Faculty Working Papers

SIMULATION VERSUS SINGLE-VALUE ESTIMATES IN CAPITAL EXPENDITURE ANALYSIS: A COMMENT AND ANALYSIS

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Simulation Versus Single-Value Estimates In Capital Expenditure Analysis: A Comment and Analysis

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conclude that because single-point-estimates result in better decisions for shareholders this technique is superior to simulation.

Let us assume, for the time being, that their analysis and conclusion vis-a-vis shareholders is correct. This is not a sufficient reason to conclude that the information about project risk that simulation provides is irrelevant in the analysis of capital expenditures. Students of organizational behavior are well aware of the fact that business organization have multiple goals [1, pp. 27-32] and that management responds to the desires of many groups that interact with the business or participate in it. Indeed, management is more apt to engage in "satisficing" a number of these groups than in maximizing shareholder wealth [5, p. 169]. Accordingly, we must determine if the improved appreciation of risk that simulation provides will increase the ability of management to attain the multiple goals of a business or help them "satisfice" the groups that interact with or participate in it.

Will an analysis of risk help the manager keep his job (by not being known as the instigator of a failed project)? Will it help provide steady employment by preventing the dislocation that might occur if a major project failed? Will it help prevent a community from losing its industrial base by helping a firm avoid bankruptcy? Clearly the answer to these questions is yes.

Stockholders with a diversified portfolio are unique in that they can balance and offset the risks and rewards of multiple undertakings. Not all investors, communities, employees, and/or managers have this opportunity. For them the result of a single project is very important.

ocially responsible managers must consider the possible consequences of heir decisions on those persons and groups that cannot diversify, and he best way to consider these possible consequences is through an analysis f risk. Simulation is important because it helps provide information bout risk.

PROJECT RISK AND STOCKHOLDER RISK

Although we believe management does not and should not only onsider the impact of capital expenditures on shareholders with diversi- ied portfolios, we do agree that management should consider the interests f such persons. L & L argue that simulation is inferior to point estimates hen management is concerned with the interests of shareholders. We do ot believe that L & L have substantiated their argument against the use f simulation for this purpose. Nor do we believe that the alternate model resented by L & L is appropriate in its context or practical.

roject's Own Risk

L & L's case against simulation models is based, in part, on the llegation that a project's risk, or own-variance, is "irrelevant." They rgue that "Not only Sharpe [6] [7] and Lintner [3] [4], but a growing list f their intellectual descendants ... have in fact established that the ne irrelevant feature of an asset's prospective returns is its 'own risk' - the outcome uncertainties unique to the asset itself." [2, p. 29] We isagree with this interpretation of the capital market models of Sharpe nd Lintner. Indeed, this statement appears to be inconsistent with & L's explanation of Sharpe's expected return equation, where L & L state:

"Significantly, the own-variance of the security itself σ_j^2 , enters this expression only through σ_j being implied in the covariance term σ_{jm} . It is therefore relevant only to the extent that there exists a correlation of outcomes between security j and portfolio m." [2, p. 30]

It is also worth noting that Lintner does not regard an asset's "own-risk" as "irrelevant" in corporate capital budgeting. According to Lintner:

> "...for a company whose stock is traded in the market ... the minimum expected return (in dollars of expected present value) required to justify the allocation of funds to a given risky project is shown to be an increasing function of each of the following factors: (i) the risk-free rate of return; (ii) the 'market price of (dollar) risk'; (iii) the variance in the project's own present value return (italics ours); (iv) the project's aggregate present value return-covariance with assets already held by the company, and (v) its total covariance with other projects concurrently included in the capital budget. All five factors are involved explicitly in the corresponding (derived) formula for the minimum acceptable expected rate of return on an investment project." [3, p. 14]

L & L's argument continues with the assertion that simulation "... does not reveal how the distribution displayed interacts with the other distributions of return confronted by the firm in its concurrent projects or by investors in their personal portfolios. Insofar as the analyst relies on that display, he may render notably perverse judgements." [2, pp. 29-30]

According to L & L:

> "The compelling virtue of the traditional single-point value analysis is that it can incorporate the necessary recognition of market-dependency. Sharpe [6] [7] has shown that, under the pressure of investor portfolio construction, asset yields will tend to equilibrate in the capital market in such a way that the expected returns on all risky securities will be related to the default-free rate ..." [2, p. 30]

L & L associate the findings of Sharpe for securities to the general case of capital expenditure analysis. No evidence is offered to show that the assumptions of capital market theory hold in capital expenditure analysis; nor do L & L substantiate the implied assumption that firms hold diversified portfolios of assets. We do not question the findings of the Sharpe model as applied to securities, but we hold suspect L & L's implied assertion that those findings are applicable in all capital expenditure analyses.

L & L's Alternate Model

Our final comments concern L & L's "alternative model," where they claim that "This discipline of the marketplace, and the risky-asset prices it enforces, means that a "reading" of required expected returns is possible from observable data." [2, p. 30] We question this inference. Does it hold for new products, one-of-a-kind projects, or in a changing economic environment? L & L add that "All the analyst need do in evaluating a project is to identify the prevailing yield on investments in lines of business similar to the one being contemplated -- i.e., in activities of corresponding

'market relatedness'." [2, p. 30] We first must ask, what is "market relatedness"? L & L offer no definition of this term. We also question the practicallity of obtaining financial data from other companies, particularly companies "in lines of business similar to the one being contemplated," which, presumably are competitors.

L & L continue:

> "He (the analyst) should then apply <u>that</u> yield as the discount rate against the expected (single point) annual cash flows of the project at issue. If it has a positive present value as thereby derived, it should be accepted; if not, rejected. In most instances, this procedure simply involves measuring a firm's cost of capital, since cost of capital <u>is</u> the equivalent for a firm of the σ_j in the equation above."[1] [2, pp. 30-31]

L & L use a reference to Sharpe as justification for this statement. We do not understand how this statement was derived from their Sharpe reference, which is given in its entirety below.

> "The security market line can be used directly as a criterion for the acceptance or rejection of investment projects by a firm. The key is to consider such a project as a potential security to be held by the firm's owners. Thus, if a project plots above the security market line, it should be accepted; if it plots below the line, it should be rejected. In more traditional terms, <u>the cost of capital for a project is the expected rate of return shown by the security market line for projects of equal volatility.</u>"[2] "The expected dollar cash flow should be discounted at this rate of interest; if the present

value is positive, the project should be undertaken; if not, it should be rejected." (italics added) [7, p. 94, footnote]

Sharpe is not advocating discounting a project at the firm's cost of capital, but the expected return of projects of equal volatility.

Even if we follow this "model" vis-a-vis Sharpe's explanation, we encounter problems. Projects of equal volatility are investments that have the same covariance with the market, assuming that the variance of the market is constant. We suspect that the analyst would encounter estimation problems for this formulation. In addition, the "model" is unclear in the situation where alternative projects are considered. If the alternative projects have different volatilities, it is unclear what rate of return should be used to discount the projects. Two different volatilities result in two discount rates, one for each project. Should we pick the project with the highest net present value, based upon the fact that the projects are discounted at different rates?

CONCLUSION

We feel that the arguments presented in the last section of L & L's paper do not support their conclusion that "the information provided by simulation is, at best, no better than is generated by the traditional single-point present value approach, and in one very important respect, is markedly inferior." [2, p. 19]

FOOTNOTES

[1]The expected return is given by:

$$\bar{R}_j = i + (\bar{R}_m - i)\left(\frac{\sigma_{jm}}{\sigma_m^2}\right)$$

where $\bar{R}_j$ is the expected rate of return, i is the risk-free interest rate, $\bar{R}_m$ is the expected return of the market portfolio, σ_{jm} is the covariance between the security j and the market, and σ_m^2 is the variance of market returns.

[2]Volatility is defined as the covariance between security j and the market divided by the variance of market returns. This expression is $\left(\frac{\sigma_{jm}}{\sigma_m^2}\right)$, which is contained in the last term in footnote 1 above.

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