Building Blocks of the Modern Portfolio Theory

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Abstract

Markowitz brings to portfolio theory variance, covariance, and diversification. Adding these concepts adds different opinions and vision to portfolio analysis. Roy accepts the importance of diversification and low variance for portfolio analysis. Roy also accepts that a disaster level that is a level under which the investor should not invest in an asset. If the estimated price is less than the critical price, then either he should reject this asset altogether or he should contract liabilities in this form if this is possible. Tobin accepts that risk averters are actually diversifiers. One of the baskets of the two baskets covers consoles which are risky. If proportion of consoles is increased, risk and return of the portfolio which covers cash and consoles increases, too. He sees cash a tool to decrease risk of a portfolio.

Key Takeaways:

-The modern portfolio theory has two builder fathers: Markowitz and R**oy.**
-Roy invented "disaster level" to limit the risk of investors.
-Tobin added "cash" as a riskless asset to the portfolio to decrease the risk of the portfolio.

Keywords: Mean-variance analysis, Safety First Approach, Liquidity Preference Approach, Market Model

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1. Introduction

Investment was very important subject for human being in the history and today. Before 1950s, investors used to think about the maximization of expected return to meet expected risks. Of course, this insight was valid all the markets by sellers and buyers of securities. Think about that the sellers. They are maximizers, too. For this reason, they would require possible high prices to maximize their returns. Because of this situation, the yield of the buyers or investors will decrease in advance during buying the security or securities. So, how will they maximize their expected returns? I think that this is a dilemma. In this paper, I will discuss what happened in financial science after this point.

2. Mean Variance Analysis and the Critiques

2.1. Mean Variance Approach (1952)

Markowitz thinks that the process of selecting a portfolio may be divided into two stages. The first stage starts with observation and experience and ends with beliefs about the future performances of available securities. The second stage starts with the relevant beliefs about future performances and ends with the choice of portfolio. Markowitz says that this paper is concerned with the second stage. He considers the rule that the investor should consider expected return a desirable thing *and* variance of return an undesirable thing. He thinks that this rule has many sound points, both as a maxim for, and hypothesis about, investment behavior. He thinks that for variations in expected returns, a risk premium should be included to expected return. He adopts the importance of diversification in building an investment portfolio. However, diversified portfolio is not preferred to all non-diversified portfolios. Diversification cannot eliminate all variance. The portfolio with maximum expected return is not necessarily the one with minimum variance. There is a rate at which the investor can gain expected return by taking on variance, or reduce variance by giving up expected return. An investor should want to select a portfolio suitable for expected return-variance rule. The rule is "Select a portfolio with minimum variance for given expected return or more and maximum expected return for given variance or less". The expected return- variance of return rule is useful both as a hypothesis to explain well established investment behavior and as a maxim to guide one's own action. The rule serves better as an explanation of and guide to investment as distinguished from speculative behavior. The expected return-variance hypothesis also implies the right kind of diversification for the right reason. The adequacy of diversification is not thought by investors to depend solely on the number of different securities held. Firms in dissimilar industries are preferred to firms in same industry.

At the same time, it is necessary to avoid investing in securities with high covariance among themselves. Firms in different industries have less covariance. For this reason, they should be preferred (Markowitz1952 77-89).

Markowitz summarizes the process of portfolio analysis that it starts with information concerning individual securities and it ends with conclusions concerning portfolios as a whole. The purpose of the analysis is to find portfolios which best meet the objectives of the investor (Markowitz1959:3).

It could be said that the main idea of the Markowitz's approach is expected return could be increased without increasing risk and the risk could be decreased without decreasing the expected return via asset diversification. However, every diversification does not increase the return. Its precondition is less covariance and correlation among securities included to the portfolio.

2.2. Critiques to the Mean Variance Analysis

Markowitz himself says about his own approach about portfolio selection that his work on portfolio theory considers how an optimizing investor would behave (1990:279). Varian says that Markowitz posed the problem of minimizing the variance of a portfolio taking as a constraint a required expected return. This way of posing the problem contained two significant insights. First, Markowitz realized that the mathematics could not pick out a single optimal portfolio, but rather could only identify a set of efficient portfolios that had the lowest possible risk for each possible expected return. Secondly, Markowitz recognized that the appropriate risk facing an investor was portfolio risk and how much his entire portfolio of risky assets would fluctuate. Markowitz's formulation of portfolio optimization leads quickly to the fundamental point that the riskiness of a stock should not be measured just by the variance of the stock, but also by the covariance. In fact, if a portfolio is highly diversified, so that the amount invested in any given asset is "small," and the returns on the stocks are highly correlated, then most of the marginal risk from increasing the fraction of a given asset in a portfolio is due to this covariance effect. This was, perhaps, the central insight of Markowitz's contribution to finance (1993:160-162). Varian thinks that minimizing a variance of a portfolio, calculating a set of efficient portfolios, and covariance were important contributions to the portfolio theory. In my opinion, Varian confirms Markowitz' mean- variance model. He accepts the model's importance for the portfolio theory.

Rubinstein thinks that Markowitz had the brilliant insight that while diversification would reduce risk, it would not generally eliminate it. He thinks that Markowitz's paper is the first mathematical formalization of the idea of diversification of investments: the financial version of "the whole is greater than the sum of its parts". Through diversification, risk can be reduced, but not generally eliminated without changing expected portfolio return. Markowitz postulates that an investor should maximize expected portfolio return while minimizing portfolio variance of return (2002:1042). Rubinstein confirms Markowitz about reducing risk via diversification and that risk cannot be eliminated fully.

Rubinstein says that Markowitz (1952) concentrates on advisable behavior for an investor with a single-period horizon (2006:148). It is an important critique that it has a single period horizon.

He also adds his opinions about Markowitz (1952) and Markowitz (1959) that they are interested in decision rules that can be recommended to rational investors. It is normative modeling or prescriptive modeling (Rubinstein 2006:167). In my opinion, Rubinstein would prefer non-normative modelling. They would be more advising and informing about securities to be invested.

Campbell and others say that Markowitz (1952) provides the foundation for the current theory of portfolio choice. He describes the task of asset allocation as having two stages. The first stage ''starts with observation and experience and ends with beliefs about the future performances of available securities.'' The second stage ''starts with the relevant beliefs and ends with the selection of a portfolio.'' Although Markowitz only deals with the second stage, he suggests that the first stage should be based on a ''probabilistic' 'model. However, in the usual implementation of Markowitz's second stage, it is assumed that people know with certainty the inputs from the first stage, i.e., the exact means, variances and correlations. Campbell and others add that two major shortcomings of the traditional Markowitz approach are the ability to handle higher moments and parameter uncertainty (2010:469). They appreciate the probability belief on the first stage even though application in Markowitz model is carried out as if the inputs of the portfolio selection stage are known in certainty. The writers criticize parameter uncertainty. They are right about that because if parameters are uncertain, the result about efficient portfolios could be unhealthy, too. Estimation with estimated values is pretty hard job. For this reason, estimation of inputs that is expected returns of securities should be fulfilled carefully.

3. Safety First Approach and the Critiques

3.1Safety First Approach

Roy asserts that for large numbers of people, an idea of disaster exists. These are disasters such as very high inflation rate and very little income which will be a reason to change a person's occupation, death, bankruptcy, and a prison sentence. For this reason, the principle of Safety First is reasonable and probable in practice that an individual will seek to reduce as far as is possible the chance of such a catastrophe occurring. The thought of maximizing expected utility is not useful for the safety. It is meaningless for the people who are open this kind of exposures. It may be possible that the outcome of economic activity which is regarded as disaster is not independent of the expected value of the outcome. In the model, the resources should not be reckoned in terms of any one asset. Roy wishes to ensure that at the end of a given period the resources do not fall to or below an amount "d" also in real terms. The prices of assets are not money prices but prices measured in terms of the composite numeraire which Roy uses for reckoning his real resources. Roy thinks that a concept which is critical price which is for if an investor was to commit all his resources to one kind of asset and its price at the end of the period fell to or below or rose no further than d/k, then the disaster that he dreads would have come about. To decide which assets to hold and how much of them, he considers each asset in turn. Then, he asks himself "if the prices of all the other assets fell to the critical price, what is the best estimate of price of the asset under examination? If the estimated price under these conditions exceeds the critical price, then he should hold some of his resources in this form. If the estimated price is less than the critical price, then either he should reject this asset altogether or, better still, he should contract liabilities in this form, if this is possible. Thus, in the critical price, he has a criterion which enables him to decide what things are eligible as assets and what as liabilities. Roy also asserts that it is preferred to hold one's resources in a large number of different forms because he may diminish the chance of a large gain somewhat by so doing, he also reduces the probability of a really catastrophic outcome. It can also be calculated the upper bound of the least chance of disaster and so he can tell how complement or otherwise he should be in the existing situation. Roy also thinks that if investor's expectations about all assets are the same, he is not indifferent as to which assets he holds. Although he cannot affect the expected outcome, by varying his holdings, he can affect his uncertainty about the outcome. This will be least when he spreads his resources equally among all the assets. Roy thinks that the preference to hold an investor's resources in a large number of different forms is an important difference between this theory and the theories which depend on the maximization of expected return (1952:432-439). It can be seen frankly that he accepts diversification and variance. He also adds his analysis a "disaster" level to be avoided. The disaster level d is seen very important for the investors' future. He asserts that he is far from the opinion that maximizes the expected return is the only determiner of the investment. A low variance could also be used to evaluate the investments.

3.2. Critiques to the Safety-First Model

Sullivan acknowledges that about three months later from Markowitz, Roy also published a paper that argues for portfolio selection using the mean-variance criterion. In essence, Markowitz and Roy developed the same theory of portfolio selection at the same point in time, independently of each other. He thinks that Roy deserves equal credit for establishing the foundations of modern portfolio theory (2008:263, 267).

This model accepts mean variance criterion in portfolio selection. Like Markowitz, Roy accepts the importance of variance in portfolio building, too. This is an improvement against maximum expected return insight of investment public.

Sullivan's opinion about the importance of the Safety-First model is adopted by Markowitz (1999), too.
Singer thinks that a comparative advantage of the safety-first criterion over deviation risk measures, such as the variance, is its consistency with the way investors perceive risk (2010:2).
Many investors would prefer the disaster level limit of Roy because of living expenditure of them.

4. Liquidity Preference Approach and the Critiques

4.1. Liquidity Preference Approach

Tobin thinks that if an investor is not certain of the future rate of interest on consoles[1], investment in consoles then involves a risk of capital gain or loss. The higher the proportion of his investment balance that he holds in consoles, the more risk the investor assumes. At the same time, increasing the proportion in consoles also increases his expected return. Tobin also thinks that, for given risk, an investor always prefers a greater to a smaller expectation of return.

[1]Console means a perpetual bond issued by certain governments and redeemable at the option of the government. They were issued by the Bank of England and the U.S government. The British consoles have been fully redeemed (Source: en.wikipedia.org).

He says that all risk averters are diversifiers, plungers don't exist. That is, a risk-averter is necessarily a diversifier. Tobin says that tax rates, and differences in tax treatment of capital gains, losses, and interest earnings, affect in calculable ways the investor's risks and expected returns. For these reasons, it is worthwhile to examine the effects of a change in an investor's estimate of risk on his allocation between cash and consoles. Tobin shows at the Figure 3.6 at p.83 that, the point C' is a dominant point at which it would not be possible to obtain a higher expected return than at C' without incurring additional risk, or to diminish risk without sacrificing expected return. According to Tobin, among monetary assets, cash is relatively riskless, even though in the wider context of portfolio selection, the risk of changes in purchasing power, which all monetary assets share, may be relevant to many investors. Breaking down the portfolio selection problem into stages at different levels of aggregation-allocation first among, and then within, asset categories-seems to be a permissible and perhaps even indispensable simplification both for the theorist and for the investor himself. Tobin says that Markowitz's main interest is prescription of rules of rational behavior for investors. However, the main concern of this paper is the implications for economic theory, mainly comparative statistics, that can be derived from assuming that investors do in fact follow such rules (1958: 71-85). He accepts that diversification decreases risk. He says that indirectly via risk averter investors about them he thinks that they avert from risk through diversification. He accepts risk-return relationship. He thinks that economic theory and especially purchasing power affects investors in their actions about their investment. He accepts some factors such as taxes and interest affect the expected return and risk.

4.2. Critiques to the Liquidity Preference Approach

Varian thinks that Markowitz's model of portfolio selection focused only on the choice of risky assets. Tobin (1958) extended the model to include a riskless asset. In doing so, he discovered a surprising fact. The set of efficient risk-return combinations turned out to be a straight line. Tobin's discovery dramatically simplified portfolio selection. His analysis showed the same portfolio of risky assets is appropriate for everyone. All that varies is how much money you choose to put in risky assets and how much you choose to put in the riskless asset. Each investor can limit his investment choices to two "mutual funds:" a money market fund that invests only in the riskless asset (e.g., Treasury bills) and another fund that invests only in the magical portfolio that yields (σm, Rm). But one still needs to determine just which stocks, and which proportions of stocks, comprise the magic portfolio m—and that is a difficult and costly computation (2003:162-163). The inclusion of a riskless asset decreases the risk level of the security portfolio depending on the level of riskless and risky assets in the portfolio.

Buitler thinks that together with Markowitz, Tobin developed the mean-variance approach to portfolio choice under uncertainty. Buitler evaluates that Tobin imagines that in a world with one safe asset and a large number of risky assets, portfolio choice by any risk-averse portfolio holder can be described as a choice between the safe asset and the same portfolio of risky assets. The ratio of the shares in the total portfolio accounted for by any pair of risky assets is the same for all risk-averse portfolio holders. The degree of risk aversion only determines the shares in the total portfolio accounted for by the safe asset and by the common portfolio of risky assets. According to Buitler, this is an important and beautiful resultwhich is not done justice by Tobin's own summary: 'Don't put all your eggs in one basket'. Indeed, Tobin's remarkable result is better summarized as 'regardless of your degree of risk aversion and caution, you will only need two baskets for all your eggs' (2003: F585-587). The riskless asset could be thought as an assurance for risk averter investors. The degree of risk averting of the investors determines the level of the riskless asset.

5. Market Model and the Critiques

5.1. Market Model

Sharp has extended Markowitz's work on the second of his two stages. This stage is portfolio analysis. He improved a model called diagonal model. The model has two virtues. The one of them is that it could be constructed without assuming away the existence of interrelationships among securities. The second is that it could capture a large part of such relationships about which there is considerable evidence.

The major characteristic of the diagonal model is the assumption that the returns of various securities are related only through common relationships with some basic underlying factor. The return from any security is determined solely by random factors and this single outside element. Sharp says that, in diagonal model, the number of estimates required from the analyst is greatly reduced. According to Sharp, if the portfolio analysis problem is expressed in terms of the basic parameters of the diagonal model, computing time and memory space required for solution can be greatly reduced. However, the cost of a large analysis is still far from insignificant. Thus, there is every incentive to limit the computations to those essential for the final selection of a portfolio.

By taking into account the possibilities of borrowing and lending money, the diagonal code restricts the computations to those absolutely necessary for determination of the final set of efficient portfolios. Sharp (1963) says at the end of his article that the diagonal model may be able to represent the relationships among securities rather well and thus that the value of portfolio analysis based on the model will exceed their rather nominal cost. For these reasons, it appears to be an excellent choice for the initial practical applications of the Markowitz technique (1963:277-292). He accepts relationships among securities. This means covariance among securities. Computing time is decreased with the diagonal model. Portfolio analyst cost is decreased with the model. This is an initial application of the Markowitz model. This model is not a building block alone. However, it could be thought an important support of Markowitz model. That is, it is an auxiliary technique of a building block Markowitz model.

5.2. Critiques to the Market Model

Varian says that William Sharpe was a doctoral student at UCLA, one of the first students there to take courses in both economics and finance. When it came time to write a thesis, Fred Weston suggested that he talk with H arry Markowitz, who was then at RAND. Markowitz became Sharpe's unofficial thesis advisor and put him to work trying to simplify the computational aspects of portfolio theory. Sharpe explored an approach now know n as the "market mode l" or the "single factor" model. He thinks that Sharpe's approach reduced the dimension ality of the portfolio problem dramatically and made it much simpler to compute efficient portfolios (2003 163 -164).

Rubinstein thinks that Sharp's (1963) model has provided the standard way of measuring the inputs into models of optimal portfolio construction (2006:159).

Mangram says that Markowitz's groundbreaking work formed the foundation of what is now popularly known as 'Modern Portfolio Theory' (MPT). The foundation for this theory was substantially later expanded upon by Sharpe. The problem, with respect to MPT, is that the majority of investigations of the topic focus on the highly complex statistics-based mathematical modeling and formulas which support the concept's theoretical assumptions. Typically, these investigations present their findings utilizing unnecessarily complicated rhetoric and intricate formulaic expressions. In opposite, the less complicated treatments are generally overly simplified, non-comprehensive, and lack the rigor requisite of serious scholars and practitioners (2013:59).

Archana and Srilakshmi think that various models such as Markowitz model, Sharpe Index model and Multi Index model can be used to build a portfolio. Among them, Sharpe's Index model is considered to be effective, simple and easy method compared to other two as the other models requires huge number of inputs, and are complex in nature to calculate. Since, large inputs are required for other models, computing also takes longer time and by then the nature of securities can change (2020:1233).

6. Partners or Followers of the Building Blocks

Markowitz says that even though he is often called the father of modern portfolio theory, Roy (1952) can claim an equal share of his honor, too (1999:5).

Sullivan thinks that Markowitz and Roy developed the same theory of portfolio selection at the same point in time, independently of each other. He thinks that Roy deserves equal credit for establishing the foundations of modern portfolio theory (2008:263, 267).

Markowitz and Roy thought about the same think about portfolio theory in the U.S. and in the Britain. They could be thought as partners to construct the modern portfolio theory as building blocks.

Buitler thinks that the theoretical work of Markowitz and Tobin in the 1950s on portfolio choice stimulated a large number of empirical studies of portfolio selection and asset market behavior (2003:F587). It means that the two works are different than each other. The two of them contributed to begin other empirical studies about portfolio selection. However, the two of them are different than each other. The Markowitz's theory does not cover any riskless asset while Tobin adds the portfolio some cash. That is, Tobin is a follower of Markowitz about that.

7. Conclusion

Building blocks of the modern portfolio theory are mean–variance analysis of Markowitz (1952),safety first model of Roy (1952), liquidity preference model of Tobin (1958), and the market model of Sha rp (1963).As Markowitz accepted (1999), Roy could be accounted another father of modern finance t heory other than himself. Tobin added cash as a riskless asset to risky assets while he was composin g a security portfolio. Sharp (1963) facilitated the Markowitz's model's quantitative parts.
Sharp (1963) also built a single index model because he thought that all security prices are connecte d with a security index and move in the connection of this index.

These four models complete an opinion that there are other ways to increase the yield in the securit y markets for the investors other than the maximization expected return. Their concepts are expected return, variance, covariance, disaster level (Roy), riskless asset (Tobin), risky assets, security index (S harp), console (Tobin). After their thought and empirical studies, some financial knowledge was adde d to finance theory. These are:

- Decreasing variance without decreasing expected return is possible
- Decreasing covariance among securities in a portfolio increases the yield from a security portfolio
- Cash or liquidity could be used a tool for decreasing risk
- A disaster level fixing by an investor could be a useful tool to fight risks for investors investing in financial markets
- Increasing the number of the securities in the portfolio does not increase the return without decreasing variance and covariance
- Security prices are not far from index values because index values are calculated from the security prices and quantities traded.

The building blocks were only starting point for the modern portfolio theory. It continued after these studies and still is continuing.

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