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# A Note on Estimating the Cost of Capital for the Undiversified Business Owner

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About 70 percent of businesses are organized as sole proprietorships, and many business owners are not well-diversified, yet the finance discipline is largely silent regarding how to estimate the opportunity cost of capital for undiversified investors. In this paper, the Capital Market Line (CML) is presented as the appropriate vehicle for estimating such an investor's return requirement. Recognizing the applicability of the CML allows the undiversified investor's exposure to an investment's total risk to be objectively linked to the market price of risk. Knowing the appropriate return requirement is useful for valuation and capital budgeting purposes.

## I. INTRODUCTION

Finance literature offers little guidance on how to estimate an undiversified investor's required rate of return for an asset. A sole proprietor, for example, is often not well-diversified<sup>1</sup>. Such an individual's risk exposure is not limited to an asset's systematic risk as assumed by both the capital asset pricing model (CAPM) and the arbitrage pricing theory (APT). These entrepreneurs frequently bear the total risk of their ventures and their return requirements should reflect this exposure. In such cases, it is inappropriate to estimate required returns using, for instance, the oft-cited technique of utilizing asset betas estimated from pure plays in a traditional CAPM framework (Brigham & Gapenski, 1993; Fuller & Kerr, 1981; Levary & Seitz, 1990). Unfortunately, practitioners have little guidance other than using such a technique and making an ad-hoc adjustment for added risk to the

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estimated return requirement (see Pratt, 1989, p. 76). This note presents a method for estimating an undiversified investor's opportunity cost for a project, based on the project's total risk. The approach links the owner's level of risk exposure to the market-based price of risk using the Capital Market Line. The technique is useful for valuing closely-held businesses and for capital budgeting in sole-proprietorships.

## II. TOTAL RISK AND THE CAPITAL MARKET LINE

An undiversified investor is exposed to the total risk of an enterprise. To estimate such an investment's return requirement, begin by assuming that an investor intends to hold shares of only one actively-traded stock, XYZ Corporation. This investor is exposed to XYZ's total risk. The Capital Market Line (CML) captures the relationship between a portfolio's total risk and required return, and Equation 1 applies the CML to the investor's single-stock portfolio.

$$R(r_{xyz}) = R_f + (SD_{xyz}/SD_{mkt})(R_{mkt} - R_f) \quad (1)$$

where

$R(r_{xyz})$  = the required return for a portfolio made up exclusively of XYZ's stock

$R_f$  = the risk-free rate of return

$SD_{mkt}$   $SD_{xyz}$  = the standard deviation of returns for the respective assets (the market portfolio and XYZ)

$R_{mkt}$  = the expected return for the market portfolio.

$R(r_{xyz})$  correctly measures the investor's return requirement because it corresponds to the opportunity cost of holding a portfolio consisting entirely of asset XYZ. To see this, note that the XYZ investor's risk exposure is  $SD_{xyz}$ . The investor, therefore, could choose a well-diversified portfolio (perhaps a mutual fund) with exactly the same standard deviation of returns. In equilibrium, this mutual fund's return would be given by the CML and would equal  $R(r_{xyz})$ . By choosing to hold XYZ, the investor forgoes the opportunity to hold the well-diversified portfolio having identical risk and collecting that portfolio's return. Thus, the efficient portfolio's return is the investor's opportunity cost and therefore the investor's return requirement. In the end, the example's investor will choose not to hold XYZ in isolation because the stock's expected return will be less than the CML-based required return. This is because

diversified investors will price XYZ so that its expected return equals their return requirements. For a single stock, like XYZ, diversified investors return requirements will be based solely on the stock's degree of market risk, only a fraction of its total risk. Because of their lower risk exposure, diversified investors' return requirements are less than undiversified investors', driving up the stock's price to a level above the amount that undiversified investors will be willing to pay.

### **III. THE COST OF CHOOSING TO BE UNDIVERSIFIED**

Why, then, do some entrepreneurs choose an investment strategy that leaves them undiversified? There are several possible answers. Perhaps by being one's own boss, a sole proprietor gains utility from the satisfaction of "doing it myself." Another possibility is that an opportunity in a product or service market offers returns high enough to more than compensate for being undiversified. In either case, knowing the return requirement established in the capital market for the level of risk that they take on allows these proprietors to recognize the opportunity cost of their decision to be undiversified. This rate is as useful as the discount rate in valuing a business and in estimating a hurdle rate for use in capital budgeting.

### **IV. THE OPPORTUNITY COST OF CAPITAL FOR AN UNDIVERSIFIED OWNER**

The CML captures the relationship between an asset's total risk and its return requirement. For traded securities, the procedures for directly estimating the CML's inputs are well-established (Pratt, 1989; Ibbotson & Sinquefeld, 1989), but for closely-held assets the pure-play approach is generally used.

In the CAPM pure-play technique, the market risk of a closely-held firm, an operating division, or an investment project is estimated by locating a traded firm whose business is the same as that of the closely-held firm or the project of interest. This comparable company is called the "pure-play" and its equity's beta may be estimated using the usual regression technique. The CML version of the pure-play also requires that a comparable, actively-traded firm be found. But rather than estimating beta, the standard deviation of the pure-play's returns is estimated.<sup>2</sup> The standard deviation of market returns is also required. These estimates, along with estimates of the risk-free return and the

market risk premium, are substituted into Equation 1 and firm's required return, based on total risk, can be estimated.

## V. SOME INSIGHTS USING THE CML-BASED APPROACH

To illustrate the effect of estimating the opportunity cost of capital using the Capital Market Line, it is helpful to first re-express the CML measure of risk in terms of the more familiar beta.

$$R(r_a) = R_f + (B\hat{\alpha}/Corr_{a,m})(R_{mkt} - R_f). \quad (2)$$

Equation 2 makes possible an interesting observation: The measure of market risk from the CAPM may be adjusted to reflect total risk by dividing beta by the correlation between the asset's returns and the market's. Thus, the lower the correlation, the less total risk is "explained<sup>3</sup>" by beta, and the greater will be the difference in required return estimates between the two approaches. On the other hand, an asset with perfect positive correlation with the market requires no adjustment what-so-ever in its CAPM-estimated return to arrive at its CML-estimated return. Such an asset contains only market risk, so either risk metric will capture the relevant relationship.

Table 1 compares rate of return requirements estimated using the CML with those estimated using the CAPM. The returns shown were calculated using a risk-free rate of five percent, a market risk premium of seven percent, a range of betas from 0.5 to 1.5, and correlations ranging from 0.20 to 0.70. These figures were chosen as they seemed representative of actual data likely to be encountered in practice. The top line in the table is the CAPM-estimated return requirement, which also corresponds to the return for an asset whose correlation with the market equals positive one.

In Table 1, note that low beta businesses that are highly correlated with the market require very small adjustments to their CAPM returns. Only 1.5 percent must be added to 8.5 percent in order to adjust the return on an asset with a beta of 0.50 and market correlation of 0.70 to reflect its total risk rather than market-only risk. However, the required returns of high beta businesses with low market correlations must be more than tripled to arrive at CML-estimated opportunity costs.

The data in Table 1 illustrates the potential for error inherent in adjusting opportunity costs for non-diversification by either subjectively adding a few percentage points, or doubling or even tripling a CAPM-estimated benchmark. Either ad-hoc method of adjustment can lead to

**Table 1**  
**Required Returns Estimated Using Equation (2)**  
*(Assuming  $R_f = 5\%$  and  $R_{mkt} - R_f = 7\%$ )*

CORR	BETA		
	$B = 0.50$	$B = 1.00$	$B = 1.50$
1.00 <sup>a</sup>	8.5%	12%	15.5%
0.70	10%	15%	20%
0.50	12%	19%	26%
0.20	22.5%	40%	57.5%

Note: <sup>a</sup> The top row in the table, corresponding to the correlation between the asset and the market equalling one, yields the same required return as does the CAPM.

sizeable errors. The decomposition of total risk into market risk and correlation, however, enables an analyst to look to the nature of the firm's business and industry for guidance in estimating return requirements.

## VI. CONCLUSIONS

Although finance largely ignores the problem of opportunity cost estimation for the undiversified investor, there are those individuals who choose to hold portfolios containing very few assets. In fact, sole-proprietors are arguably the backbone of the economy, representing about 70 percent of business organizations. This paper presents a method for estimating the opportunity cost of capital for an undiversified investor based on the capital market line. In addition, the paper adds insight as to the size of the quantitative difference between market-based return requirements and return requirements based on total risk. Last, by expressing total risk as a function of market risk and correlation with the market, the analyst may gain some economic insight as to the characteristics of firms whose returns based on total risk are substantially above their returns based on market risk.

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## NOTES

1. Sole proprietors sometimes mortgage their homes and even borrow against their inheritances to finance their ventures.

2. One difficulty is that the pure-play may have a capital structure different from the firm of interest. Equity returns are more variable when firms employ more leverage. Thus, if a levered pure play is used to estimate an opportunity cost, it will yield a "conservative" estimate, erring on the "high" side.
3. The square of the correlation coefficient,  $R^2$ , may be interpreted as the proportion of total variation in a dependent variable which is "explained" or lowered by a statistical relationship. In this case, total variation is an asset's total risk and it is being statistically explained by beta, the asset's relative market risk.

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