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Cash Flow Variability and Random Systematic Risk

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Abstract

This paper investigates the relationship between the volatility of a firm's cash flow patterns and the randomness of its systematic risk. The findings indicate the existence of a set of intricate relationships between systematic risk and a firm's operating, financing, and liquidity management policies. Also, it appears that an analysis of the various components of a firm's cash flows can provide a convenient mechanism for improving *ex ante* estimates of systematic risk.

Cash Flow Volatility and Random Systematic Risk

I. Introduction

Since the development of the Sharpe-Lintner-Black [33, 25, 5] Capital Asset Pricing Model (CAPM) over a decade ago, the concept of systematic risk or beta has become an integral component of financial theory. For example, several widely used textbooks in the field of managerial finance [7, 9, 10, 13, 16, 21, 34, 41, 43] indicate that systematic risk should play a crucial role in determining a firm's required rate of return. In deriving an estimate for a firm's beta, several textbooks have suggested the use of the single-index market model given in equation (1).

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \qquad (1)$$

In equation (1), $R_{i,t}$ is the t-th period's return on firm i; α_i is an intercept term; β_i is the i-th firm's beta; $R_{m,t}$ is the t-th period's return on market; and $\varepsilon_{i,t}$ is a residual error term for period t.

During the last few years, several papers have investigated the determinants of a firm's beta. See, for example, [2, 3, 4, 8, 26, 27, and 40]. Myers [29] has reviewed some of these studies and has noted a limitation in using cross-sectional regression analysis to explain levels of systematic risk. That is, cross-sectional analysis overlooks cyclicality or, more specifically, the covariance between changes in a firm's earnings and the earnings of the overall economy or "market". Indeed, Myers found that cyclicality, earnings variability, financial leverage, and growth are significant in determining beta.

Recently, Fabozzi and Francis [12], Lee and Chen [24], and Sunder [36] have argued that some form of Theil and Mannes' [39] random coefficient model (RCM) (see also Theil [38] and Judge, et al. [22]) may specify the market model, equation (1), more effectively. These studies have introduced another dimension to systematic risk: its randomness over time.

The purpose of this paper is to investigate the relationship between the volatility of a firm's cash flow patterns and the randomness of its systematic risk. Two statistical procedures will be used to explain this relationship. First, using Sunder's technique [36], this paper will investigate the stationarity of systematic risk for a sample of 114 corporations randomly selected from the Fortune 1000 [15]. Second, through multivariate and univariate analysis of variance (MANOVA and ANOVA, respectively), tests will be performed to check for a statistical relationship between randomness in systematic risk and the volatility of corporate cash flows over time. Section II provides a discussion of random coefficient models, and the techniques used to measure cash flow variability will be given in Section III. Next Section IV discusses hypotheses, data, and statistical procedures; this will be followed by the results of the study in Section V. A summary of the paper and its conclusions are given in Section VI.

II. Random Coefficients Models

Traditional use of the market model in equation (1) assumes that β_i is a fixed coefficient. Under these conditions ordinary least squares (OLS) procedures can provide an unbiased and consistent estimator for a firm's systematic risk. Although a specific OLS estimate of β_i may fluctuate around its true value, the variance of β_i will approach zero as the estimation sample size increases. On the other hand, if systematic risk is assumed to be a random coefficient, β_i will have a defined variance, and this variance will not approach zero even if the estimation sample size approaches infinity.[1]

The Theil-Mannes RCM [39] is given in equation (2):

$$y_t = \beta_t x_t + \varepsilon_t \tag{2}$$

where $$E\begin{bmatrix}\varepsilon_t \\ \beta_t\end{bmatrix} = \begin{bmatrix}0 \\ \beta\end{bmatrix}, \quad V\begin{bmatrix}\varepsilon_t \\ \beta_t\end{bmatrix} = \begin{bmatrix}\sigma_\varepsilon^2 & 0 \\ 0 & \sigma_\beta^2\end{bmatrix},$$

$$E\left\{\begin{bmatrix}\varepsilon_t \\ \beta_t - \beta\end{bmatrix}[\varepsilon_s \quad \beta_s - \beta]\right\} = 0, \quad t \neq s,$$

and $$\beta_t = \beta + \psi_t.$$

In the RCM, y_t and x_t represent the t-th deviations from their respective means, and β_t is assumed to fluctuate over t around a true value, β, with variance, σ_β^2. The error term, ε_t, is independent over t and identically distributed, with mean zero and finite variance. Similar conditions also apply to the error term, ψ_t. Finally, E and V are the expectation and variance operators, respectively.

Recently, Fabozzi and Francis [12] used the Theil-Mannes RCM to investigate randomness in systematic risk using the single-index

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[1] Hildreth and Houck [20] have suggested that missing variables in the specification of a linear model can provide a rationale for using a RCM rather than a fixed coefficient model. Thus recent evidence regarding arbitrage pricing theory [31], as well as the existence of excess risk-adjusted returns derived through firm size or P/E trading rules [1, 30] is consistent with a RCM specification.

market model. Unfortunately the Theil-Mannes RCM implicitly imposes a restriction that the model's intercept term is zero.

Sunder [36] has developed an alternative RCM.[2] Not only does his model include an intercept term; it is a general model of the stochastic generating process for systematic risk. That is, the process can range from a mean reverting form to a random walk model. Given the fact that one cannot theoretically or empirically justify the exclusion of an intercept term from either the single-index market model or excess return form of the CAPM, Sunder's RCM appears superior to the Theil-Mannes approach. Also, based upon Blume's evidence [6] that betas tend to regress toward one, the mean reverting version of Sunder's model has strong intuitive appeal.[3] Accordingly, this study will apply Sunder's RCM under the assumption of a mean reverting process in order to test randomness in individual firms' systematic risk.

III. Cash Flow Variability

Since the landmark work by Williams [44],[4] financial theorists and practitioners have accepted the inextricable link between value

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[2] For sake of brevity a detailed presentation of Sunder's RCM will not be given here; however, the interested reader is referred to [36].

[3] In [36], Sunder used the random walk version of his RCM. Our study is concerned with beta randomness and not the level of systematic risk *per se*. An analysis indicated that our random coefficient betas' t-values are almost identical under either the mean reverting or random walk models.

[4] For an excellent discussion of cash flow valuation analysis in the context of the CAPM, see [14].

and future cash flows. This section will discuss a methodology to assess the variability of five components of a firm's cash flow. These components are derived from a "sources and uses" of cash format given in Helfert [19, p. 15]. A simplified version of Helfert's model is given in Table 1. As seen there, the model has five major sources and/or uses

Table 1

of cash: Net Operating Funds Flow (NOFF), Net Financial Funds Flow (NFFF), Capital Expenditures (CEXP), Dividends (DIV), and Changes in Cash and Marketable Securities (ΔC). Also the sum NOFF + NFFF - CEXP - DIV - ΔC, must always equal zero; this results from the sources = uses in nature of the model.[5]

Although the configuration and size of the annual cash flow components vary considerably from firm to firm, the following scenario might be typical of a viable company operating in a stable economic or "constant growth" environment. NOFF should provide the bulk of a firm's total cash inflows. Based upon the tax advantages noted by Modigliani and Miller (M&M) [28], these operating inflows would probably be augmented by an increase in NFFF, primarily from net increases in short-term and/or long-term debt. CEXP would be the principal use of the NOFF and NFFF sources, while a relatively stable DIV level would absorb a portion of the cash inflows. Finally, ΔC would serve as a "swing" variable that would provide a liquidity cushion when cash inflows are short and a reserve for excess funds when they are flush. Clearly seasonality complicates the timing and synchronization of cash flows.

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[5] Spies [35] has used a similar format to analyze in a partial adjustment framework the sources for and uses of a firm's capital budget.

However, by focusing on year to year changes in these five cash flow components, seasonality effects should be minimal.

If one assumes a steady-state environment, it seems reasonable that the ratio of each of the annual cash flow components divided by a firm's ending total assets should be stable. (Note that this division adjusts for firm size, and thus places large and small firms on equal, proportional scale.) On the other hand, an unstable environment and/or firm would require a significant juggling act on the part of management in order to keep the five, annual cash flow components synchronized. If management can offset these cash flow shortfalls over time, one would observe significant changes in the ratios of these cash flow components to total assets through time.

Let $R_{NOFF,t}$ equal Net Operating Funds Flow from period t-1 to t ($NOFF_t$) divided by ending Total Assets at period t (TA_t). Using this notation, the ratio of each cash flow component to total assets follows.

$$R_{NOFF,t} = NOFF_t/TA_t \tag{3}$$

$$R_{NFFF,t} = NFFF_t/TA_t \tag{4}$$

$$R_{CEXP,t} = CEXP_t/TA_t \tag{5}$$

$$R_{DIV,t} = DIV_t/TA_t \tag{6}$$

$$R_{\Delta C,t} = \Delta C_t/TA_t \tag{7}$$

Now let the change in each cash flow ratio equal $\Delta R_{j,t}$ ($j = 1,\ldots,5$), where j is an index designating the five ratios defined in equations (3)-(7), respectively. These ratios are defined in equations (8) through (12).

$$\Delta R_{NOFF,t} = R_{NOFF,t} - R_{NOFF,t-1} = \overline{\gamma}_{NOFF} + \varepsilon_{NOFF,t} \quad (8)$$

$$\Delta R_{NFFF,t} = R_{NFFF,t} - R_{NFFF,t-1} = \overline{\gamma}_{NFFF} + \varepsilon_{NFFF,t} \quad (9)$$

$$\Delta R_{CEXP,t} = R_{CEXP,t} - R_{CEXP,t-1} = \overline{\gamma}_{CEXP} + \varepsilon_{CEXP,t} \quad (10)$$

$$\Delta R_{DIV,t} = R_{DIV,t} - R_{DIV,t-1} = \overline{\gamma}_{DIV} + \varepsilon_{DIV,t} \quad (11)$$

$$\Delta R_{\Delta C,t} = R_{\Delta C,t} - R_{\Delta C,t-1} = \overline{\gamma}_{\Delta C} + \varepsilon_{\Delta c,t} \quad (12)$$

In equations (8) through (12), $\overline{\gamma}_j$ equals the average change in $R_{j,t}$ (t=1,...,T). The variable, $\varepsilon_{j,t}$, is an error term for each ratio that occurred in period t (t=2,...,T); $\varepsilon_{j,t}$ is simply the difference between $\Delta R_{j,t}$ and $\overline{\gamma}_j$.. Clearly, important economic information related to the relative size and variability of cash flow is contained in each $\overline{\gamma}_j$. It is hypothesized that the variables, $\overline{\gamma}_j$ (j=1,...,5), will be significantly related to the instability of systematic risk.

IV. Hypotheses, Data, and Statistical Procedures

Hypotheses

This research will focus upon two hypotheses:

1. For many firms, systematic risk is unstable.
2. Random systematic risk is directly linked to cash flow instability.

First, using a sample of 114 firms selected randomly from the 1980 edition of the Fortune 1,000 [15], it will test whether these corporations' measures of systematic risk are stable. The betas will be estimated using 60 monthly returns obtained over a five year period covering January 1975 through December 1979. Second, using five indices of cash flow instability, $\bar{\gamma}_j$ (j = 1,...,5) defined in equations (8)-(12), respectively, it will attempt to identify a statistical link between cash flow volatility and beta randomness. The cash flow instability components will also be calculated over the period, January 1975 through December 1979.

Data

As noted earlier, 114 corporations were randomly selected from the Fortune 1000. To be included in the sample, each corporation must have been listed on both the COMPUSTAT Annual Industrial and University of Chicago's CRSP monthly return tapes. Also, it was necessary that each company have a December 31 fiscal year-end. This allowed the betas and cash flow volatility measures for all companies to be estimated over the same sixty month period. Using these criteria, thirty companies were selected from each quartile in the Fortune 1000. That is, thirty were selected from companys ranked 1 through 250, 251 through 500, etc. Unfortunately, due to data availability, only 24 companies ranked 751-1000 met the sample selection criteria. Thus the data are slightly biased toward larger firms. The sample firms and their Fortune rankings are given in Appendix A.

Data used to construct Helfert's funds flow statements were obtained from Standard and Poor's COMPUSTAT Annual Industrial files. The CRSP monthly return files provided the data for estimating Sunder's random coefficient model. The value weighted, dividend inclusive Fisher Index served as a proxy for the market.

Statistical Procedures

The principal technique used in this study was MANOVA using three classification categories based upon the probability that a corporation's beta is not stable. Using Sunder's approach [36], a one-tailed t-test determines if one can reject the null hypothesis that a firm's beta is stable.

The first step in the analysis was to calculate a random coefficient beta and t-value for each firm in the sample. Based upon this t-value one can assess the probability of instability. If the t-value falls in zone 1 in Figure 1, one cannot reject the stable systematic risk hypothesis at a significance level of 5 percent. Firms falling in this zone will be in the stable beta category. In contrast, if a firm's random coefficient t-value falls in zone 2, one can be relatively confident that systematic risk is not stable. Zone 2 corporations will be classified in a second category indicating relative instability. Finally, if the t-value falls in zone 3, one can reject the stable beta hypothesis with a significance level of 1 percent. Firms in zone 3 will be classifed in a third category indicating instability in systematic risk.

Figure 1

V. Results

The results of the random systematic risk classification analysis are given in Appendix A and Table 2. Appendix A provides the name of each company, its Fortune 1000 ranking, and its systematic risk category. Table 2 gives a summary of the Appendix and also breaks down the systematic risk categories by firm size.

Table 2

Several interesting trends appear in the data. First, larger firms tend to have more stable betas, while smaller firms' betas are more random.[6] Second, roughly 60 percent of the entire sample had stable systematic risk during the late 1970's. However, measures of systematic risk for approximately 40 percent are random.

The results in Table 3 provide evidence that links cash flow instability and random systematic. Panel A gives the reults for multi-

Table 3

variate tests of all five $\bar{\gamma}$'s. This analysis [37, pp. 157-170] tests the following null hypothesis:

$$H_0: \bar{\Gamma}_1 = \bar{\Gamma}_2 = \bar{\Gamma}_3, \tag{13}$$

where

$$\bar{\Gamma}_i = \begin{bmatrix} \bar{\gamma}_{NOFF,i} \\ \bar{\gamma}_{NFFF,i} \\ \bar{\gamma}_{CEXP,i} \\ \bar{\gamma}_{DIV,i} \\ \bar{\gamma}_{\Delta C,i} \end{bmatrix} \qquad (i = 1,\ldots,3)$$

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[6] The tendency for smaller firms to have more random levels of systematic risk potentially sheds some light on an anomoly recently detected by Banz [1] and Reinganum [30], who found that smaller firms tend to have higher risk adjusted returns *vis-a-vis* larger firms. If, as indicated in Table 2, there is greater uncertainty regarding the proper level of risk adjustment or beta for smaller firms, investors would demand higher returns. To the extent that this randomness in systematic risk may not be diversified away, due to thinness of the equity market for and/or a lack of adequate information on smaller companies, investors should receive excess returns. See [1, p. 17].

is a vector containing five average cash flow variability components for firms in systematic risk category i (i=1,...,3). This null hypothesis states that the cash flow volatility vectors are the same across all systematic risk categories.

Based upon statistics developed by Hotelling and Wilks (see [37]), it is possible to derive "approximate" F-values of the hypothesis given in (13). As seen in Panel A, neither F-value indicates that there is a significant difference in the $\overline{\Gamma}_i$ vectors at the 10 percent level.

Panel B contains the results of univariate analysis of variance across individual cash flow variability components. The F-values for the five components indicate that changes in relative levels of NOFF, NFFF, and ΔC are statistically related to randomness in systematic risk at the 3.8, 7.5, and 2.4 percent levels, respectively. In view of "operating cash flow" nature of M&M's [28] risk class definition, as well as Hamada's [17, 18] work integrating M&M's debt related tax shields within the CAPM, the relationships between NOFF and NFFF proportional changes and random systematic risk are theoretically sound and are not surprising. The significance of the ΔC liquidity variable is also intuitively plausible, and points out a direct link between working capital/liquidity policy actions and random systematic risk.

There does not appear to be a strong link between random systematic risk and changes in capital expenditures or dividend policy. Given the long-run nature of both capital expenditure and dividend policies, these results are not surprising. In other words, in the absence of extraordinary events, the relative level of both capital expansion and dividends does not change.[7] However, it appears that the way in which these cash outflows are funded has a direct impact on the randomness of systematic risk.

Based upon the ANOVA results an alternative multivariate test similar to the one described in equation (13) was performed. However, only three average cash flow variability components were used: $\bar{\gamma}_{NOFF,i}$, $\bar{\gamma}_{NFFF,i}$, and $\bar{\gamma}_{\Delta C,i}$ (i=1,...,3). The results of this test are reported in Panel C of Exhibit 4. Based upon both the Hotelling and Wilks statistics, one can reject the hypothesis that the $\bar{\Gamma}_i$ (i=1,...,3) are similar across the i-th categories of systematic risk at the 5 percent level. On this basis, there is a direct link between random systematic risk and corporate operating, financing, and liquidity related cash flow instability.

Table 4 provides insight into the nature of how the means and standard deviations of the cash flow variability components in Panel C of Table 3 change across the beta randomness categories,[8] although absolute size of these $\bar{\gamma}$'s is relatively small.

Table 4

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[7] Similar results were also found by Spies [35].

[8] Although the $\bar{\gamma}$ variables defined in equations (8) through (12) represent the average change in each cash flow component divided by ending total assets, each γ incorporates only the net change between the last and first cash flow return. (The others washout in the averaging process.) This emphasis on the first and last period potentially biases the results of this study. However, this bias is diminished by the fact that all firm's betas and cash flows are measured over the same time period. Thus, all firms were subjected to the same peaks, troughs, and dips in the business cycle and "market" trends. Major trends in the economy had the potential to affect all firms in the same, systematic fashion. However, many corporations would clearly exhibit cash flow characteristics that do not move in lockstep with the business cycle. Because these results reported in this study capture deviations from systematic trends in the business and market cycles, any potential bias introduced by an emphasis on beginning and ending cash flow characteristics is attenuated.

All the beta randomness categories on average experienced a decline in the proportion of net operating cash flows to total assets, and the size of the decline is positively related to the degree of systematic risk randomness. As one compares the mean net financial cash flow variability components across randomness categories, stable betas firms experienced an increase in net financing inflows. This is in direct contrast to the moderately random firms, which on average saw almost no change in financing patterns, and the random beta firms experienced a large increase in financing inflows. Contrasting trends also appear in the liquidity variables. On average, the stable firms experienced very little change in their cash and marketable securities cash flow patterns. However, the random systematic risk firms saw a decline in liquid assets.

Additional insights regarding trends across the randomness categories are revealed when one compares the operating, financing, and liquidity volatility vis-à-vis averages for the entire sample. Regarding the stable beta firms, average decreases in relative operating cash flows were negative, but they were less than the norm for the entire sample. At the same time, increases in financing cash flows were also less than the sample average. Finally, although the average sample firm drew upon its liquidity reserves, the stable beta corporations on average added to liquid assets.

Regarding the moderately random beta corporations, on average, oprating cash flow decreases were slightly larger than the sample average, but the companies were much less dependent upon financial inflows. However, decreases in liquidity reserves appeared to bridge the gap between cash flow sources and uses. In contrast, the random beta firms appeared to have endured the worst of all possibilities. Compared with sample norms, operating and liquidity cash flow decreases, as well as financial inflows increases, were all bigger than sample averages.

The results of this study indicate that randomness in systematic risk will be affected by net changes in net cash flows from sales, expenses, and changes in working capital, financing sources and uses, and cash and marketable securities balances. On balance, these results point to a set of intricate relationships between systematic risk and a firm's operating, financing, and liquidity management policies. They indicate a crucial need by corporate managers to integrate and balance continuously long-run capital investment, financing, and dividend decisions with short-term working capital management and liquidity policies.

VI. Summary and Conclusions

Since the development of the Sharpe-Lintner-Black [33, 25, 5] CAPM, the concept of systematic risk has become part of accepted finance orthodoxy. Recently several studies [12, 24, 36] have indicated that systematic risk may be random. The purpose of this paper was twofold. First, using a sample of 114 corporations drawn at random for the 1980 version of the Fortune 1000, this study tested for a randomness in systematic risk over a 60 month period covering January 1975 through December 1979. Analysis of these firms' betas indicated that approximately 60 percent were stable, while 40 percent exhibited some degree of randomness. Second, using the results of the random systematic risk analysis, an attempt was made to derive a statistical link between three categories of systematic risk randomness and five variables which measure cash flow volatility. The five variables were derived from an analytical technique described by Helfert [19]. The variables measure volatility of net cash flows from operations and changes in working capital, financing decisions and fixed coverage expenses, capital expenditures, dividends, and changes in cash and marketable securities. Each of the cash volatility measures was adjusted for firm size. Multivariate and univariate analysis of variance indicated that three cash flow volatility measures were statistically related to randomness of systematic risk; two, related to capital expenditures and dividends, were not. This does not imply that capital expenditures and dividend policies are unrelated to systematic risk. Instead it appears that there is long-run stability in both dividend and capital expenditure cash flows, and thus the ratios of the cash uses relative to asset size do not change significantly through time. On the other hand, the stability of these cash outflows indicates a recurring need for cash, even in periods of earnings downturns and/or net working capital increases.

On balance the results point to a set of intricate relationships between randomness of systematic risk and a firm's operating, financing, and liquidity management policies. Further, these policies are simultaneously determined and must be congruent with long-run corporate capital expenditure and dividend policies.

Recently a number of authors [6, 11, 23, 32, 42] have addressed themselves to the issue of the accuracy of "historical betas," and how these measures of systematic risk can be improved to form better ex ante betas. The results of this study indicate that randomness in systematic risk is directly linked with variability in cash flow. This link between random betas and cash flow variability is not a simple one. Instead this relationship is dependent upon (1) the simultaneous interactions of operating, financing, and liquidity policies and results, and (2) how well these policies and their outcomes conform to the long-run capital expansion and dividend policies of a firm. There also appears to be a relationship between the degree of beta randomness and the severity of changes in operating, financing, and liquidity policies needed to bridge the gap between sources and uses of cash flow. This tends to highlight a critical need to balance continuously short-term and long-run managerial policies. Finally, it appears that an analysis of the various components of a firm's cash flows can provide a convenient mechanism for improving *ex ante* estimates of a corporation's systematic risk.

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Table 1

A Simplified Version of Helfert's Funds Flow Analysis

Operating Flows:		Operating Inflows*	
	less:	Operating Outflows**	Net Operating Funds Flow
Financial Flows:		Financial Inflows***	
	less:	Financial Outflows****	Net Financial Funds Flow
less: Discretionary Flows:			Capital Expenditures
			Dividends*****
less: Liquidity Flows		Ending Cash and Marketable Securities	
	less:	Beginning Cash and Marketable Securities	Δ Cash & Marketable Securities
			0

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* Operating Inflows include revenue and other income sources. Also included are sources of funds from certain operating or working capital accounts, for example, decreases in accounts receivable or inventories, increases in wages and accounts payable, etc.

** Operating Outflows include all operating expenses except depreciation. Also included are uses of funds for certain operating or working capital accounts, for example, increases in accounts receivable or inventories, decreases in wages and accounts payable, etc.

*** Financial Inflows include sources of funds from debt and equity issues, i.e., increases in short-term and long-term debt and proceeds from the sale of various categories of equity, etc.

**** Financial Outflows include uses of funds associated with debt and equity accounts, i.e., interest and fixed coverage expenses, repayment of short-term and long-term debt, purchase of treasury stock, etc.

***** Dividends incorporate all forms of common and preferred stock dividends.

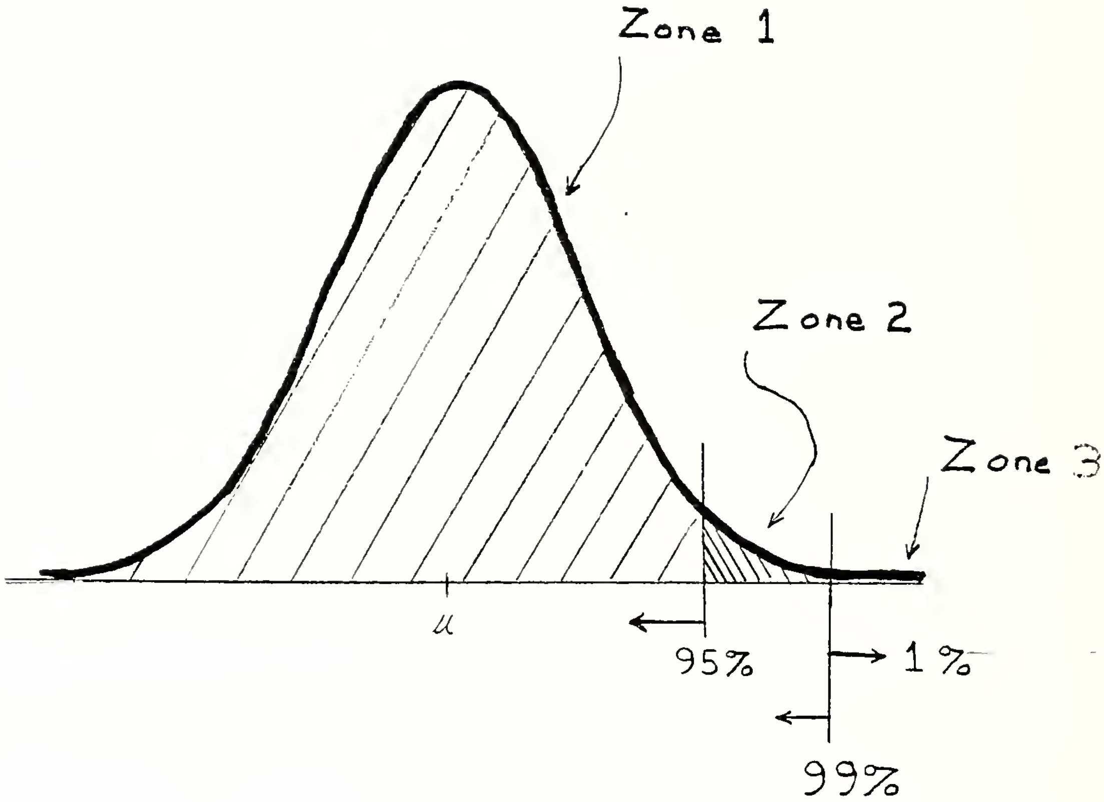

Figure 1

Zones of Systematic Risk
Instability

Table 2

Random Systematic Risk Category by Firm Size

Fortune Ranking	# of Firms	Category 1 (Stable) #	Category 1 (Stable) %	Category 2 (Moderately) (Random) #	Category 2 (Moderately) (Random) %	Category 3 (Random) #	Category 3 (Random) %
1 - 250	30	20	66.67%	4	13.33%	6	20 %
251 - 500	30	23	76.67%	4	13.33%	3	10 %
501 - 750	30	18	60 %	7	23.33%	5	16.67%
751 - 1,000	24	9	37.5%	6	25 %	9	37.5 %
Total	114	70	61.4%	21	18.42%	23	20.18%

Stable # Firms	Stable %	Random # Firms	Random %
70	61.4%	44	38.6%

Table 3

Results of Cash Flow Instability - Random Systematic Risk Analysis

Multivariate Test of Significance Using All Five γ's

	Test Name	Value	Approximate F	Significant F
PANEL A	Hotelling T^2	.1447	1.53	.129
	Wilks Λ	.8702	1.54	.126

Univariate Analysis of Variance

	Variable	Hypothesis Mean Square	Error Mean Square	F	Signif. of f
PANEL B	$\bar{\gamma}_{NOFF}$	.00204	.00060	3.38	.038
	$\bar{\gamma}_{NFFF}$	.00216	.00081	2.66	.075
	$\bar{\gamma}_{CEXP}$	.00001	.00001	1.58	.211
	$\bar{\gamma}_{DIV}$	.00032	.00023	1.39	.254
	$\bar{\gamma}_{\Delta C}$	.00143	.00037	3.85	.024

Multivariate Test of Significance Using γ_{NOFF}, γ_{NFFF}, and $\gamma_{\Delta C}$

	Test Name	Value	Approximate F	Significance of F
PANEL C	Hotelling T^2	.1348	2.43	.027
	Wilks Λ	.8782	2.44	.027

Table 4

Average Cash Flow Variability Measures by Systematic Risk Categories

Randomness Category	$\bar{\gamma}_{NOFF,i}$ (σ)	$\bar{\gamma}_{NFFF,i}$ (σ)	$\bar{\gamma}_{\Delta C,i}$ (σ)
i = 1 (stable) (n=70)	-3.818 E-3 (.0285)	8.350 E-3 (.0322)	.232 E-3 (.0210)
i = 2 (Moderately) (Random) (n=21)	-9.417 E-3 (.0182)	.821 E-3 (.0213)	-10.964 E-3 (.0144)
i = 3 (Random) (n=23)	-19.043 E-3 (.0138)	20.239 E-3 (.0211)	-9.076 E-3 (.0172)
Total for sample (n=114)	-7.921 E-3 (.0250)	9.362 E-3 (.0290)	-3.708 E-3 (.0197)

Random Systematic Risk Categories

Company Name	Fortune Ranking	Category	Company Name	Fortune Ranking	Category
ACF Industries	289	2	Kimberly-Clark Corp.	162	1
ATO, Inc.	361	3	LeHigh Valley Ind.	940	2
Allied Products Corp.	556	1	Louisiana Land & Expl Co.	331	1
Amalgomated Sugar Co.	747	1	Lukens Steel Co.	545	3
Amax, Inc.	115	1	MCA, Inc.	241	1
American Broadcasting	169	2	MEI Corp.	686	2
American Sterilizer Co.	797	3	MacMillan, Inc.	393	1
Amp, Inc.	281	1	Maytag Co.	521	1
C. R. Bard, Inc.	745	1	McGraw-Hill, Inc.	307	1
Bausch & Lomb, Inc.	454	1	Mead Corp.	135	1
Belding Heminway	989	1	MMM	51	3
Bemis, Inc.	377	1	Monsanto Co.	48	1
John Blair & Co.	759	3	Moore McCormack Resource, Inc.	468	1
Bliss & Laughlin Inds., Inc.	617	2	Munsing Wear, Inc.	936	1
Bristol Meyers Co.	122	1	Murphy Oil	207	1
Browne & Sharpe Mfg. Co.	768	1	NVF Co.	378	1
Brunswick Corp.	242	1	Nashua	395	1
CTS Corp.	779	1	National Steel Corporation	76	1
Capital Cities Communications	497	1	Oak Industries, Inc.	624	1
Carlisle Corp.	572	1	Palm Beach, Inc.	573	2
Certain-Teed, Corp.	303	3	Papercraft Corp.	998	3
Champion International Corp.	86	2	Porter, Inc.	672	1
Chesapeake Corp. of VA	700	1	Publicker Inds., Inc.	920	1
Chromalloy American Corp.	209	2	Quaker State Oil Refin. Corp.	360	1
Chrysler	17	3	Questor Corp.	466	2
Cleveland-Cliffs Iron Co.	549	1	RTE Corp.	760	3
Cone Mills Corp.	363	1	Raybestos Manhattan, Inc.	607	1
Conwood Corp.	903	2	H. H. Robertson Co.	461	2
Cox Broadcasting Corp.	640	3	Rohm & Haas	202	1
Crompton & Knowles Corp.	687	3	Ronson Corp.	939	3
Cummins Engine, Inc.	192	1	Royal Crown Cos, Inc.	489	1
Cyclops Corp.	304	1	Schaefer F&M	830	1
Dan River, Inc.	411	1	Seagrave Corp.	977	2
Dentsply Intl., Inc.	691	2	Sherwin-Williams Co.	251	1
Easco Corp.	536	3	Simmonds Precision Prod., Inc.	997	3
Electric Memories and Magnetic	887	2	Singer Co.	132	3
Evans Products Co.	215	1	Southdown, Inc.	651	1
FMC Corp.	102	1	Standard Brands	131	1

Appendix A (cont'd.)

Random Systematic Risk Categories

Company Name	Fortune Ranking	Category
Faberge, Inc.	684	1
Federal Paper Board, Inc.	493	1
Federal Signal Corp.	990	2
Ford Motor Company	4	1
GF Business Equipment	834	2
GK Technologies, Inc.	260	1
General Motors	2	3
General Portland, Inc.	631	1
W. R. Grace & Co.	55	1
Graniteville Co.	609	3
Hammerville Paper Co.	269	1
Hanna Mining Co.	502	1
Haisco	299	1
Hazeltine Corp.	971	3
Houghton Mifflin	853	3
Insilco Corp.	408	3
Intl. Telephone & Telegraph	11	3
Itek Corp.	560	1
Katy Industry, Inc.	680	2
Standard Oil of California	6	1
Standard Oil of Indiana	10	3
Stanley Works	310	1
Stewart Warner Corp.	527	2
Storer Broadcasting	819	1
Sun Chemical Corp.	463	1
Texas Instruments	104	2
Thiokol Corp.	388	1
Thomas Industry, Inc.	698	1
Trane Co.	370	2
United Industrial Co.	869	1
U. S. Tobacco Co.	701	1
Ward Foods, Inc.	594	2
Warner Communications	199	1
Watkins-Johnson Co.	951	1
Wean United	751	3
White Consolidated Industries	173	1
White Motor Corp.	248	1
Wometco Enterprises	585	1