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Deliverable II

**Validating Financial Models and Their Assumptions**

**Mean-Variance Portfolio Theory**

Mean-variance analysis asserts that investors can analyze possible investments with only the expected return, variance, and correlations of the investment. Mean-variance analysis has four underlying assumptions. First it assumes all investors are risk-averse; investors will choose the less risky investment for the same expected return. Next it assumes that the expected return, variances, and covariances of all investments are known and those are they are the only metrics required to create an optimal portfolio. And lastly it assumes the market has no friction; there are not transaction costs or taxes.

**Modern Portfolio Theory**

Modern portfolio theory seeks to improve mean-variance analysis by assuming that all investors have homogeneous expectations regarding the expected return, variance and correlations of the investment. These homogenous expectations imply every investor will hold the same optimal portfolio, which is referred to as the market portfolio (consists of all securities which are tradable in the capital market).

**Systematic Risk**

There are two main types of risks. Non-systematic risk is specific to a firm or sector, it can be diversified away for free, and thus investors require no risk-premium to hold it. Systematic risk is market-wide risk, cannot be diversified away, and investor do require a risk premium to hold it. An assets sensitivity to market risk can be calculated using the market portfolio (from modern portfolio theory) as a benchmark. “Because it is difficult to find data for returns of many bonds and small stocks, it is common in practice to use the S&P500 portfolio as an approximation for the market portfolio, under the assumption that the S&P500 is large enough to be essentially fully diversified” [1].

**Beta**

The sensitivity of a security to the systematic risk of the market portfolio is known simply as beta.

A beta above one implies that the asset has greater systematic risk than the market portfolio and will have greater movements in the returns compared to the market portfolio. A beta below one implies the asset as less systematic risk so their returns will not move less than the market. Beta can also be calculated with linear regression.

**CAPM**

“The Capital Asset Pricing Model (CAPM) is widely used to calculate the required return or expected return of a security using the market portfolio as a benchmark for systematic risk” [1].

CAPM asserts that the expected return of an asset is equal to the risk-free rate plus the product of systematic risk of the asset and the market risk premium . For CAPM to hold, the assumptions of mean-variance portfolio theory and modern portfolio must hold. CAPM relies heavily on the market-portfolio for systematic risk which requires the market to be efficient. The Efficient Market Hypothesis (EMH) can give in site the efficiency of the market-portfolio.

**EMH**

An efficient market is one which “prices adjust rapidly to reflect any new information” [4]. Prices adjust instantaneously due to competition in the market, which should make it impossible to realize consistent superior profits. But if EMH does hold, an inefficient market may allow some to realize consistent superior profits.

Past studies have focused on the efficiency of the market. In 1953, Kendal researched stock prices for regular cycles [1]. He concluded that the market was efficient because stock prices followed a random walk and have no effect on future prices [1]. In 1988, Poterba and Summers researched the proportional variance of stocks [1]. They found that variances did increase proportionally, again suggesting the market is efficient. And in 2017, Brealey, Meyers, and Allen studied the autocorrelation coefficients of stock returns, also concluding that there is no relationship between past and future stock prices [2]. These studies all suggest the market is efficient, and consistently superior returns are not possible because the stock prices reflect all available information, there is no free lunch.

Researchers however have been able to identify market anomalies which should not exist in an efficient market. Underreaction anomalies such as the ‘Earnings announcement puzzle’ show that after companies released earnings reports, stocks take six-months to fully react to the information [1]. Overreaction anomalies such as the ‘New-Issue/IPO puzzle’ show that newly issued stocks are initially overreacted to causing the stock price to be overly bid up initially, however returns have been shown to fall below those of comparable firms in the future [1]. These findings suggest that the market does not adjusted instantaneously to new information, making it inefficient, allowing for consistent superior profits.

**Reference:**

1. Corporate Finance (Fourth Edition), 2017, by Berk, J. and DeMarzo, P., Pearson
2. Derivatives Markets (Third Edition), 2013, by McDonald, R.L.
3. “Best Practices in Estimating the Cost of Capital: Survey and Synthesis,” Financial Practice and Education 8 (1998) <https://www.hbs.edu/faculty/Publication%20Files/Best%20Practices%20in%20Estimating%20the%20Cost%20of%20Capital%20Survey%20and%20Synethesis_e59fb55c-eeac-4abe-9ae9-04c4c623e8c3.pdf>