nonfinancial variables for the public firms. Although approximately 93 percent of all loans were classified correctly, 90 percent of the total sample were initially rated as Category I loans by the bank staff. The results showed the misclassifications as being relatively high for loans rated other than Category I.

An empirical research project by von Stein and Ziegler [1984] focused on the prognosis and surveillance of corporate credit risks. The authors used both quantitative and qualitative measures. They presented a three part approach that incorporated an early warning system, an evaluation of a bank-accounts information system and a system to assess the management.

Other authors have made contributions that were tangential to the loan risk prediction models. Altman [1980, 1985] has written extensively in relation to the commercial lending process, credit scoring and the costs of errors in lending. Dickerson [1987] and Kehlbeck [1980] made substantive contributions to the loan review process and the grading of commercial loans. Recently Udell [1989] focused on the use of the loan review process as an agency cost issue. He contrasted the loan review process as being an early warning system vis-a-vis acting as a system to monitor loan officers performance. Lev [1989] has synthesized the research related to the usefulness of earnings that has direct implications to financial statement analysis. Foster [1986] has a chapter devoted to loan risk classification where he evaluated the research related to the topic.

The lessons from the literature on loan risk classification highlight a few dimensions. First, because public data sources are readily available, there are a large number of studies that predict bankruptcy and bond ratings. However, there are only a few loan risk classification studies because loan information and data are private. Second, the accuracy in predicting the rating of low risk, Category I, type loans is quite high, but the models are only modestly successful in predicting the ratings of higher risk loans. Third, the studies all commented on the need to use both quantitative and qualitative information in the prediction process. Finally, the financial information used was primarily balance sheet and income statement based ratios and only a few funds flow measures were included.

A REVISED CASH FLOW MODEL

One of the most useful financial tools for analyzing the performance of management is the statement of cash flows. The cash flow model integrates accounting information from the balance sheet and the income statement, and it provides a unique interpretation of the allocation of a firm's resources. The cash flow statement is a basic financial analysis tool for evaluating the performance of management related to the strategic use of corporate resources. The cash flow analysis reflects the subtleties and nuances of management trade-offs, and it provides chronological benchmarks for measuring and judging management effectiveness.

In 1972 Erich Helfert developed a unique format for presenting a funds flow statement. The Helfert technique integrates balance sheet

and income statement variables and subdivides the funds flow into three natural decision areas of management. These three resource decisions are investment, operations, and financing. The Helfert technique closely resembles the FASB 95 Statement of Cash Flows which utilizes the direct method for reporting operating cash receipts and disbursements.

The statement of cash flows presents a summary of changes in the financial position of the firm between two time periods. It is widely used by corporate executives, credit analysts, investors, and other outside parties to evaluate the financial changes occurring in a firm and to identify the trend of major cash receipts and payments. It is computed by measuring changes in each of the balance sheet items between two periods and using the income statement items for the period under study.

After extensive use of the Helfert funds flow analysis statement, we restructured it to have 12 major components. These 12 cash flow components are operating, receivables, inventories, other current assets, payables, other current liabilities, financial, fixed coverage expenditures, investment, dividends, other asset and liability flows, and change in cash and marketable securities. A net flow is determined for four of the components, namely operating, other assets and liabilities, financing, and investment. A cash inflow has a positive sign and a payment has a negative sign. The algebraic sum of the components are equal to the change in cash and marketable securities. The revised format for the cash flow analysis and the acronyms for each variable are presented below.

Operating Flows

	Inflows	(OI)
minus:	Outflows	(OO)
equals:	Net Operating Flow	(NOF)

Working Capital Components (WCC)

Determine if each WCC is either an inflow or outflow:

	Inflow (I)	Outflow (O)
ARF	ARFI	ARFO
INVF	INVFI	INVFO
OCAF	OCAFI	OCAFO
APF	APFI	APFO
OCLF	OCLFI	OCLFO

Other A&L Flows

	Inflows	(OA&LI)
minus:	Outflows	(OA&LO)
equals:	Net Other A&L Funds Flow	(NOTHER)

Financial Flows

	Inflows	(FI)
minus:	Outflows	(FO)
equals:	Net Financial Flow	(NFF)

Investment Flows

	Inflows	(II)
minus:	Outflows	(IO)
equals:	Net Investment Flow	(NIF)

Dividend Outflows (DIV)

Fixed Coverage Expenditure Outflows (FCE)

Net Inflow (-) or Net Outflow (+)
Sum of the above cash flow components

minus: Change in Cash (CC)
(Ending Cash-Beginning Cash,
where a - = Outflow and a + = Inflow)

equals: zero

The interrelationship among the components is complex, therefore, equation (1) is presented in a sources and uses format of a most likely case. Excepting changes in cash and marketable securities, a source (S) would be a positive number and a use (U) would be negative.

$$\begin{array}{cccccccccc} NOF_t & + & ARF & + & INVF & + & OCAF & + & APF & + \\ + & & - & & - & & - & & + & \\ (S) & & (U) & & (U) & & (U) & & (S) & \end{array}$$

$$\begin{array}{cccccccc} OCLF & + & NFF_t & + & FCE_t & & & \\ + & & + & & - & & & \\ (S) & & (S) & & (U) & & & \end{array}$$

$$\begin{array}{cccccccccc} + & NIF_t & + & DIV_t & + & NOTHER_t & - & CC_t & = & 0 \\ & - & & - & & - & & + & & \\ & (U) & & (U) & & (U) & & (S) & & \end{array} \qquad (1)$$

Cash Flow Components

Exhibit 1 presents the percentage contribution each cash flow component makes to the total cash flow. The percentage contribution of each component is based on the concept that the sum of the inflows equals the absolute value of the sum of the outflows. The revised cash flow model is based on the overall accounting relationship that results in the sum of flows being equal to zero as shown in equation (1).

The percentage contribution is calculated by dividing each component by the total cash flow (TCF), which is equal to either the total inflow (TI) or the absolute value of the total outflow (TO). The total inflows of $90 million equals the absolute value of the total outflows as shown in Exhibit 1. Each inflow and outflow component is divided by $90 million. For example, the net operating cash flow contributed 44.4 percent of the total inflows, while net investment cash flow composed 42.2 percent of the total outflows. Exhibit 1

presents the percentage contribution of each of the 12 components. The contribution of each component takes on special interpretative significance when a time series of each component is developed over several periods. The stability and level of contribution reflects the results of management decisions.

Summary of Key Relationships

In evaluating management performance with cash flow components, a hierarchy of relationships emerge. First, a basic economic relationship is the investment coverage ratio (ICR), which is the number of times that net operating inflows cover capital investment outflows. The higher the ICR the stronger the financial health of a company. In equation form[2]

$$\frac{NOF/TNF}{|NIF/TNF|} = ICR. \qquad (2)$$

The size of the cash outflow going to discretionary expenditures is another fundamental economic relationship. The discretionary coverage ratio (DCR) is

$$\frac{NOF/TNF}{\left|\frac{NIF}{TNF} + \frac{DIV}{TNF}\right|} = DCR. \qquad (3)$$

The higher the DCR the stronger the financial health of a company.

A third important relationship in measuring financial health with cash flow components is the discretionary and fixed coverage expenditures ratio (DFCER). The DFCER measures the number of times net operating inflows cover the cash outflows to discretionary and fixed coverage expenditures. That is,

$$\frac{NOF/TNF}{\left|\frac{(NIF)}{TNF} + \frac{(DIV)}{TNF} + \frac{(FCE)}{TNF}\right|} = DFCER. \qquad (4)$$

Free cash flow (FCF) is a concept widely used in financial valuation models and it is closely related to the DFCER coverage ratio. By definition FCF before net investment in working capital components is net operating cash flow minus net capital investment, dividends and fixed coverage expenditures, i.e., FCF = NOF - (NIF+DIV+FCE). A FCF coverage ratio is the equivalent of DFCER. That is

$$\frac{FCF/TNF}{\left|\frac{NIF}{TNF} + \frac{DIV}{TNF} + \frac{FCE}{TNF}\right|} + 1 = \text{FCF coverage before working capital} = DFCER \qquad (5)$$

The FCF coverage ratio is shown as free cash flow (before working capital) in Exhibit 2. Naturally, the larger the free cash flow coverage ratio before working capital investment the lower the financial risk and vice versa.

The next level of coverage in the hierarchy is free cash flow coverage after working capital. Experience shows that some working capital components are users of cash while others are suppliers of cash. The free cash flow coverage ratio after working capital incorporates the five working capital (WC) components in the denominator. The FCF coverage ratio after working capital is defined in 6.

$$\frac{FCF/TNF}{\left|\frac{NIF}{TNF} + \frac{DIV}{TNF} + \frac{FCE}{TNF}\right| + \Sigma\frac{WC\ OUTFLOWS}{TNF} - \Sigma\frac{WC\ INFLOWS}{TNF}} + 1 = \text{FCF after working capital.} \qquad (6)$$

The FCF coverage ratio is shown as free cash flow (after working capital) in Exhibit 2. The larger the free cash flow coverage ratio after taking the commitment to working capital into account the lower the financial risk and vice versa.

Finally, the strongest financial health position occurs when the total coverage ratio (TCR) equals 1. That happens when net operating cash inflows cover the expenditures for the 11 remaining outflow components. Specifically,

$$\frac{\text{NOF/TNF}}{\left|\left(\frac{\text{NIF}}{\text{TNF}}\right) + \left(\frac{\text{DIV}}{\text{TNF}}\right) + \left(\frac{\text{FCE}}{\text{TNF}}\right) + \ldots + \left(\frac{\text{CC}}{\text{TNF}}\right)\right|} = \text{TCR}. \qquad (5)$$

Companies that experience large total coverage ratios are generally recognized as being the leading competitor within their industry, e.g., IBM, R. R. Donnelley or Procter and Gamble. Conversely, companies with a small TCR are generally in a financially weak position.

Exhibit 2 presents a brief example of the cash flow coverage ratios for five different hypothetical companies. The example companies are arranged according to financial risk, with Company A having the lowest risk characteristics and Company E having the highest risk characteristics. Company A is an example of a firm that is a recognized industry leader and has a strategic competitive advantage over its industry rivals. The net operating cash flows represent 100 percent of all cash inflows. Company A's strong financial position shows in all of its coverage ratios from investment to total coverage. In contrast the cash flow measures and the coverage ratios in Exhibit 2 portray Company E as a firm that is in a weak position both competitively and financially.

Analyzing the chronological trend of the cash flow components and evaluating the hierarchy of their interrelationships provide financial analysts a solid basis for interpreting the financial health of a firm. In turn the flows reflect the success of management strategies and policies during the period of analysis.

DATA ACQUISITION

The acquisition of the data started when a large regional bank agreed to share balance sheet and income statement data for a large sample of industrial companies with whom they had an ongoing lending relationship. The bank provided complete annual data for 44 companies for the period 1985-1986 and complete annual data for 103 companies in 1986-1987. In addition to the accounting information, the bank provided a loan risk ranking for each firm. These rankings fell into one of five categories, with category one being the lowest risk level and category five the highest risk. The data were provided on sheets of paper, therefore, it was necessary to prepare a computerized file for each company. In addition to the financial data, the bank provided qualitative information that indicated if the loan was secured or unsecured, guaranteed or not guaranteed, and the liquidity status of the collateral.

STATISTICAL TESTS

The balance sheet and income statement information for the 147 companies was used to determine the cash flow components for 44 companies in 1986 and 103 companies in 1987. The means and standard

deviations for each of the 12 cash flow components are presented in Exhibit 3.

Previous loan risk classification studies by Dietrich and Kaplan [1982] and Marais, Patell and Wolfson [1984], and bond rating classification studies by Kaplan and Urwitz [1979] and Gentry, Newbold and Whitford [1988] have utilized a polytomous probit technique to predict loan and bond ratings. Because probit has broad acceptance as a predictive model when several ratings are being studied, it is used in this study. Polytomous probit provides an estimate of the conditional probability that a firm is a member of each rating class. The conditional probabilities are based on the cash flow components and additional qualitative information for 1986, 1987 and 1986-1987 combined. The highest probability determines the predicted rating (PrPl) of the loan. When PrPl is the same as the actual bank rating, the loan is correctly classified by the model, (PrPl = PrA). When the probability of the predicted rating is greater than the probability of the actual bank rating (PrPl > PrA), there is a misclassification of the rating.

Initially, only cash flow components were used in the probit model to determine the ratings for each borrower. These ratings were compared to the actual bank ratings of the borrower. The objective of the test is to determine the accuracy of the cash flow components in classifying the loan risk rating. That is, does the model generate loan ratings that match the rating assigned by the bank staff? The probit coefficients for the cash flow components are reported in Exhibit 4 for 1986, 1987 and for 1986-1987 combined. The change in cash component was omitted from the analysis to avoid statistical

overidentification. The tests used 11 cash flow components and a scale measure, total cash flows/total assets (TCF/TA).

Several cash flow components were statistically significant in classifying the loan's risk class. Net operating cash flow and dividends were significant at either the .01 or .05 level of significance for all three periods. The fixed coverage expenditures component was significant at the .01 level for all three periods. The inventory component was significant at the .05 level of significance for the 1987 data.

The classification accuracy is reported in Exhibit 5 for the 1986 loans and in Exhibit 6 for the 1987 loans. Exhibit 7 shows the classification results when the 1986 and 1987 data are combined. The classification accuracy results were 56.82% in 1986, 61.16% in 1987 and 56.46% when 1986 and 1987 data were combined.

Interpretation of Misclassification

There is a distinct pattern of misclassification evident in Exhibits 5, 6 and 7. In 1986, for the lower risk loans, probit classified two of the three loans rated 1 by the bank staff as having a 2 rating and six of the 11 loans rated 2 by the bank were classified as 3s. In 1987 only one of the eight loans rated as 1 by the bank was correctly classified and none of the 14 loans rated 2 were correctly classified. In general the probit ratings of these loans were lower than the bank ratings. That is, the cash flow components indicated the financial based risks were greater than the risk class assigned by the bank staff.

The misclassification of the 3 rated loans is markedly smaller. In 1986, 17 of the 23 loans were correctly classified, while in 1987, 56 of the 60 loans were correctly classified. The misclassifications were about equally distributed on either side of the 3 rating. In both years the loans rated 4 by the bank were found to have a 3 rating by the probit model. In 1986 all five loans rated 4 by the bank were classified as 3s by the model, and 13 of the 19 loans in 1987 rated a 4 by the bank were classified as 3s by probit. The 5 rated loans in 1986 were correctly classified by probit, but two loans rated 5 in 1987 were rated higher by probit.

In general, the pattern that emerges is that when using cash flow components in a probit model, the actual ratings by the bank staff appear to overstate the rating of the lower risk loans and understate the rating of the higher risk loans. This type of misclassification was not observed in previous studies by DK or MPS because their samples did not contain a large proportion of higher risk loans. In an attempt to better explain the ratings, qualitative information on each loan was introduced into the analysis.

As noted earlier three qualitative pieces of information were provided by the bank for each loan. Each loan was shown to be either secured or unsecured, and either guaranteed or not guaranteed. Of the 147 loans, 44 were secured and the remainder unsecured. The liquidity of the collateral for the secured loans was also rated. The distributions of the collateral ratings are presented in Exhibit 8.

The qualitative factors were added as dummy variables to the cash flow components in order to determine if the classification accuracy

of a revised probit model would improve. These classification accuracy results are shown at the bottom of Exhibits 5, 6 and 7. There was a substantive increase in the classification accuracy for the 1986 data, that is from 57 percent to 75 percent. The classification accuracy increased modestly for the 1987 data and the combined 1986-1987 data.

The coefficients for these tests that included the qualitative factors are shown in Exhibit 4. The results in Exhibit 4 show the same cash flow variables were significant, and in 1986 the guarantee dummy variable was significant. Exhibit 9 provides the distributions of the guarantee/no guarantee variable by bank rating class. In 1986 Exhibit 9 shows the guaranteed loans are concentrated in the higher risk 3, 4 and 5 ratings and the nonguaranteed loans are concentrated in the lower risk 1, 2 and 3 rated loans. This distribution of the guarantee and no guarantee information resulted in improving the ability of the model to match the rating assigned by the bank staff.

The secured/unsecured dummy variable was significant in 1987 as shown in Exhihit 4. In 1987 Exhibit 10 shows the secured loans were concentrated in the 3, 4 and 5 ratings and the unsecured were concentrated in the 1, 2 and 3 ratings. This distribution of the secured and unsecured loans improved the ability of the probit model to match the ratings assigned by the bank staff from 61 percent to 63 percent, as shown in Exhibit 6.

When the data for 1986 and 1987 were combined, both the guarantee and the secured dummies were significant in classifying the loan risk class. The lower portion of Exhibit 10 shows the loans that were both

secured and guaranteed were heavily concentrated in the 3, 4 and 5 risk classification. It is apparent that these dummy variables add value to the understanding of the loan risk classification system. The liquidity of the collateral did not contribute to the analysis primarily because it was concentrated in the less liquid collateral categories as shown in Exhibit 8. Exhibit 11 shows that the qualitative information improved the accuracy of the ratings for 10 of the 1986-1987 loans. It also shows qualitative factors misclassified six loans and, the classification of six loans was improved, but not enough to match the ratings assigned by the bank staff.

Further analysis shows that the probit misclassification of the 1 and 2 rated loans was related to the dividend cash flow component. Exhibit 12 shows that there was a substantive difference in the cash outflow going to dividends for the 1 and 2 rated loans. In both rating classes the companies selected by the probit model were distributing a much higher percent of their total cash outflow to dividends than the companies rated 1 and 2 by the bank staff. For the 4 rated companies, Exhibit 12 shows a marked difference in the operating, investment and fixed coverage components. Unfortunately there are only four companies that probit determined as being rated a 4. Therefore, it is not possible to make a generalized observation concerning the differences between the 4 rated companies.

Prediction Results

A holdout sample technique was used to test the predictive accuracy of the probit model. The two samples of 147 companies were

combined and a random sample of 100 companies was selected. The cash flow components and the qualitative measures for the 100 companies were used to determine the probit model coefficients. These coefficients are used to predict the loan risk ratings of the 47 companies in the holdout sample. The coefficients are reported in Exhibit 13. The dividend component was significant at the .01 level in predicting the loan risk ratings. The higher the dividend components the lower the risk rating and vice versa. Likewise, the net operating flow (NOF), other current assets (OCA), and fixed coverage expenditures (FCE) were significant at the .05 level. The higher the net operating flow or the lower the fixed coverage expenditure the lower the loan risk rating, or vice versa, as shown in Exhibit 13. Also other current assets are positively related to loan risk, e.g., prepaid expenses such as prepaid insurance, rent and operating-administrative expenses. None of the qualitative variables were significant in the prediction model.

The probit model correctly predicted approximately 64 percent of the bank loan risk ratings for the holdout sample, as shown in Exhibit 14. The 64 percent success rate is at the top of the accuracy results found in previous studies that predicted Moody's bond ratings for five separate categories, Aa to B, Horrigan [1966], Pinches and Mingo [1973], Belkaoui [1983], Gentry, Newbold and Whitford [1988]. As previously indicated, Dietrich and Kaplan [1979] and Marais, Patell and Wolfson [1984] had markedly higher accuracy in predicting loan risk ratings, but their samples were heavily weighted with low risk loans, which is

unlike the risk distribution of the sample companies included in this study.

Exhibit 15 indicates that approximately 64 percent (30/47) of the loan ratings in the holdout sample were accurately predicted and an additional 34 percent (16/47) of the predicted ratings were in a cell that was adjacent to the actual rating. Thus 98 percent (46/47) of the predicted ratings are either correct or within one rating class of the actual, where the model's second highest conditional probability classification was the correct rating. To acquire additional insight into the prediction quality Exhibit 14 shows that of the 47 loans in the holdout sample, 39 had ratings that were either a 2 or a 3. Thus, a naive predictor that classified all loans a 3 would be correct or within one rating class of a 2 rating 39 times out of 47. The null hypothesis that our predictor performs at this level can be tested through a chi-square goodness of fit test. Since 46 of the 47 loans were predicted correctly or within one class, the calculated test statistic is $(46-39)^2/39 + (1-7)^2/7 = 6.40$. Compared with tabulated values of the chi-square distribution with one degree of freedom, the null hypothesis that our predictor performs at the level of the naive predictor can be rejected at the 5 percent significance level.

CONCLUSION

The accuracy of a probit model using cash flow components in classifying loan risks ranged from 57 to 61 percent. The qualitative information related to the loans modestly improved the accuracy of the loan risk classification to be between 60 and 75 percent. The

significant cash flow components in the analysis were operating, dividends and fixed coverage expenditures in all periods and inventory in 1987.

The predictive accuracy of the model was tested using a holdout sample. A probit model using cash flow components and qualitative information was 64 percent accurate in predicting the loan ratings assigned by the bank staff. Additionally, 98 percent of the predicted ratings were either correct or within one rating class of the actual rating where the second highest probability was the correct rating. By comparison, the predictive accuracy in this study is equal to the best results found in previous studies that predicted five categories of bond ratings. However, the predictive accuracy of loan classification models by Dietrich and Kaplan [1979] and Marais, Patell and Wolfson [1984] are markedly higher than the results in this study, but, unlike this study, their samples were heavily weighted with low risk loans.

In conclusion, the prediction model was reasonably successful, but the loan risk rating process incorporates other variables and/or dimensions that our study was unable to measure or detect. The challenge of our next study, that uses inductive learning in an expert system, is to capture more information and improve the predictive accuracy of the model.

FOOTNOTE

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[2]In the spirit of consistency, the following ratios are reported as cash flow components. However, it is not necessary to have TNF in the denominator.

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EXHIBIT 1

CONTRIBUTION OF EACH CASH FLOW COMPONENT TO THE TOTAL FLOW
(in millions of dollars)

INFLOWS		OUTFLOWS	
Net Operating	$40	Net Investment	$-38
Receivables	5	Inventories	-13
Payables	15	Other CA	- 2
Other CI	8	Dividends	- 8
Net Other A&L	12	Fixed Coverage Expenses	- 3
Net Financial	10	Changes in Cash	-26
Total Inflow (TI)	$90	Total Outflow (TO)	$-90

TI = TO = TCF

Percentage Contribution of Each Cash Flow Component

Cash Flow Component/TCF	Percent of Total Inflow (TI) or Total Outflow (TO)
Net Operating	+ 44.4
Receivables	+ 5.6
Payables	+ 16.7
Other CL	+ 8.9
Net Other A&L	+ 13.3
Net Financial	+ 11.1
Total Inflow	+100.0
Net Investment	- 42.2
Inventories	- 14.5
Other CA	- 2.2
Dividends	- 8.9
Fixed Coverage Expenses	- 3.3
Change in Cash	- 28.9
Total Outflows	-100.0

EXHIBIT 2

AN EXAMPLE OF THE HIERARCHY OF CASH FLOW COVERAGE RATIOS FOR COMPANIES WITH INCREASING FINANCIAL RISK CHARACTERISTICS

Cash Flow Component Total Net Flow	Lowest Risk		Company		Highest Risk
	A	B	C	D	E
NOF/|TNF|	100	60	50	40	20
NIF/|TNF|	-40	-35	-30	-26	-14
DIV/|TNF|	-10	-15	-15	-10	-0
FCE/|TNF|	-5	-10	-15	-20	-30
NWC*/|TNF|	-10	-8	-5	0	+5
TO/|TNF|	-100	-100	-100	-100	-100

Coverage Ratios	Lowest Risk		Company		Highest Risk
[NOF/|TNF|÷|X**|/|TNF|]	A	B	C	D	E
Investment (ICR)	2.5	1.71	1.67	1.54	1.43
Discretionary (DCR)	2.0	1.2	1.11	1.11	1.43
Free Cash Flow (before working capital)***	1.82	1.0	.83	.71	.46
Free Cash Flow (after working capital)	1.54	.83	.77	.71	.51
Total Coverage (TCR)	1.0	.60	.50	.40	.20

*NWC = Σ w.c. components (outflows) - Σ w.c. components (inflows)

**X = outflow component

***Discretionary & Fixed Coverage Expenditures (DFCER)

EXHIBIT 3

MEANS AND STANDARD DEVIATIONS OF THE CASH FLOW COMPONENTS,
1986, 1987 and 1986-1987

Cash Flow Component	1986		1987		1986-1987	
Total Cash Flow	Mean	S.D.	Mean	S.D.	Mean	S.D.
Operating	.4930	.2272	.4701	.2640	.4770	.2538
Receivables	-.0943	.1661	.0826	.2142	-.0861	.2010
Inventories	-.0904	.2258	-.0221	.1838	-.0425	.1997
Other CA	.0243	.0985	.0032	.0949	.0050	.0990
Payables	-.0789	.1594	.0502	.1718	.0588	.1606
Other CL	.0075	.1153	.0336	.1272	.0258	.1249
Other A & L	-.0973	.2135	-.0300	-.2140	-.0501	.2161
Financing	.1406	.2816	.0082	.3248	-.0479	.3183
Fixed Coverage	-.0979	.0889	-.1029	.0943	-.1014	.0927
Investment	-.2311	.2074	-.2522	.1949	-.2459	.1990
Dividend	-.0842	.1241	-.0684	.1145	-.0731	.1175
Change in Cash	-.0006	.2198	-.0072	.2351	-.0052	.2306
TCF/TA	.2779	.1204	.2958	.1507	.2904	.1425
N	44		103		147	

EXHIBIT 4

PROBIT COEFFICIENTS FOR CASH FLOW COMPONENTS AND FOR CASH FLOW COMPONENTS WITH QUALITATIVE FACTORS, 1986, 1987, 1986 AND 1987

	1986		1987		1986 & 1987	
Cash Flow Component	CFC	CFC+Q	CFC	CFC+Q	CFC	CFC+Q
Constant	4.15***	5.26***	1.88***	2.30***	2.34***	2.69***
Operating	-4.34**	-4.47**	-1.81**	-2.22***	-1.93***	-2.10***
Receivables	-1.00	-0.94	-0.49	-0.34	-0.49	-0.39
Inventories	1.47	1.02	-1.97**	-1.55*	-0.69	-0.38
Other CA	4.52	4.88	1.70	0.92	1.87*	1.51
Payables	2.37	2.05	0.52	0.87	0.57	0.62
Other CL	-2.51	-2.90	-1.16	-0.62	-1.05	-0.85
Other A & L	-1.24	-1.44	-0.19	-0.52	0.31	-0.64
Financing	1.16	1.17	-0.81	-0.76	-0.21	-0.13
Fixed Coverage Exp.	-10.88***	-8.42**	-5.62***	-4.70***	-5.44***	-3.79**
Investments	-0.12	-0.18	-0.32	-0.35	-0.07	-0.22
Dividends	6.02***	9.39***	3.06**	2.29*	3.61***	3.54***
TCF/TA	0.15	2.08	1.41	0.06	0.72	-0.66
Dummy Variables						
Secured/Unsecured		-1.76		1.79**		1.67**
Guarantee/ No Guarantee		1.62**		-0.05		0.47**
Liquidity of Collateral		0.52		-0.09		-0.15
n	44	44	103	103	147	147

*Significant at .10 level of confidence.
**Significant at .05 level of confidence.
***Significant at .01 level of confidence.

EXHIBIT 5

CLASSIFICATION OF LOAN RISK RATINGS WITH CASH FLOW COMPONENTS, 1986

Bank Rating	Classified Ratings 1	2	3	4	5	Total
1	1	2				3
2		5	6			11
3		3	17	2	1	23
4			5			5
5					2	2
TOTAL	1	10	28	2	1	44

56.82 percent of bank loan risk ratings are classified correctly.

CLASSIFICATION OF LOAN RISK RATINGS WITH CASH FLOW COMPONENTS AND QUALITATIVE FACTORS, 1986

Bank Rating	Classified Ratings 1	2	3	4	5	Total
1	1	2				3
2		9	2			11
3		2	19	1	1	23
4			3	2		5
5					2	2
TOTAL	1	13	24	3	3	44

75 percent of bank loan risk ratings are classified correctly.

EXHIBIT 6

CLASSIFICATION OF LOAN RISK RATINGS WITH
CASH FLOW COMPONENTS, 1987

Bank Rating	Classified Ratings 1	2	3	4	5	Total
1	1	1	6			8
2	3		11			14
3	2		56	2		60
4			13	6		19
5			1	1		2
TOTAL	6	1	87	9	0	103

61.16 percent of bank loan risk ratings are classified correctly.

CLASSIFICATION OF LOAN RISK RATING WITH CASH FLOW
COMPONENTS AND QUALITATIVE FACTORS, 1987

Bank Rating	Classified Ratings 1	2	3	4	5	Total
1	1		7			8
2	2	2	10			14
3	1		53	6		60
4			11	8		19
5				2		2
TOTAL	4	2	81	16	0	103

63.11 percent of bank loan risk ratings are classified correctly.

EXHIBIT 7

CLASSIFICATION OF LOAN RISK RATINGS WITH CASH FLOW COMPONENTS, 1986-1987

Bank Rating	Classified Ratings 1	2	3	4	5	Total
1	2	2	7			11
2	3	3	19			25
3	2	1	77	2	1	83
4			23	1		24
5			3	1		4
TOTAL	7	6	129	4	1	147

56.46 percent of bank loan risk ratings are classified correctly.

CLASSIFICATION OF LOANS BY RISK RATINGS WITH CASH FLOW COMPONENTS AND QUALITATIVE FACTORS, 1986-1987

Bank Rating	Classified Ratings 1	2	3	4	5	Total
1	2	5	4			11
2	4	2	19			25
3	1	2	76	5		83
4			16	8		24
5			2	2		4
TOTAL	7	8	117	15	0	147

59.86 percent of bank loan risk ratings are classified correctly.

EXHIBIT 8

DISTRIBUTION OF COLLATERAL QUALITY
1986 AND 1987

		Number of Loans
Unsecured Loans		103
Secured with . . .		
Marketable Securities	2	
Marketable Securities and Assets of Low Marketability	1	
Assets of Low Marketability	10	
Marketable Securities and Fixed Assets	1	
Assets of Low Marketability and Fixed Assets	23	
Fixed Assets	7	
Total Secured Loans		44
Grand Total		147

EXHIBIT 9

FREQUENCY DISTRIBUTION OF GUARANTEED AND NON GUARANTEED LOANS

Bank Rating	1986 Total	1986 Guaranteed	1986 Not Guaranteed	1987 Total	1987 Guaranteed	1987 Not Guaranteed
1	3	0	3	8	0	8
2	11	1	10	14	3	11
3	23	8	15	60	20	40
4	5	4	1	19	9	10
5	2	2	0	2	1	1
	44	15	29	103	33	70

EXHIBIT 10

FREQUENCY DISTRIBUTION OF SECURED AND
UNSECURED LOANS BY LOAN RISK CLASS 1986 AND 1987
AND SECURED/GUARANTEED COMBINATIONS BY LOAN RISK CLASS

Bank Rating	1986 Total	1986 Secured	1986 Unsecured	1987 Total	1987 Secured	1987 Unsecured
1	3	0	3	8	0	8
2	11	1	10	14	0	14
3	23	8	15	60	16	44
4	5	2	3	19	14	5
5	2	1	1	2	2	0
	44	12	32	103	32	71

SECURED AND GUARANTEED COMBINATIONS

	1986	1987	Total
1	0	0	0
2	1	0	1
3	4	8	12
4	2	8	10
5	1	1	2
	8	17	25

EXHIBIT 11

CHANGE IN CLASSIFIED LOAN RISK RATING
BY ADDING QUALITATIVE INFORMATION,
1986-1987

	Number of Ratings that Changed		
	CFC Ratings Were Improved to Match Bank Rating by Adding Qualitative Factors	CFC Ratings Matched Bank Rating, But Did Not Match When Qualitative Factors Added	CFC Ratings Did Not Match Bank Ratings, But Were Improved by One Level When Qualitative Factors Added
CFC Ratings Were Less Risky Than CFC+Q	7[a]		
CFC Ratings Were More Risky Than CFC+Q	3[b]		
CFC+Q Ratings Were Less Risky Than CFC		1[c]	4[e]
CFC+Q Ratings Were More Risky Than CFC		5[d]	2[f]
Total	10	6	6

Ratings by . . .

	Bank	CF	CFQ
a.	3	2	3
b.	3	4	3
c.	2	2	1
d.	2	2	3
e.	3	1	2
f.	3	5	4

EXHIBIT 12

MEAN AND STANDARD DEVIATION OF SELECTED CASH FLOW COMPONENTS BY RISK RATING CLASS DETERMINED BY BANK AND PROBIT, 1986 AND 1987

Selected Cash Flow Components		Rating Determined by . . . 1		2		3		4	
		Bank	Probit	Bank	Probit	Bank	Probit	Bank	Probit
N		11	7	25	6	84	129	24	4
Operating	Mean	.6706	.7347	.6224	.6350	.4354	.4729	.4337	.0702
	S.D.	.1062	.1637	.1485	.1113	.2587	.2405	.2420	.1672
Investment	Mean	-.3074	-.3109	-.2615	-.2006	-.2539	-.2522	-.2061	-.0584
	S.D.	.1653	.1109	.2195	.1496	.2014	.2036	.1715	.0310
Dividends	Mean	-.1822	-.3981	-.1789	-.3468	-.0480	-.0456	.0097	0
	S.D.	.1193	.1066	.1573	.1191	.0893	.0655	.0196	0
Fixed Coverage	Mean	-.0572	-.0318	-.0845	-.0642	.0987	-.1075	.1464	-.0695
	S.D.	.0367	.0253	.0652	.0635	.0998	.0946	.0931	.0902

EXHIBIT 13

PROBIT COEFFICIENTS FOR CASH FLOW COMPONENTS
AND QUALITATIVE FACTORS FOR THE PREDICTION OF
LOAN RISK RATINGS, 1986 AND 1987 COMBINED

Cash Flow Component	Probit Coefficients
Constant	2.518***
Operating	-2.006**
Receivables	0.453
Inventories	-0.371
Other CA	2.484**
Payables	1.006
Other CL	-0.792
Other A&L	-0.880
Financing	-0.416
Fixed Coverage Expenditures	-3.772**
Investments	0.117
Dividends	3.748***
TCF/TA	-0.430
Dummy Variables	
Secured/Unsecured	0.382
Guarantee/No Guarantee	0.168
Liquidity of Collateral	0.130
n	100

*Significant at .10 level of confidence.
**Significant at .05 level of confidence.
***Significant at .01 level of confidence.

EXHIBIT 14

PREDICTION OF LOAN RISK RATINGS IN THE HOLDOUT SAMPLE WITH CASH FLOW COMPONENTS AND QUALITATIVE FACTORS, 1986-1987

	Predicted Ratings					
Bank Ratings	1	2	3	4	5	TOTAL
1	--		1			1
2	3	--	7			10
3	1		28			29
4			5	2		7
5						
TOTAL	4	0	41	2	0	47

63.83 percent of bank loan risk ratings are predicted correctly.

EXHIBIT 15

SUMMARY OF HOLDOUT SAMPLE RESULTS FOR
LOAN RISK RATING MODEL 1986-1987

Bank Rating (1)	Correct Rating (2)*	Adjacent Rating (3)**	Nonadjacent Rating*** (4)	Total (5) = (2+3+4)
1	0	0	1****	1
2	0	10	0	10
3	28	1	0	29
4	2	5	0	7
5	0	0	0	0
TOTAL	30	16	1	47
% OF TOTAL	63.83	34.04	2.13	100.0

*Number of model-determined ratings that were correct.

**Number of model-determined ratings that were in a rating class adjacent to the actual bank rating.

***Number of model-determined ratings that had the highest probabilities but were not adjacent to the actual bank rating.

****Number of ratings in which the probabilities for the actual bank ratings were not second in size to the predicted rating.