Chapter 5
Challenges in Estimation of Beta:
Market Models Used for Risk Estimation

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ABSTRACT

Capital asset pricing model (CAPM) brings deep intuitive understanding of the relationship between expected return and risk. Unfortunately, the empirical record of the CAPM has not been satisfactory since its commencement. The empirical testing of CAPM is void in most cases due to the use of an inefficient index as a proxy for market portfolio. Plausible tests require a well-diversified market portfolio which so far has been unfeasible to obtain. Lack of validity in empirical records has been caused by complexity in exerting valid estimations of the beta coefficient. This chapter judges which of the indices provides investors the best beta forecast and questions which time period should be selected for beta calculation. This chapter reveals that the choice of return intervals causes variations in beta estimation of the security. Applying higher frequency has an advantage in that it increases the number of observations, but a shortfall is that beta tends to have substantial bias with shorter return intervals used.

INTRODUCTION

To present date, the CAPM remains one of the most popular models in finance, the model is straightforward and uses only one factor yet powerful and widely applicable. The CAPM builds on Harry Markowitz's earlier work on modern portfolio theory and was introduced by William Sharpe (Markowitz, 1952). The CAPM shows a linear expected return-risk relationship that exactly defines the expected return given the systematic risk of a security. In doing so the CAPM makes the conversion from total risk to systematic risk, the main determinant of expected return.

The model affirms that the expected return of securities changes only by their systematic risk which is represented by beta (Fama & French, 2004). According to the CAPM, investors should create a portfolio which is a combination of the market portfolio and the risk-free asset. The model is not only essential from a conceptual perspective but is also applied broadly in practice (Brown & Walter, 2013). Investors use the model's expected rate of return to calculate the value of assets such as bonds, stocks, mortgages and other similar assets. Businesses on the other hand use the required rate of return obtained from the CAPM in capital budgeting for evaluating economic feasibility of the projects and decision-making processes. Moreover, investors use different ratios such as Sharpe ratio, Treynor ratio and Jensen's alpha that are derived from the CAPM to measure the performance of mutual fund managers, pension fund managers and institutional money managers (Jensen, 1968; Jensen, 1972).

Even though the CAPM is a model that simplifies an intricate investment environment by introducing the relationship between security's risk and return, unfortunately the empirical record of the CAPM has not been satisfactory ever since its commencement (Johnstone, 2013; Merton, 1973). In addition, the model is subject to theoretical limitations. Theoretical constraints that are intrinsic in the structure of the model are as follows:

- A number of unrealistic assumptions about investors: investors are risk-averse, utility maximizing, rational individuals and investors are price takers; about markets: markets are frictionless, including no taxes and no transaction costs; about holding period: investors plan for the same single holding period; about investors beliefs: investors have homogeneous beliefs or expectations; about investments: all investments are indefinitely divisible. These assumptions mean that all investors give the same value to all securities therefore all investors will choose the same optimal risk portfolio, which is the market portfolio.
- Limited number of investment characteristics such as systematic risk of the asset.
- Application of the model for one period only. A single-period model is incapable to encompass parameters that change over time.

Empirical concerns in CAPM implementation can be summarized as follows:

- Using a market portfolio that includes all assets existing in the economy. The market portfolio however is not yet observable.
- The empirical testing of CAPM is void in most cases due to the use of inefficient index as a proxy for market portfolio opposite to what the hypothesis put forward that the benchmark should be efficient. Plausible tests require well diversified benchmark that is the world market portfolio which has been unfeasible to obtain so far. In fact, the theory suggests that the CAPM is not testable unless we can find out the precise composition of the market portfolio.
- In addition, lack of validity in empirical records has been caused by complexity in exerting valid estimations of the beta coefficient.

Our objective in this reading is to identify and discuss the main challenges that analysts and investors face while estimating beta. The foundation of this reading is to define beta that would maintain an exact fit between the data and econometric model. Based on the theoretical and practical applications our aim is to obtain the beta for a plausible comparison that could also be used to reflect future investment decisions.

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