Survey of Literature on Portfolio Theory

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THE CONVENTIONAL APPROACH

Diversification

The present survey takes as the main point of reference the question proposed in Markowitz (Markowitz, 1952): **What explains diversification?**

In attempting to answer this question Markowitz (Markowitz, 1952), Markowitz (Markowitz, Portfolio Selection: Efficient Diversification of Investments, 1959) and Tobin (Tobin, 1958) created what is known in the literature as the two-factor model. Since Markowitz' 1952 paper, this approach assumes that asset returns are random variables. The portfolio return is the summation of the returns on each individual asset. Thus, the expected portfolio return is equal to the expected value of the addition of the returns on each asset. With this analogy between mathematical expectation and asset returns Markowitz proposes a way to measure risk for each asset: The variance of its past returns. This measurement of risk extended to a portfolio is equivalent to the variance of the sum of the random variables (Asset returns) that form the portfolio. These two factors (The expected value and the variance) can be used to select the most efficient combinations of assets. The efficient portfolios are those whose expected return cannot be increased without generating an increase in their variance. Tobin (Tobin, 1958) shows that there is a logical connection between the assumption that asset returns are random variables, variance and expected returns as the main criteria for selecting assets, and the Morgenstern-Von Newman expected utility theory. If investors behave as the expected utility theory predicts then they will select their portfolio in accordance with the two-factors approach. Markowitz (Markowitz, Portfolio Selection: Efficient Diversification of Investments, 1959) makes the same connection between the expected utility theory and the two-factors approach.

Tobin (Tobin, 1958) demonstrates the important 'separation theorem'. This theorem asserts that optimal compositions of portfolio (Excluding cash) are independent from decisions between risky assets and cash. This implies that borrowing or lending cash is subordinate to optimal decisions o investment in risky assets (Lintner, 1965). Hence, the speculative demand for cash obeys the two-factors approach. It is worth noting that Markowitz (Markowitz, Portfolio Selection: Efficient Diversification of Investments, 1959) makes the caveat that variance is not the only way to measure risk, that the normal distribution is not the only possible one, that there are other decision making approaches (like Shackle's) that can be taken into account and that the proposed analysis does not replace the analyst's judgment.

In sum, the two-factors model asserts that diversification occurs due to rational and risk-averse individuals selecting those securities that grant them higher portfolio returns with low or no increase in the portfolio variance. The assets that have this characteristic are the ones that bear a low correlation with the securities already in the portfolio. Highly correlated securities would increase the variance of

the portfolio (portfolio risk) making the portfolio allocation less optimal however their high individual returns may be. Moreover, holding a single asset is not optimal if by adding a security, the portfolio risk decreases whilst maintaining its return, or the portfolio return increases by maintaining its risk. Since in general, there are securities in the market that have low correlation, it is always more efficient to hold a variety of assets. This diversification is explained by the selection of efficient portfolios.

Asset Pricing

The most important derivation of the two-factors approach is the Capital Asset Pricing Model (CAPM). This model is also known in the literature as the Sharpe-Lintner model due to the papers by Sharpe (Sharpe, 1964) and Lintner (Lintner, 1965) and (Lintner, Security Prices, Risk, And Maximal Gains from Diversification , 1965). The Sharpe-Lintner model derives a general equilibrium framework. Sharpe (Sharpe, 1964) derives *'a market equilibrium theory of asset prices under conditions of risk'p427.* Sharpe aims to explain the upward-sloping capital asset market line that assumes a positive relation between the expected return and the risk of an asset. Sharpe explains this relation by showing that a market with well diversified portfolios (according to the mean-variance approach explained above) must reward with a higher expected return those securities that are highly correlated with the *'market portfolio'*. The *market's portfolio* is formed by all the financial assets of the economy and, hence, is well diversified. The higher the correlation between a particular security and the market portfolio, the lower the potential gains from including it in a particular portfolio since it will add to the risk of the portfolio. Thus, if an asset with a high correlation with the market is to be demanded, it must have a higher expected return. An asset's correlation with the market by definition cannot be diversified. Thus, this is the risk that needs to be compensated (priced) with a higher expected return. Under equilibrium conditions, the diversifiable risk (the one that obeys the particular characteristics of an asset) would be effectively diversified.

Lintner (Lintner, Security Prices, Risk, And Maximal Gains from Diversification , 1965) presents a more complete formalization that renders essentially the same result as those shown by Sharpe adding a justification for the use of variance in the measurement of risk. Lintner's (Lintner, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, 1965) rigorous methodology consists in proving the logical connection between the assumptions about uncertainty and the rational behavior (Maximization). The author offers formal proofs of the connections between the expected utility theory, probability distribution functions, the risk conditions of the market, the assumptions on market competition and expectations (Idealized uncertainty).

The Efficient Capital Markets Hypothesis (EMH) and rational expectations:

The next step in the theoretical development of the financial theory based on the two factors approach was its empirical analysis. To accomplish this, it was necessary to find the connection between the actual prices and the decision making process by investors. If prices *'fully'* reflect the available

information and investors are rational, investors should behave as the two-factors model and its derivation, the CAPM predicts. Fama (Fama, 1970) in line with the Chicago school develops a general framework in order to test the EMH. This general framework highlights the logical coherence between the special cases that are being evaluated. In addition to the evaluation of the two-factors approach there are single asset models that are based on the statistical properties of the time series of single prices. It is possible to characterize the statistical properties of the fluctuation of prices that are compatible with the EMH. Fama also shows that equilibrium is required by the market efficiency hypothesis. A sufficient condition for the hypothesis to hold is that 1- Zero transaction costs, 2-All information is publicly available, and 3- Information is interpreted in like manner by all agents. The two-factors approach is compatible with the EMH it should be verifiable empirically.

Empirical Evidence:

The empirical evidence of the two-factors model and its implication the CAPM has not been successful. In spite of the study by Wagner and Lau (Wagner & Lau, 1971) which demonstrated that diversification is effective in reducing portfolio risk until up to ten securities, other authors have shown that the CAPM either renders poor empirical results or is not testable. The paper by Richard Roll (Roll, 1977) explains that in order to test the CAPM it is necessary to know the *'true market portfolio'* which is the portfolio whose return correlation with that of the market is equal to 1. Since the latter is not observable it is necessary to find a proxy. But such proxy must have correlation with the market equal to one. This is a tautology. Thus, the CAPM is not testable.

Further Developments in CAPM:

Merton (Merton, 1973) develops a dynamic form of the traditional capital asset pricing model furthered by Sharpe and Lintner. Merton allows for the in Investment opportunity set to change. He does so by allowing the risk free interest rate to change. In this way the interest rate has a stochastic character. Merton's method is to deduce statistical properties from accepted microeconomic principles. Thus, his conclusion that the first two moments explain portfolio selection are derived from the assumptions of continuous trading and continuous Markov structures.

Ross (Ross, 1976) a more general framework that does not require knowledge about the market portfolio or the specification of utility functions. However, there is much controversy about the way to select the factors that affect the prices of assets.

Comprehensive Surveys:

The survey by Campbell (Campbell, 2000) begins with the general assumptions and theorems in the field of which most of the theories presented are special cases. The price of an asset depends on two basic

factors: The random pay off in a future time and the stochastic discount factor (SDF). The latter is the most general version of uncertainty present in the literature. An important assumption is the condition of arbitrage or martingale. Additional restrictions to the general form have been proposed due to the form in which information on returns is available. The CAPM and the two parameters model for the same matter are derivations of this general structure. The dynamic version of the pricing model is required. Expected utility theory is needed (Micro foundation). Empirical work trying to reconcile all these perspectives renders a contradiction between the empirical findings and the predictions of the theories. These contradictions are called puzzles. Due to these puzzles the focus shifted from the empirical verification of theories to the stochastic characterization of the data so that it suggests the type of microeconomic theory that should be formulated. The approach has rendered implausible theoretical assumptions. Another approach has concentrated in complementing the traditional theories with the relationship between asset allocation and both consumption theories and the labor market. Another strand has changed the assumptions on preference (Behavioral finance) and on rationality (Irrational expectations). The puzzles, however, remain unexplained. Financial economics seems to take for granted the necessary implication between stochastic processes and microeconomics; it also takes for granted the need for the use of stochastic processes. The author recommends the article by Sundaresan (Sundaresan, 2000) in order to analyze the continuous time version of the models.

The literature on Psychology and finance is surveyed by (Hirshleifer, 2001) and highlighted as a more general approach to financial markets. The core of this strand of financial economics is to incorporate psychological factors in economic decision making so as to explain pricing biases. The author show the main terminology employed. It is worth noting the importance of the equity premium and risk free puzzles as well as the Allais paradox. It is also interesting the notions of heuristics and rules of thumb. In addition, overconfidence, sunk costs and horizontal interactions play an imporal role. Most of the literature seems to be focused in using psychological traits to explain pricing bias. In different parts of the article Hirshleifer mentions the importance of psychology in explaining deviations from 'true states of nature'. [Hence, psychological experiments [by definition] set up situations in which such states of natures in fact exist. Hence there is no uncertainty, as there is an experiment design. This is different from the actual finance arena in which there is true uncertainty. In the latter, the psychological and logical functions are intrinsically interconnected (See notes above)]. Parts of this literature are also centered in bounded rationality (Limited computing capabilities). In addition humans have developed psychological mechanisms to deal with inherently complex systems like the financial where the mere use of rationality is not possible. Thus, those psychological traits must be studied. Another strand has to do with the missjudgement of probabilities and difficulties with understanding correlation structures.

Conclusion: The demise of the CAPM and its Zombie character:

After so many attempts to reconcile the empirical evidence with the predictions of the CAPM, Fama (Fama & French, The Capital Asset Pricing Model: Theory and Evidence, 2004) concludes that

"The capital asset pricing model (CAPM) of William Sharpe (1964) and John Lintner (1965) marks the birth of asset pricing theory (resulting in a Nobel Prize for Sharpe in 1990). Four decades later, the CAPM is still widely used in applications, such as estimating the cost of capital for firms and evaluating the performance of managed portfolios. It is the centerpiece of MBA investment courses. Indeed, it is often the only asset pricing model taught in these courses.

The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk. Unfortunately, the empirical record of the model is poor – poor enough to invalidate the way it is used in applications" p 25

Hence, if no other capital asset pricing model can be derived from the two-factors approach, then the way in which financial economics have studied the allocation of portfolios since Markowitz is flawed and a new approach is required. This demise has prompted the rise of behavioral finance and the inclusion of notions like human capital. The remains of this strand of research which are the behavioral finance camp and the conventional statistical analysis of time series have no alternative explanation to the diversification problem. A new explanation to diversification is needed.

THE POST KEYNESIAN APPROACH:

The Post Keynesian literature does not have a quantitative explanation for diversification. The treatment has been merely qualitative by stressing the role of fundamental uncertainty. Nevertheless, the theory of asset pricing had had a wider development. Two main surveys of the literature are provided by Tymoigne (Tymoigne, 2009) and Kregel (Kregel, 2010).

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