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ABSTRACT

The absence of a theory of financial failure has resulted in researchers using the computer to select financial ratios for classifying failed and nonfailed companies. This methodology selected ratios that tended to be dependent on the sample of selected companies. The result is that a uniform set of ratios for predicting bankruptcy has not evolved. We have utilized the accounting funds flow model as an unambiguous measure of cash flows in order to overcome the measurement bias of previous studies. The rationale for the funds flow components is developed. Eight funds flow components and nine previously successful ratios are used in the logit model to classify 58 small companies. For all of the classification tests completed the funds flow components provide superior results to the financial ratios. The funds flow components that were significant in classifying small failed and nonfailed companies were dividends, net other asset and liabilities and net investment.

Classifying Bankruptcy of Small Firms with Funds Flow Components and Financial Ratios

Financial ratios reflect key relationships among financial variables and provide basic guidelines for financial planning and analysis. Ratios are frequently used as a basis for interpreting a firm's performance trends, its business, financial and market risk patterns, and various corporate strategic decisions such as mergers, consolidations and bankruptcy. Although ratios have been successfully used in multiple discriminant analysis (MDA), e.g., Altman [1, 3, 4, 5], Altman, et al. [6, 7], Blum [13], Deakin [19], Edmister [21], Elam [23], Libby [37], Mensah [41], Moyer [44], Ohlson [47], and Taffler [54], and logit models, e.g., Martin [38], Ohlson [47], and Mensah [41], to classify failed and nonfailed firms, the process used in selecting ratios has been criticized, e.g., Foster [27] and Ohlson [47]. Previous bankruptcy prediction studies did not have a theory of financial failure on which to base the selection of specific ratios, therefore , as suggested by Foster [27], brute empiricism was used to determine significant explanatory ratios. In the evolution of this methodology one common set of ratios has not emerged as the foundation for explaining bankruptcy. Rather, for each set of data there has been a unique collection of ratios for explaining failure.

To overcome the criticisms of the lack of a theory for selecting ratios to classify failed and nonfailed firms and the dependence of the empirically selected ratios on the data base used, we turned to the accounting funds flow model developed by Helfert [30]. The FASB Exposure Draft [62] shows the accounting funds flow model measures the

interaction of all financial flows within the firm. Unlike financial ratios which serve as proxies for measuring cash flow, funds flow components are direct measures of cash inflows and outflows.

Several authors have identified a series of statistical problems related to the use of the MDA model, e.g., McFadden [39], Eisenbeis [22], Joy and Tollefson [32], Santomero and Vinso [49], Ohlson [47], and Zavgren [61]. In response to these criticisms this study uses the logit model to differentiate between failed and nonfailed firms. Both flow components and financial ratios are used in this classification process.

In an earlier study we developed the rationale for using funds flow components as predictors of corporate bankruptcy [28]. We used financial data from large companies to test empirically the accuracy of the funds flow components to classify failed and nonfailed firms.

The objectives of the study are to review the financial failure literature and identify the ratios that were useful in discriminating between failed and nonfailed firms; to develop a model of the funds flow components and illustrate its use; to compare empirically the discriminating ability of ratios to funds flow components in classifying failed and nonfailed small firms; and to analyze the empirical results and make recommendations for future research.

I. LITERATURE REVIEW

Altman [1] and Beaver [11, 12] wrote classic articles in the late 1960's on the use of financial ratios as predictors of corporate failure. Beaver used a univariate approach and achieved a level of predictive accuracy that has not been surpassed by subsequent studies.

Altman introduced multivariate discriminant analysis (MDA) to determine if financial ratios could discriminate between failed and nonfailed firms. The original multiple discriminant analysis technique was modified in subsequent studies by Altman [3, 4, 5], Altman and Loris [7], Altman and McGough [8], and Altman, Haldeman and Narayanan [6]. Primary contributions of Altman's studies were the use of a comprehensive profile of financial variables to distinquish failed from nonfailed firms and the high degree of accuracy in predicting failure one year before it actually happened.

Altman and Beaver did not offer a theoretical justification for the initial selection of a large number of financial ratios. Beaver's [11, p. 29] ratios were chosen on the basis of (1) popularity in the literature, (2) potential relevancy to the study or (3) possible cash flow orientation. Altman [1, p. 594] selected ratios on the basis of (1) popularity in literature, (2) potential relevancy to the study and (3) judgment. Statistical techniques were used to select the final set of ratios that were used to predict corporate failure. In 1983 Altman [5, p. 106] indicated the following procedures are utilized to determine the final profile of variables: (1) observation of the statistical significance of various alternative functions including determination of the relative contributions of each independent variable; (2) evaluation of intercorrelations among the relevant variables; (3) observation of the predictive accuracy of the various profiles; and (4) judgment of the analyst.

The Altman and Beaver studies have been criticized by several authors. Johnson [31] and Neter [46] observed the studies only explained failure in an ex post context. Additionally, Johnson indicated

it is important to measure both the level and trend of the predictive variable and that ratios measured only the level of a variable at a single point in time. Moyer [44] found that not all of the significant ratios in Altman's study were useful in explaining failure of larger sized firms. Wilcox [60] identified the need to use a debt/net cash flow relationship that was similar to the ratio used by Beaver.

Scholars involved in bankruptcy research recognize the absence of a theory of bankruptcy or financial distress. Several authors have contributed to the development of a theoretical framework that underlies financial failure, i.e., Bulow and Shoven [16], Golbe [29], Scapens, Ryan and Fletcher [51], and Scott [52].

During the period 1966-1983 at least fourteen studies have used financial ratios to predict financial failure for industrial and retail companies. Most of the studies used the MDA model to determine a unique set of financial ratios to classify failed and nonfailed firms. Recently a few studies have used logit or probit models to classify firms. Table I presents the financial ratios from the fourteen studies that were useful in predicting failure from one to five years before the event. The authors are listed on the vertical axis and the ratios on the horizontal axis. The significant financial ratios in each study are marked with an X. The ratios are classified into seven factor groupings identified by Pinches, Mingo and Caruthers [48], Pinches, Eubank, Mingo and Caruthers [49], and Chen and Shimerda [18]. The seven factor groupings are return on investment, capital turnover, financial leverage, short-term liquidity, cash position, inventory turnover and receivables turnover. Size is also included as an eighth factor.

The fourteen studies are arranged in chronological order. The early studies by Beaver [11] and Altman [1] used financial ratios from only three of the seven factor groups, i.e., return on investment, capital turnover and financial leverage. The Tamari [56] study in 1966 and Beaver [12] in 1968 contained ratios from five of the factor groups. In 1972 Deakin [19] had at least one financial ratio from all seven factor groups. In subsequent years the authors uncovered a variety of ratios that were useful in predicting failure and these ratio combinations contained from four to six factor groupings. The ratios in each of the seven factors found to be most useful in predicting financial failure are summarized in Table II.

Many other studies contributed to the literature by expanding or modifying the original works of Altman and Beaver, e.g., Castagna and Matolcsy [17], Diamond [20], Lev [36], and Taffler and Tisshaw [55]. Meyer and Piper [43], Sinkey [53], Martin [38], and Korobow, Stuhr and Martin [34] determined financial ratios most useful in predicting bank failure. Altman [4] analyzed financial ratios that were most useful in explaining the failure of railroads. Finally, Altman and Loris [7] evaluated the ratios underlying the failure of over-the-counter security dealers.

Other authors have contributed lengthy studies or summaries of the bankruptcy literature. For example, Argenti [10] reviews the literature and synthesizes the causes and symptoms of bankruptcy. Additionally, Argenti [10, Chapter 1] and Foster [27, Chapter 14] develop the rationale for studying the collapse of a firm. Nelson [45] studied bankruptcies to learn how financial markets adjust to failure. He concluded the

study with a series of reform measures designed to reform the bankruptcy process.

A major criticism of the bankruptcy studies is the brute empiricism approach used in choosing 20 to 40 variables and then using a stepwise discriminant method to select the variables for the final discriminant analysis [27, p. 477]. The significance of the ratios selected in previous studies has been dependent on the data sample used in the empirical analysis and the results have a sample bias. Because there is not an underlying theoretical rationale to justify the selection of specific ratios, the empirical findings cannot be generalized to indicate the most likely predictors of financial distress. Establishing a theoretical framework for selecting financial ratios is necessary before the prediction of financial distress can be improved.

Financial theorists agree that net cash flows are the basis for determining the value of a firm, e.g., Brealey and Myers [14], Brigham [15], Van Horne [57], and Weston and Brigham [59]. The need to use cash flows from operations in predicting failure has been suggested by Largay and Stickney [35], Mensah [41], Ohlson [47], Scott [52], and Zavgren [61]. Unlike financial ratios which serve as proxies for measuring cash flows, funds flow components unambiguously measure accrual accounting cash inflows and outflows. This study develops a common set of eight net funds flow components. The funds flow components were developed originally by Helfert [30] and are also found in an FASB Exposure Draft [62]. By measuring the relative proportion each component contributes to either total net inflow or total net outflow, a pattern of uniform cash flow information is created. Like

the sample bias in the ratio based studies, the relative contribution of each component is dependent on the companies in the sample. However, using a uniform set of eight systematically related components to measure total financial performance avoids a measurement bias that may be encountered when using ratios. Unlike the funds flow components, financial ratios selected by the MDA approach are not necessarily interrelated in a total system context. The degree that the selected set of ratios do not encompass all dimensions of a total interrelated system, a measurement bias will exist vis-a-vis the funds flow model.

Another criticism of earlier bankruptcy studies focused on the shortcomings of multivariate discriminant analysis (MDA). The statistical problems of MDA were identified earlier. An alternative to MDA is the use of a conditional probability model. The use of conditional logit or probit analysis avoids the problems related to the use of MDA. With a conditional probability model no assumptions have to be made regarding prior probabilities of bankruptcy and/or the distribution of the predictor variables. The empirical analysis in this study utilizes the logit program.

II. THE MODEL

A. Rationale

Net cash flow is composed of cash inflows and outflows. In an accounting context cash inflows equal cash outflows. The level and speed of each cash inflow and outflow component reflects the operating, investment and financing decisions of management. For a given state

of economic conditions, the mix of the components generating cash inflows or outflows is a signal of the resource allocation decisions of management. Measuring the change in the level and speed of each cash inflow and outflow component provides a theoretical rationale to differentiate between financially successful or financially failing firms.

The financial success or failure of a firm is related to the level and speed that net cash flow components move through a firm. The higher the level and/or speed that net cash flow components move through the firm, the smaller the probability of failure. For example, the level of net cash flow from operations rises when either the quantity or price of products sold increase or when the cost of operations for a given level of sales are decreased. There is an increase in the speed that net operating cash flows move through a firm when sales increase more rapidly than investment, i.e., assets turnover is increased. The result reflects increased efficiency in the management of assets.

The development of the preceding theoretical framework makes it possible to construct a set of propositions that relate the trend of the cash inflow and outflow components to the probability of failure.

1. The larger the proportion of net cash inflow coming from operations, the smaller the probability of failure. [The larger the difference between cash inflows and outflows from operations, the higher the return on sales and the greater the financial strength of a firm.]

2. The larger the proportion of net cash outflow going to capital investment, the smaller the probability of failure. [The size of the net cash outflow going to capital investment directly reflects on the size of the firm's market share and the expected growth in demand for its products.]

3. The smaller the proportion of net cash inflow coming from outside borrowing, the smaller the probability of failure. [The larger the net cash flow from operations the lower the need to borrow in

order to meet the cash outflows for investment. As net operating flows become smaller the need to borrow may increase to meet cash flow shortfalls. The higher the flow of funds from borrowing, the greater the financial risk and the higher the probability of failure.]

4. The smaller the proportion of the net cash outflow going to interest and leasing expenditures, the smaller the probability of failure. [The smaller the fixed coverage expenditures in relation to operating earnings the lower the financial risk and the chances of failure.]

5. The smaller the proportion of net cash outflow going to net working capital, the lower the probability of failure. [Net working capital is considered to be under control when it is increasing at a lower rate than the rate of increase in sales. Net working capital (NWC) equals Δ accounts receivable plus the Δ in inventories plus the Δ in other net working capital items minus the Δ in accounts payable. Working capital components are imperfectly related to sales, but the relative increase in the turnover of receivables or inventories or the relative decrease in the turnover of accounts payable are considered an increase in internal operating efficiency.]

6. The larger the relative proportion of net cash outflow going to dividends, the smaller the probability of failure. [Companies paying a higher proportion of their cash outflows in dividends are signalling not only their financial ability to pay the dividend, but they are satisfying the preferences of their stockholders.]

7. The larger the proportion of inflows that result from an increase in other liabilities (e.g., accrued income taxes) or a decrease in other assets, the lower the probability of failure. [Companies with a trend of increased deferred income taxes and/or decreasing other assets are experiencing investment growth, while companies with declining income taxes and/or increased other assets are experiencing a decline in investment growth.]

B. Funds Flow Components

In theory, actual cash flow data would provide the best information to use in empirical tests designed to discriminate between failed and nonfailed firms. Unfortunately, actual cash flow data are not publicly available. The next best source of data are funds flows generated from balance sheet and income statment information. The model we have used

to identify funds flow measures was developed in 1972 by Erich Helfert [30].

After extensive use of Helfert's funds flow model, we redesigned it to have eight major components. The eight funds flow components are operations, working capital, financial, fixed coverage expenses, capital expenditures, dividends, other asset and liability flows and the change in cash and marketable securities. Five of the components are subdivided into inflows and outflows. They are operations, working capital, other assets and liabilities, financing and investment. A net flow is determined for each of these five components. The algebraic sum of these five components minus dividends and net fixed coverage expenses will equal the change in cash and marketable securities. The revised format for the funds flow analysis and the acronyms for each variable are presented below.

Operating Flows

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

Working Capital Flows

	Inflows	(WCI)
minus:	Outflows	(WCO)
equals:	Net Working Capital Funds Flows (NWCFF)	

Other A&L Flows

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

Financial Flows

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

Investment Flows

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

Dividend Outflows (DIV)

Fixed Coverage Expenditure Outflows (FCEF)

Change in Cash (CC) [equals the sum of preceding seven components or the change in the cash account listed below.]
equals: Ending Cash and Short Term Investments
minus: Beginning Cash and Short Term Investments

C. Revised Model

The funds flow components contained in the revised Helfert model are presented in equation (1).

$$NOFF_t + NWCFF_t + NFFF_t + FCEF_t + NIFF_t + DIV_t + NOA\&LF_t - CC_t = 0 \quad (1)$$

Because the interrelationship among the components is complex, equation (1A) 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:

$$\underset{(S)}{+}\ NOFF_t + \underset{(U)}{-}\ NWCFF_t + \underset{(S)}{+}\ NFFF_t + \underset{(U)}{-}\ FCEF_t + \underset{(U)}{-}\ NIFF_t + \underset{(U)}{-}\ DIV_t + \underset{(U)}{-}\ NOA\&LF_t + \underset{(U)}{+}\ CC_t = 0 \quad (1A)$$

Net operating funds flows (NOFF) are composed of all operating inflows (OI), of which sales is the primary source, minus all operating outflows (OO). The primary operating outflows are expenditures related to the cost of goods sold, selling and advertising taxes, research and development, rental, extraordinary, minority interest claims.

Normally, NOFFs are the primary source of funds inflow. However, seasonal and/or random events may cause NOFFs to be negative, which

represents an outflow or a use of funds. Also declining market share or size of market, or internal operating inefficiences may cause NOFFs to be negative.

Net working capital funds flow (NWCFF) can be either a use or a source of funds. A net outflow of funds for working capital occurs when accounts receivable (AR) or inventories (INV) are increasing or when accounts payable (AP) are decreasing, or a combination of both. Under these conditions, NWCFFs are negative because they reflect an outflow of funds. Alternatively, when the level of AR or INV is reduced or when AP is increased, or both, this represents an inflow of funds and the NWCFFs are positive.

During a transition in current operations, management may change the level of AR, INV, and AP. Thus working capital funds provide management a buffer to adjust the funds flow in order to maintain an equilibrium condition between sources and uses.

If all funds uses in (1A) are financed totally by net operating funds (NOFFs), e.g., - (NWCFF + FCEEF + NIFF + DIV + NOA&LF - CC) = NOFF, the firm does not need to utilize external sources of funds. Such a condition is consistent with a firm in a strong competitive position, for example a firm that has a dominant share of a growing market.

When a firm's internal operating funds are insufficient to meet the investment outflows, external debt or equity, the major components of net financial funds flow (NFFF), may be sold to finance the shortfall in funds. When debt and/or leasing are utilized, interest, debt amortization and leasing expenditures must be paid. These are defined as fixed coverage expenditure flow (FCEF). Fixed coverage payments will

always be an outflow (use) of funds. Finally, NIFFs will usually be an outflow.

When operating funds flows are relatively unstable, complex investment and financing policies emerge. In these circumstances we observe firms use four accounts as buffers: NWCFFs, NFFFs, change in cash and marketable securities (CC), and net other assets and liabilities (NOA&LF). However, when a firm experiences a rapid decline in its net operating flows, the shortfall in cash inflows is frequently offset by short-term borrowing (NFFF). Although short term borrowing may be considered a part of working capital, we are following the convention established by Helfert that includes short term debt in financial fund flows.

If the decline in operating flows is dramatic, a firm might be forced to sell fixed assets, inventories and/or receivables to offset an outflow for operations and fixed coverage expenditures. Such a strategy results in the firm reducing its economic base upon which operating flows are generated, and increasing its probability of failure.

III. EMPIRICAL ANALYSIS

A. Relative Funds Flow Components

The objective of the empirical analysis is to compare relative funds flow components to financial ratios as predictors of failure in an ex post setting. The primary concept in calculating the relative funds flow components is to determine the percentage of the total net inflows that are contributed by each net inflow component and the percentage of total net outflows contributed by each net outflow component. The accounting convention underlying the funds flow statement

results in total net inflow of funds (TNIF) being equal to the absolute value of total net outflow of funds (TNOF). Thus we simplified the notation by substituting the expression total net flow (TNF) for TNIF and TNOF. That is

$$TNF \equiv TNIF \equiv \left| TNOF \right| . \tag{2}$$

Thus to find the percentage each fund flow contributes to the total net flow (TNF), each net funds flow component is divided by TNF.

B. Financial Ratios

Nine financial ratios were selected to be used in the logit model for classifying failed and nonfailed sample companies. The three primary criteria used in selecting the ratios were (1) the most frequently used ratios, (2) asset size and (3) financial market effect. The most widely used ratios from the fourteen studies in Table II provide a solid, basis for selection. We selected seven ratios from the list that were used in four or more studies. The seven ratios selected were net income/total assets, EBIT/total assets, total debt/total assets, cash flow/total debt, net working capital/total assets, current assets/current liabilities and cash plus marketable securities/current liabilities. We excluded retained earnings/total assets because it was quite similar to total debt/total assets. Altman, et al., [6] has shown the importance of including size and financial markets in the evaluation of financial performance. For the final two ratios we used the log of total assets as a proxy for size and total market value of common stock/book value of total capital as the financial market proxy.

C. Failed Company Selection Process

The Standard and Poor's Compustat 1981 Expanded Annual Industrial Research and the Expanded Over-the-Counter Research Tapes of companies previously listed on these tapes were the basic information source used to determine companies that failed during the period 1970-1981. We discovered there were 174 companies that were deleted from the Compustat Annual Research Files due to failure related circumstances during the twelve year period. The deletion of a company does not necessarily indicate bankruptcy, although the Compustat Annual Research File codes the company as bankrupt. Frequently companies will stop reporting financial statement to Compustat two or more years before experiencing bankruptcy.

The second phase of the screening process involved a search of leading information sources to determine why a company was deleted from Compustat, i.e., F&S Index [24], Fisher [25], Financial Stock Guide Service [26], and Wall Street Journal Index [58]. Bankruptcy studies have focused on the predictive ability of financial information released approximately one year before the date of failure to serve as a predictor of failure within the next twelve months. Acquiring accurate dates when failure occurred and comparing it to the date of the latest annual financial statements are two important parts of the research methodology in the study. If it was found that a company declared bankruptcy, or was declared bankrupt or was liquidated, we acquired from the previous published sources the best available date of record of the failure.

The classification of the 174 companies deleted from the Compustat file due to failure related circumstances is presented in Table III.

Table III shows there were 136 companies classified as failed, i.e., 99 involved in bankruptcy and 37 were liquidated.

During the third phase of the screening process, the recorded date of failure is compared to the date of the last reported annual report of the failed company. If the date of failure is known precisely and it occurred four months or more after the date of the last recorded annual report (i.e., the date of the latest fiscal year end), the date of failure and the financial statement are assumed to be one time period apart. If the precise date of failure was less than four months after the date of the last annual report, the annual report of the preceding year becomes the closest to the date of failure. In standardizing the comparison dates, experience indicates at least three months are required to complete the bankruptcy filing process. Thus, for example, a company with a date of failure one month after the date of its latest annual report would more than likely have been involved in bankruptcy proceedings, i.e., it was very close to financial failure before the last annual report was released. The annual report of the preceding year would contain the type of standardized information needed for comparative statistical analysis. If only the year of the failure is known, failure is assumed to have occurred on January 1 of that year. The date the last annual report is compared to the January 1 failure date when establishing the number of periods that expired before one company failed.

Balance sheet and income statement information for failed industrial companies are used to determine the funds flow components and the financial ratios. Leases were not capitalized as recommended by

Altman, et al. [6], because these data were not available for all of the companies during the period studied. Complete financial statement information was available for only 45 of the 136 companies for one year before failure. Using a criterion of less than $50 million in sales and assets as the size cutoff for a small company, we found 29 of the 45 companies could be classified as small.

D. Matching

Previous bankruptcy studies have matched the sample failed companies with a sample of nonfailed companies that were in the same respective industries and of approximately the same asset size. This study matched each of the 29 failed small companies with a nonfailed small company in the same industry, selecting matching companies that were similar in asset size and sales for the fiscal year three years before bankruptcy. The matching nonfailed small company was required to have the necessary financial information for the period studied. A list of the 29 failed companies and the matching set of 29 nonfailed companies is presented in Tables IV and V, respectively.

IV. ANALYSIS

The objective of the analysis is to compare the discriminating ability of relative funds flow components to financial ratios in classifying failed and nonfailed small companies. The logit technique is used to examine the predictive ability of the funds flow components and the ratios. We used funds flow components and ratios for one year before failure.

A. Overview

The mean and standard deviation of each funds flow component are presented in Table VI. A brief review of these data shows there is generally a marked difference between the means of the failed and nonfailed companies. With the exception of one flow component, (DIV/TNF), the standard deviations of the failed firms are substantially larger than the components of the nonfailed companies. The propositions concerning the relationship between the level of each funds flow component and the probability of failure are strongly supported by this set of descriptive statistical data. Also the means and standard deviations of the financial ratios are reported in Table VI. There is a wide difference between the means of the nonfailed and failed companies. In comparison to the nonfailed companies, the failed companies have a lower return on investment, lower turnover, higher financial leverage, lower short-term liquidity, and relatively smaller asset size. With two exceptions, CF/TD and MVCS/BVTC, the standard deviation is always larger for the failed companies.

Figure 1 is a graphic presentation of the mean of each relative funds flow component for the 29 failed and 29 nonfailed companies for the year of bankruptcy and the two years preceding bankruptcy. The graphics show the three year trend of the relative funds flow components for the failed versus the nonfailed companies.

In Figure 1 dramatic changes in the trend of the flow components of the failed companies are observed in operations, investment, financing, net working capital, and net other assets and liabilities. The graphics also highlight the differences that exist in the level of the relative

funds flow components between failed and nonfailed firms for the three periods. These differences are most apparent in the operation, investment, working capital, fixed coverage expenditures and dividend components.

B. Logit Results

In the late 1970s a logit model was used by Martin [38], and Korkow, Stuhr and Martin [34] in designing an early warning system of bank failure. In 1980 the logit model was proposed by Ohlson [47] to study bankruptcy prediction in industrial companies. A thorough description of the logit model is in Amemiya [9]. The objective is to use a conditional probability model to classify failed and nonfailed firms. The logit model identifies the variables that are significant in classifying failed and nonfailed firms. Logit calculates the weight each coefficient contributes to the overall prediction of failure or nonfailure. The logit coefficients are similar to the coefficients that compose the Z score developed by Altman [1].

The logit coefficients and the asymptotic T ratios are presented in Table VII. For the test using only funds flow components to classify failed and nonfailed companies, the dividend component (DIV/TNF), is significant at the .01 level. The net other asset and liability component, NOA&LF/TNF, and the net investment component (NIFF) are significant at the .05 level. When using only financial ratios, Table VII shows only the constant is significant in classifying failed and nonfailed companies.

The findings indicate the lower the relative dividend component, the higher the probability of failure. Or alternatively, the higher

the dividend component the lower the probability of failure. This finding is closely tied to proposition 6, which is the theory underlying the importance of dividends in satisfying stockholder preferences and thereby sustaining the long-run economic viability of a business firm.

A typical failing firm tends to reduce its dividend payments. This reduction in dividends as a proportion of total outflow is often related to either a significant decrease in net operating inflows and/or an increase in the relative outflow to fixed charges resulting from increased external debt financing. The data in Figure 1 show nonfailed firms maintain a relatively stable proportion of the net cash outflow to dividends while the failed firms have a declining proportion of outflows going to dividends.

The empirical results are also supportive of proposition 7 which holds the higher the source of funds from the other assets and liabilities component, the lower the probability of failure. Conversely, relatively high uses of funds to increase other assets or to reduce pension obligations or taxes are significant signals related to financial failure. Failing firms are usually not paying income taxes due to poor financial performance, therefore, accrual income taxes liabilities are reduced and appear as a use of funds. Also other accrued liability accounts, such as wages, are being reduced and are a use of funds.

The study shows the larger the net investment component, the lower the probability of failure. Alternatively, the lower the net investment component, the higher the probability of failure. This finding closely resembles proposition 2 which indicates the larger the size of the net

outflow going to capital investment, the higher the anticipated growth in the demand for a firm's products.

We completed eight separate logit analyses in order to measure the contribution of the funds flow components vis-a-vis financial ratios in classifying failed and nonfailed companies. From the logit analysis the change in the log of the likelihood function statistic serves as the basis for measuring the significance of the contribution of funds flow components and ratios. The first test uses only the intercept to classify the 58 sample companies. The objective of initially using only the intercept to classify the sample companies is to establish a standard for comparing the change in the likelihood statistic when ratios are added separately, and fund flow components are added separately. The log of the likelihood function statistic for test 1, intercept only, is -40.203 and is reported in Table VIII.

The second test adds eight of the nine financial ratios to the logit analysis. Because two of the ratios, C/CL and EBIT/TA, were used in only four studies, we tested to determine if omitting one of the nine variables would affect the results. In Test 2 we omitted C/CL from the set of nine ratios and in Test 3 we omitted EBIT/TA. When the eight ratios for Test 2 are added, the likelihood statistic drops to -24.612 as reported in Table VIII. A Chi Square test of the change in the likelihood statistic from -40.203 to -24.612 is significant at the .05 level.

The likelihood statistic for Test 3 was -24.601 and the change in the likelihood statistic from Test 1 to Test 3, -40.203 to -24.601, was not significant at the .05 level. When the nine ratios were included

in the logit analysis, the resulting likelihood statistic was -24.599. A Chi Square test of the change in the likelihood statistic from -40.203 to -24.599 was significant at the .05 level. These three tests show that the financial ratios make a significant contribution in classifying the 58 sample companies, compared to using only the intercept.

The fifth test adds seven funds flow components and a scale measure, total net flows/total assets (TNF/TA), to the intercept in classifying the sample companies. The funds flow component CC/TNF was omitted from the logit analysis because of a problem of statistical overidentification. This problem occurs because the algebraic sum of the relative flow components in any given year equals zero, as shown in (1). To prevent overidentification the residual component in the funds flow analysis, CC/TNF, is omitted from the logit model. The log of the likelihood statistic in the fifth test was -17.269 compared to -40.203 with the intercept only. The Chi Square statistic shows the addition of the eight funds flow components make a significant contribution in classifying the sample companies at the .01 level.

The final three tests combine eight funds flow components with either seven or eight financial ratios in the logit analysis. The NI/TA ratio was dropped from the analysis because it was highly correlated with NOFF/TNF ($r = .884$), EBIT/TA ($r = .799$), cash flow/total debt ($r = .669$). The omission of NI/TA did not affect the test results because similar effects are present in the three other highly correlated variables. When the ratio C/CL is omitted and the remaining seven ratios are combined with the eight funds flow measures in the logit analysis, the log

of the likelihood statistic is -13.862, as shown in Table VIII. In measuring the marginal contribution of adding seven ratios to the eight funds flow components in test 6, the Chi Square results show there is not a significant change in the likelihood statistic from -17.269 to -13.862. Table VIII shows similar results are found when the seven ratios, excluding EBIT/TA and NI/TA, are combined with the eight funds flow measures. However, when the eight funds flow components are combined with seven ratios, excluding C/CL, the marginal contribution to the likelihood statistic is significant at the .01 level, -24.612 to -11.390. The use of partial analysis shows that adding ratios to funds flow components does not make a significant contribution to the classification of the small sample companies, but the addition of the funds flow components to the ratios produces a significant contribution to the classification of the small sample companies.

Combining the set of seven ratios, excluding EBIT/TA and NI/TA, with the eight funds flow measures in the logit analysis produces a log of the likelihood function of -13.193, which is test 7 in Table VIII. Also combining the eight ratios with the eight funds flow measures results in a likelihood measure of -12.556, which is test 8 in Table VIII. The Chi Square results show that adding either the above set of seven ratios or the set of eight ratios to the eight funds flow components does not result in a significant change in the likelihood statistic from -17.269 to either -13.862 or -12.556. However, combining the eight funds flow measures with the above set of seven or eight ratios does produce a significant change in the likelihood statistics

from -24.601 to -12.556 or -24.599 to -11.390, respectively. The implication of this finding is that funds flow components contribute superior information vis-a-vis the ratios which improves the classification performance of the logit model.

There is further evidence in support of the contribution of the funds flow component in classifying small failed and nonfailed companies. The logit coefficients and asymptotic T Ratios for the combined analysis using eight funds flow components and either seven or eight ratios are reported in Table IX. The only significant variable at the .05 level are NOA&LF/TNF in tests 6 and 8 and DIV/TNF in test 6.

CONCLUSIONS

As indicators of financial performance, financial ratios have been widely used to predict corporate bankruptcy. However, there is not a theory of financial failure to provide the foundation for selecting ratios, therefore, empirical studies have utilized the computer to determine which ratios are significant. A shortcoming of this methodology was that the selected ratios were dependent on the data sample and a common set of ratios for predicting bankruptcy did not emerge. To overcome this shortcoming we adopted the accounting funds flow model to measure the change in the flow of cash through the firm. In sharp contrast to the data dependent nature of the ratios, the funds flow components measure information that is common for all firms regardless of the time period or the composition of the data sample.

A series of propositions were used to develop the theoretical rationale for using funds flow components to explain the probability of failure. The ability of funds flow components to classify failed and

nonfailed was compared to the classification performance of a set of nine previously discriminating financial ratios. The analysis used the logit model to classify 58 small sample companies.

There were three basic findings of the study. Funds flow components and ratios make a significant contribution in classifying the 58 small companies, when compared to using just the intercept of the logit model. Several tests indicated that funds flow components are superior to financial ratios for classifying small failed and nonfailed companies with the logit model.

A second observation is that when using only funds flow three of the components were significant. However, when only ratios are used, none were significant in classifying the small companies. The dividend funds flow component (DIV/TNF), dividends as a percent of total net outflow of funds, was markedly smaller for failed companies one year before bankruptcy than the nonfailed companies. Also net other assets and liabilities funds flow component (NOA&LF/TNF) was significant at the 5 percent level, which may reflect declining deferred income taxes or increasing other assets for failed companies. The net investment funds flow component (NIFF/TNF) was markedly smaller for failed companies one year before failure than the nonfailed companies. Finally, when the ratios and flow components are combined, the significant variables were the dividend funds flow component and net other assets and liabilities.

Since theoretical valuation models are based on cash flows, it is not surprising that unambiguous measures of cash flows are significant

in classifying failed and nonfailed companies. The funds flow components reflect a set of uniform measures that provide common information concerning financial flows within a firm. The dynamic nature of business and economic conditions suggest the need to reevaluate frequently the contribution of the funds flow components in predicting corporate bankruptcy. Undoubtedly changes in economic, political and environmental conditions will result in changes in the explanatory power of the various funds flow components. In the future as our experience in working with funds flow components expands, they may become more widely used in explaining financial performance and in analyzing corporate strategy.

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TABLE I[10]

AUTHORS AND RATIOS FOR FOURTEEN BANKRUPTCY STUDIES

	Return on Investment													Capital Turnover							Financial Leverage										Short-term Liquidity				Cash Position				Inventory Turnover						Receivable Turnover			
	NI/TA	EBIT/TA	NI/S	σ EBIT/TA	σ NI	CF/TA	NI/NW	CF/NW	EBIT/S	Δ NI	Slope NI	Trend Breaks		CA/TA	QA/TA	NWC/TA	S/TA	CF/S	NW/S	S/FA	log EBIT/INT	EBIT/INT	INT/NI	RE/TA	TD/TA	MVCS/BVNW	TD/NW	CL/NW	WC/NW	CF/CL	CF/TD	MVEQ/BVTD	MVEQ/TD	BVEQ/TD		CA/CL	C/TA	CL/TA	QA/CL		Quick Flow	No Credit Interval	C/CL	C/TA	C/S		CA/S	INV/S	Prod/WC	S/WC	NWC/S	CGS/INV	Prod/INV		QA/INV	QA/S	S/Rec		Size
1966 Tarmari [56]											3													2												X									X					X			X	
1966 Beaver [11]	X															X								X						X																						
1968 Altman [1]		X														X	X							X								X																					
1968 Beaver [12]	X					X										X								X												X						X										
1972 Deakin [19]	X													X	X	X								X							X					X			X			X	X	X	X					X		
1972 Edmister [21]																		X										4		X									4			4			4			4				
1974 Blum [13]					X		X				X	X																			X		X	X					6										5	X		
1975 Elam [23]			X			X	X	X	X								X	X						X		X			X	X						X		X	X			X											
1975 Libby [37]	X													X																						X	X				X			X			X							
1977 Altman, et al. [6]		X		X																	X			X		X										X																	X
1977 Moyer [44]		X														X								X							X																						
1980 Ohlson [47]	X									X						X															8					7																		X
1982 Taffler [54]		9													X									X				X																				X					
1983 Mensah [41]								X												X		X	X	X						X														X									
TOTAL	5	4	1	1	1	2	2	2	1	1	2	1		2	2	6	2	1	1	1	1	1	1	5	6	1	1	1	1	2	7	1	1	1		6	1	1	3		1	1	4	1	2		2	1	1	1	1	1	1		1	2	1		2

1. Value of Production = Sales + finished goods + goods-in-process; ratio not included in Chen and Shimerada [18].
2. Used TL in denominator.
3. Trend of net income, combined with NI/TA for one category of index of risk.
4. Company ratio/industry ratio.
5. Standard deviation, trend breaks and slope of the QA/S ratio.
6. Quick Flow = C + N.Rec. + ms + (S/12) CGS - Deprec. + S&Admin Expense + Interest) 2. A trend break occurs when the performance of a variable declines between year t and t+1.
7. Inverse, i.e., CL/CA.
8. CF = funds provided by operations.
9. TA_{t-1}
10. A footnote number is sometimes substituted for an X.

TABLE II

SUMMARY OF MOST USEFUL RATIOS FOR PREDICTING FAILURE BY FACTOR GROUP

Ratio	Number of Studies in Which the Ratio was Significant	Factor Group
Net Income/Total Assets	5	Return on Investment
EBIT/Total Assets	4	Return on Investment
Net Working Capital/Total Assets	6	Capital Turnover
Total Debt/Total Assets	6	Financial Leverage
Retained Earnings/Total Assets	5	Financial Leverage
Cash Flow/Total Debt	7	Financial Leverage
Current Assets/Current Liabilites	6	Short-Term Liquidity
Cash/Current Liabilities	4	Cash Position
Cash/Sales	2	Inventory Turnover
Quick Assets/Sales	2	Receivables Turnover

TABLE III

CLASSIFICATION OF 174 COMPANIES
DELETED FROM COMPUSTAT, 1970-1981

Classification	Number of Companies	
Bankruptcy		
Chapter 11	60	
Chapter 10	12	
Declared Bankrupt	27	
Total Bankrupt		99
Liquidation		37
Total Bankrupt and Liquidated		136
Other		
Sold assets to another firm	8	
Stopped trading	7	
Merger or Acquisition	3	
Liquidated and Exchanged	2	
Total		20
Traded in the OTC Market		14
No Information		4
Grand Total		174

TABLE IV

SAMPLE OF FAILED FIRMS, COMPUSTAT INDUSTRY CLASSIFICATIONS AND YEAR OF FAILURE

Company Name	Compustat Industry Classification	Year of Failure
Westates Petroleum Co.	Crude Petroleum & Natural Gas	1975
American Mfg. Co.	Textile Mill Products	1978
Scottex Corp.	Textile Mill Products	1972
LynnWear Corp.-CLA	Apparel & Other Finished Products	1979
Nelly Don Inc.	Apparel & Other Finished Products	1977
Westworth Mfg. Co.	Apparel & Other Finished Products	1971
Brody (B) Seating Co.	Household Furniture	1979
Paterson Parchment Paper Co.	Paperboard Containers	1973
Rowland Inc.	Misc. Chemical Products	1974
RAI Inc.	Footwear Except Rubber	1971
Sitkin Smelting & Refining	Secondary Smelting-Refining	1977
Gray Mfg. Co.	Mis. Metal Work	1974
Computer Instruments Corp.	Electronic Components NEC	1976
Harvard Industry Inc.	Electronic Components NEC	1970
Waltham Industries Corp.	Electrical Mach. & Equip.	1970
Leader Int'l. Industries Co.	Motor Vehicle Parts	1972
St. Johnsburg Trucking Co.	Trucking-Local & Long Distance	1974
Reeves Telecom Corp.	Radio-TV Broadcasters	1979
De Jur Amsco Corp.-CLA	Wholesale-Machinery & Equipment	1976
PKL Cos. Inc.-CLA	Advertising Agencies	1971
Plaza Group Inc.	Advertising Agencies	1973
Computer Applications Inc.	Business Services NEC	1969
Meister Brau Inc.	Malt Beverages	1971
Monroe Group Inc.	Knitting Mills	1971
Scherr-Tumico Inc.	Metalworking Machinery & Equipment	1977
Dei Industries	Radio-TV Transmitting Equipment	1970
Jet Air Freight	Transportation Services	1974
Dairy Queen Stores Inc.	Retail-Eating Places	1977
Presidents First Lady SPA	Misc. Amusement & Recreation	1974

TABLE V

MATCHING SAMPLE OF NONFAILED FIRMS, COMPUSTAT INDUSTRY CLASSIFICATION AND YEAR OF FAILURE

Company Name	Compustat Industry Classification	Matching Year
Universal Resources	Crude Petroleum & Natural Gas	1975
Compo Industries	Textile Mill Products	1978
Gaynor-Stafford Inds.	Textile Mill Products	1972
Decorator Industries	Apparel & Other Finished Products	1979
Movie Star Inc. CLA	Apparel & Other Finished Products	1977
Raven Industries Inc.	Apparel & Other Finished Products	1971
Ohio-Sealy Mattress	Household Furniture	1979
Clevepak Corp.	Paperboard Containers	1973
Park Chemical Co.	Misc. Chemical Products	1974
Barry (R.G.)	Footwear Except Rubber	1971
Refinement Int'l Co.	Secondary Smelting & Refining	1977
Struthers Wells Corp.	Misc. Metal Work	1974
T-Bar Inc.	Electronic Components NEC	1976
Thomas & Betts Corp.	Electronic Components NEC	1970
Whitaker Cable Corp.	Electrical Mach. & Equip.	1970
Dyneer Corp.	Motor Vehicle Parts-Access	1972
Rocor International	Trucking-Local & Long Distance	1974
Gross Telecasting	Radio-TV Broadcasters	1979
GNC Energy Corp.	Wholesale-Machinery & Equipment	1976
Foote Cone & Belding	Advertising Agencies	1971
Foote Cone & Belding Comm.	Advertising Agencies	1973
Fox-Stanley Photo Products	Business Services NEC	1969
Pittsburg Brewing	Malt Beverages	1971
Liberty Fabrics of NY Inc.	Knitting Mills	1971
Acme Precision Products Inc.	Metalworking Machinery & Equipment	1977
LaPointe Industries	Radio-TV Transmitting Equipment	1970
Canal-Randolph Corp.	Transportation Services	1974
Wendy's Int'l Inc.	Retail-Eating Places	1977
Great Lakes Recreation Co.	Misc. Amusement & Recreation	1974

TABLE VI

MEANS AND STANDARD DEVIATIONS OF FUNDS FLOW COMPONENTS AND FINANCIAL RATIOS FOR FAILED AND NONFAILED COMPANIES ONE YEAR BEFORE FAILURE

FUNDS FLOW COMPONENTS

Funds Flow Component	Group 1 Failed		Group 2 Nonfailed	
	Mean	S.D.	Mean	S.D.
NOFF/TNF	.1474	.4674	.5911	.2525
NWCFF/TNF	.1042	.4636	-.1131	.3216
NOA&LF/TNF	-.1101	.2809	.0411	.1868
NFFF/TNF	.1509	.5045	.0155	.4210
FCE/TNF	-.1712	.1400	-.1024	.1184
NIFF/TNF	-.1005	.3156	-.3171	.2680
DIV/TNF	-.0144	.0464	-.1073	.1146
CC/TNF	-.0062	.3202	-.0077	.2112
TNF/TA	.2445	.1295	.2107	.0858

FINANCIAL RATIOS

Financial Ratios	Group 1 Failed		Group 2 Nonfailed	
	Mean	S.D.	Mean	S.D.
NI/TA	-.0462	.1079	.0609	.0593
EBIT/TA	-.0110	.1256	.1267	.0986
TD/TA	.6619	.3276	.5064	.2567
CF/TD	.0426	.2867	.3326	.4018
NWC/TA	.1789	.2477	.3068	.1722
CA/CL	1.9372	1.5827	2.4305	1.3064
C/CL	.6035	1.3164	.5949	1.0355
log TA	2.6043	1.0088	3.0068	.8990
MVCS/BVTC	.9208	2.8652	.9824	.8104

TABLE VII

LOGIT COEFFICIENTS AND ASYMPTOTIC T RATIOS FOR
SEPARATE RUNS OF FUNDS FLOW COMPONENTS AND FINANCIAL RATIOS

FUNDS FLOW COMPONENTS

	COEFFICIENT	ASYMPTOTIC T RATIO
CONSTANT	2.065	1.475
NOFF/TNF	.416	.337
NWCFF/TNF	2.045	1.620
NOA&LF/TNF	-6.768	2.540**
NFFF/TNF	.885	.841
FCE/TNF	1.692	.599
NIFF/TNF	3.301	2.017**
DIV/TNF	22.119	2.590*
TNF/TA	-.810	.272

FINANCIAL RATIOS

	COEFFICIENT	ASYMPTOTIC T RATIO
CONSTANT	2.603	2.218**
NI/TA	-9.131	1.348
EBIT/TA	.296	.069
TD/TA	-1.794	1.463
CF/TD	-.606	.555
NWC/TA	4.855	1.650
CA/CL	.343	.607
C/CL	.065	.166
Log TA	-.318	1.359
MVCS/BVTC	-.026	.112

*Significant at the .01 level.
**Significant at the .05 level.

TABLE VIII

LOG OF LIKELIHOOD FUNCTION FROM THE LOGIT ANALYSIS FOR VARIOUS TESTS

Test Number	Testing Ratios and Funds Flow Separately	Log of Likelihood Function
1	Intercept only	-40.203
2	8 Financial Ratios, excluding C/CL	-24.612
3	8 Financial Ratios, excluding EBIT/TA	-24.601
4	9 Financial Ratios	-24.599
5	8 Funds Flow Components	-17.269

Test Number	Testing Combinations of Financial Ratios and Funds Flow Components[a]	Log of Likelihood Function
6	7 Ratios and 8 Funds Flow (C/CL omitted)	-13.862
7	7 Ratios and 8 Funds Flow (EBIT/TA omitted)	-12.556
8	8 Ratios and 8 Funds Flow	-11.390

[a]The ratio NI/TA is omitted from each of the following tests because it is highly correlated with NOFF/TNF, EBIT/TA and CASH FLOW/TOTAL DEBT.

TABLE IX

LOGIT COEFFICIENTS AND ASYMPTOTIC T RATIOS FOR
COMBINED RUNS OF FUNDS FLOW COMPONENTS AND FINANCIAL RATIOS

	Test 6*	Test 7	Test 8
CONSTANT	6.584 (1.251)	3.833 (1.330)	12.699 (1.380)
NOFF/TNF	-1.070 (0.402)	-0.615 (0.355)	-5.307 (1.225)
NWCFF/TNC	2.101 (1.158)	1.241 (0.751)	2.829 (1.041)
NOA&LF/TNF	-10.082 (2.071)**	-13.578 (1.931)	-20.263 (1.973)**
NFFF/TNF	1.027 (0.680)	0.950 (0.549)	2.245 (0.869)
FCE/TNF	2.083 (0.483)	-2.396 (0.597)	-0.329 (0.065)
NIFF/TNF	3.844 (1.561)	4.773 (1.403)	8.219 (1.657)
DIV/TNF	26.412 (2.020)**	42.022 (1.334)	57.968 (1.877)
TNF/TA	-5.339 (0.868)	-2.440 (0.554)	-13.023 (1.274)
EBIT/TA	5.997 (0.738)	--	15.859 (1.292)
TD/TA	-3.180 (1.269)	-40.661 (0.178)	-2.963 (0.855)
CF/TD	-3.198 (0.864)	1.075 (0.231)	-1.484 (0.276)
NWC/TA	-8.587 (1.785)***	-6.056 (0.902)	-13.510 (1.497)
CA/CL	0.938 (1.211)	0.398 (0.304)	1.233 (0.905)

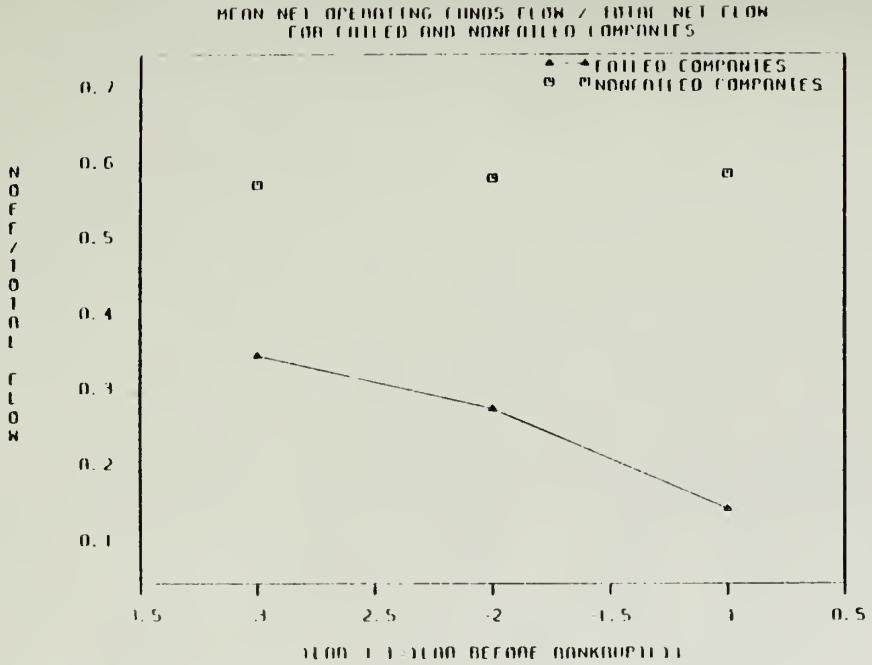
TABLE IX (cont'd.)

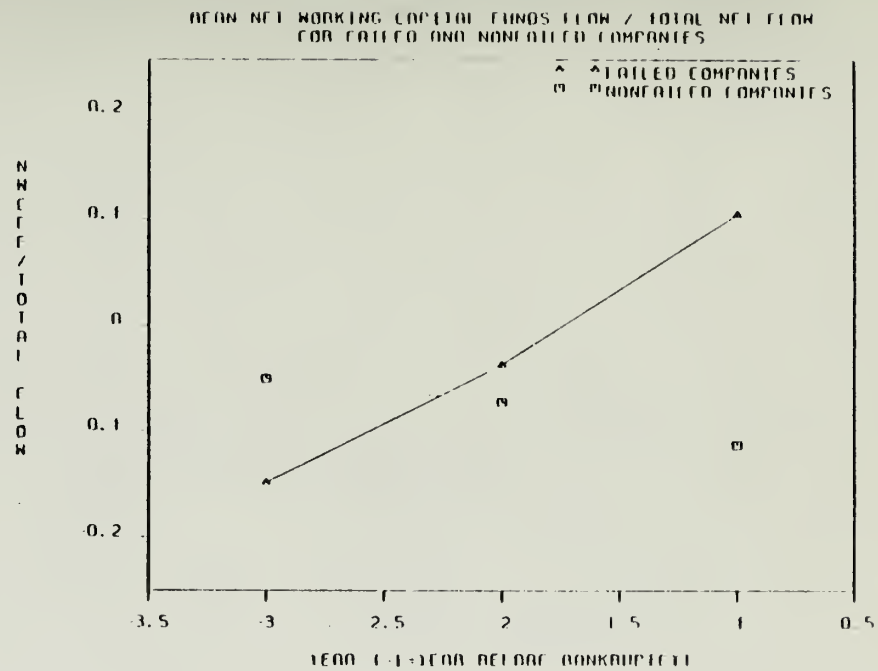
LOGIT COEFFICIENTS AND ASYMPTOTIC T RATIOS FOR
COMBINED RUNS OF FUNDS FLOW COMPONENTS AND FINANCIAL RATIOS

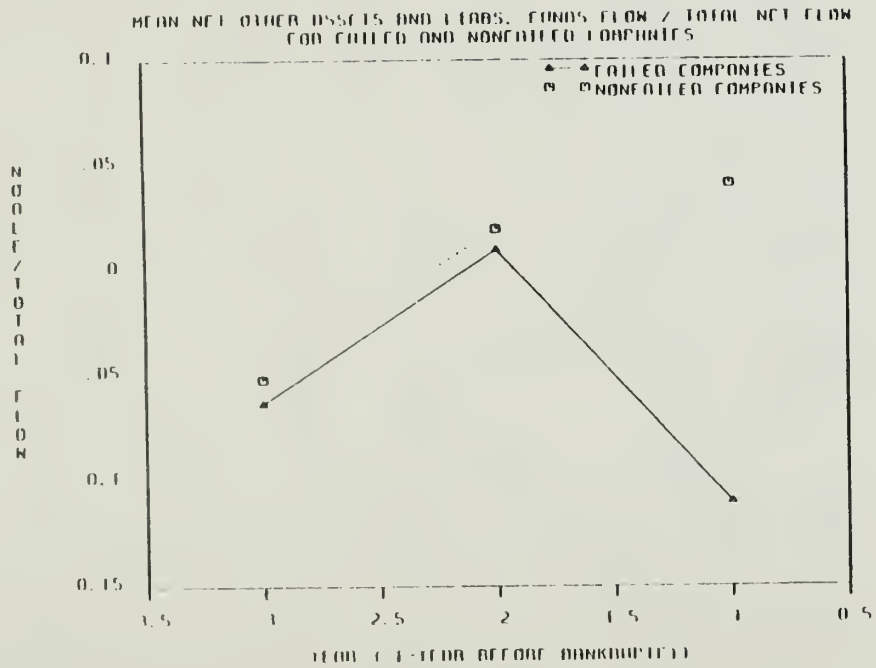
	Test 6*	Test 7	Test 8
C/CL	--	2.144 (1.383)	3.197 (1.613)
LOG TA	-0.135 (0.265)	-0.292 (0.490)	-0.791 (0.967)
MVCS/BVTC	0.777 (0.124)	0.066 (0.112)	-0.726 (1.288)

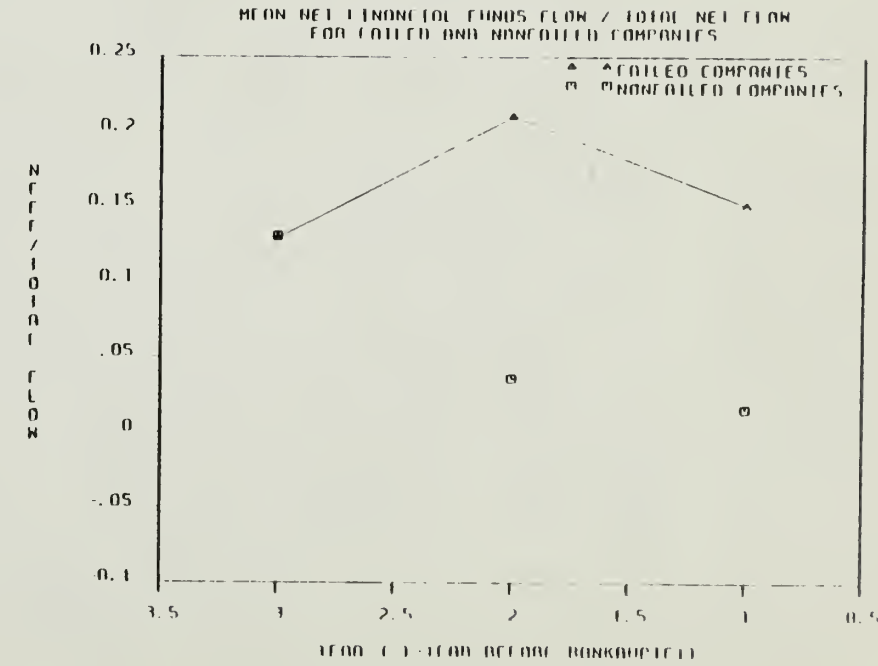
*Tests identified in Table VII.
**Significant at .05 level.

TRENDS OF RELATIVE FUNDS FLOW COMPONENTS
FOR FAILED AND NONFAILED COMPANIES









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TRENDS OF RELATIVE FUNDS FLOW COMPONENTS
FOR FAILED AND NONFAILED COMPANIES