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Multifactor Model of Risk and Return: APT to Fama and French Five Factor Model

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Abstract

This article is a literature review that discusses the articles of financial experts who popularized the method of calculating expected portfolio returns using economic factors that are considered to have an influence on the value of the portfolio greater than or equal to the influence exerted by market indices. The calculation method described in this study is an extension of the CAPM model introduced by Sharpe, Treynor, and Lintner in the 1960s.

This article discusses starting from the method of Arbitrage Pricing Theory introduced by Ross in 1976, and the economic factors that become variables in the calculation of Arbitrage Pricing Theory proposed by NF. Chen, Roll, and Ross in 1986. then explained the calculation model Fama and French 3 Factor Model introduced in 1992, then Carhart 4 Factor Model which is an expansion of FF3FM, Pator-Stambaugh Model introduced by Lubos Pastor and Robert F. Stambaugh in 2001, and finally discusses the calculation model Fama and French Five Factor Model introduced in 2014 which is an expansion of FF3FM.

Keywords: market capitalization, momentum, book value, profitability, investment, inflation, market yield, industrial production, petroleum, and interest rates

1. INTRODUCTION

The development of modern portfolio theory after its introduction by Markowitz in 1952 has grown so rapidly in these 7 decades. In the beginning, the optimal portfolio is a portfolio consisting of various shares of Companies engaged in different industry sectors to minimize the risk of each industry and maximize the returns to be obtained from each industry. The Markowitz model was further developed by Sharpe, who in his research used the assumption that investors are risk-averse in investing, and there are safe investment instruments such as government bonds that have a lower risk of default than corporate bonds. Sharpe introduced a new model based on the assumptions described in the previous sentence, namely the CAPM (Capital Asset Pricing Model) model which explains that the return provided by a stock is equal to the return from the risk *free rate* plus the beta of the security multiplied by the *risk premium market*. The CAPM model developed by Sharpe, Lintner, and Treynor is used as a method of calculating the expected return of a portfolio and also as a model for calculating *cost of equity* in WACC calculations.

The advantages of CAPM which is easy to apply, have the disadvantage of inaccurate results in projecting the expected returns of a portfolio. Weakness is caused because there are a number of variables that affect the value of a prototype, not just market index variables. Many studies have attempted to improve the CAPM model by incorporating other variables into the calculation of the CAPM model. In 1976, Ross in his article entitled The Arbitrage Theory of Capital Asset Pricing introduced the *model* of Arbitrage Pricing Theory*, and* in 1986, Ross along with Nai-Fu Chen, and Richard Roll wrote an article entitled *Economic Forces and Stock market* which defined economic forces that affect stock values. In 1992, Eugene F. Fama and Kenneth R. French in their article entitled *The Cross-Section of Expected Stock Returns* introduced SMB (market capitalization), and HML (book value) as fators that affect the value of stocks other than market indices. Mark M. Carhart in his article entitled *On Persistence in Mutual Fund Performance* published in 1997 expanded on the model introduced by Fama and French in 1992 by adding Momentum as one of the determinants of stock value in addition to market index, market capitalization, and book value. In 2001, Lubos Pastor and Robert F. Stambaugh included liquidity variables as additional variables in the *Fama and French 3 Factor Model* in their article entitled *Liquidity Risk and Expected Stock Returns.* In 2014, Fama and French added two factors affecting stock value to the calculation model they introduced in 1992 in their article entitled *A Five Factor Asset Pricing Model*, and the two factors are RMW (profitability), and CMA (Investment).

This article aims to conduct a literature review of research articles on multifactor calculation models looking for expected returns from a portfolio starting from 1976 - 2014.

1.1 Research Formulation

What does a scientific article on multifactor models developed by leading financial experts contain?

1.2 Research Objectives

Discusses the content of multifactor model research articles put forward by leading financial experts.

2. LITERATURE REVIEW

2.1 The Arbitrage Theory of Capital Asset Pricing by Stephen A. Ross (1976)

The purpose of this article is to carefully assess the arbitration model for valuation of capital assets developed by Ross in 1973. The arbitrage model is proposed as an alternative model to the *mean variance Capital Asset Pricing Model* introduced by Sharpe, Lintner, and Treynor, which has become the main analytical tool for explaining phenomena observed in capital markets for risky assets. This article also discusses the weaknesses of the CAPM model, namely assumptions that are too strict. The advantage of CAPM according to Ross is its ability to prove a linear relationship between return and risk. The five stages carried out by Ross in this article, namely:

First, it forms an arbitrage portfolio, Ƞ, of all assets n, in the sense of an orthofolio that does not use wealth, Ƞe = 0. We also need Ƞ a well-diversified portfolio with each part, Ƞ1, with orders of 1/n in quantity (abowut).

Second, based on *the law of large numbers*, for large portfolio sizes n, the arbitrage portfolio returns are:

$$\eta\tilde{x} = \eta E + (\eta\beta)\tilde{\delta} + \eta\bar{e} \approx \eta E + (\eta\beta)\tilde{\delta}$$

In other words, the effect on a diversified portfolio on independent noise is negligible.

Third, if we now also require that the arbitrage portfolio, Ƞ, be selected so that it has no systematic risk, then

$$\eta\beta = 0$$

and from the second stage $\eta\tilde{x} \approx \eta E$

Fourth, using the assumption of no wealth, the random return $\eta\tilde{x}$ has now been engineered to be equivalent to a certain return, ȠE, therefore to prevent an imbalance position that is too large, we must have ȠE = 0. Since this restriction must apply to all Ƞ, then Ƞe - Ƞβ= 0, E is spanned by e and β or $E_i = p + (E_m - p)\beta_i$

The above formula is an arbitrage theory equivalent to the first formula and if δ is the return of the market factor then βi will approach bi. The above approach, however, is substantially different from the usual mean-variance analysis and is a related but very different theory. For one thing, the argument suggests that the latter formula is not only valid in equilibrium situations. but also in all kinds of the deepest disequilibrium. On the other hand, market portfolios do not play a special role.

Ross explained that there are several weaknesses in the neuristk's conclusion, namely, if the number of assets, n, increases, then the amount of wealth, in general, will also increase. Increased wealth will increase risk aversion by some economic agents. The second point, based on the law of large numbers *explained in the second step, is that* the term noise *can be ignored for n large numbers, but if the level of risk aversion increases, with n, then both effects do not apply and the presence of* noise will remain in relation to the price. Even if *noise* can be eliminated, this does not make the final formula automatically maintained, since the imbalance position in one agent can be offset by the imbalance in the other. However, Ross's previous research showed that the latter formula could be maintained if it represented e or quasi-equilibrium.

In this article Ross uses type B agents, that is, agents who are uniformly less risk-averse than some agents who are relatively constant risk-averse. Later, Ross used a calculation model that assumed that the returns of a given portion of the asset under consideration were subjectively viewed by agents in the market as generated by a model with a form

$$\widetilde{x_i} = E_i + \beta_{i1}\tilde{\delta}_1 + \ldots + \beta_{ik}\tilde{\delta}_k + \tilde{e}_i, = E_i + \beta_i\tilde{\delta} + \tilde{e}_i$$

Where $E(\tilde{\delta}_I) = E(\tilde{e}_i) = 0$

The assumptions used by Ross are:

a. Assumption 1 (Limited liability). There is at least one asset with limited liability in the sense that there is a bond, t, (per unit invested) to losses for which the agent is liable. Assumption 1 is fulfilled in the real world by a wide variety of assets.
b. Assumption 2 (non-negativity of type B agent) There is at least one Type B agent who believes that returns are generated by the model from the third model form and cannot be ignored asymptotically
c. Assumption 3 (Homogeneity of expectations). All agents have the same expectations, E. Furthermore, all agents are risk-averse.
d. Assumption 4 (Area is disequilibrized). Suppose Ɛi expresses the aggregate demand for the i-th asset as a fraction of total wealth. We will assume that only situations with Ɛi > 0 will be considered. Note that Assumption 4 does not rule

out the possibility that an asset could be oversupplied; This assumption only implies that the economy as a whole will want to hold some of those assets.

e. Assumption 5 (expectation limitation).

Ross's article states that optimal returns and portfolio weights can be determined based on the assumptions described above. The weakness of this study is that it cannot provide forecast assumptions or variables that affect stock value and cannot determine where investors have identical anticipation and expectations. These weaknesses make further research needed to strengthen the *Arbitrage Pricing Theory model.*

2.2 Economic Forces and The Stock Market by Nai-Fu Chen, Richard Roll, and Stephen A. Ross (1986).

This article aims to discover the macroeconomic forces that influence stock price movements. Chen, et al in this article use the assumption that stock prices, like other market forces, are endogenous, which means that changes in the stock market are influenced or determined by their relationship with other variables in statistical models. Furthermore, Chen et al use the diversification argument implicit in capital market theory, only general economic variables will affect the overall pricing of the stock market. Any systematic variable that affects pricing in the economy or that affects dividends will also affect stock market returns. In addition, any variables necessary to complete the description of natural conditions will also be part of the systematic description of risk factors. An example of such a variable is one that does not have a direct influence on current cash flows, but can describe changes in the set of investment opportunities.

Chen et al in determining macroeconomic variables that affect stock prices in this article use the following explanation: "Expected cash flows change due to real and nominal forces. Changes in the expected inflation rate will affect cash flow, nominal expectations, as well as nominal interest rates. To the extent that pricing is done in real terms, unanticipated changes in the price level will have a systematic effect, and to the extent relative changes along with general inflation, there will be changes in asset valuations related to changes in the average inflation rate. Finally, changes in the expected level of real production will affect the real value of current cash flows. To the extent that the size of the risk premium does not capture the uncertainty of industrial production, innovation at the level of productive activity should have an influence on stock returns through its impact on cash flows."

Based on the explanation stated by Chen et al in the previous paragraph, the variables of nominal strength and real strength used in this article are 7 basic variables, namely: *inflation (1), treasury bill rate (TB), long-term government bonds (LGB), industrial production (IP), low grade bonds (Baa), market indices [equally weighted equities (EWNY) & value-weighted equities (VWNY)], consumption (CG), oil prices (OG).* The derivation series of the basic variables mentioned earlier are *monthly growth [MP(t)], Annual Growth [YP(t)], unexpected inflation [UI(t)], expected inflation [E[I(t)]], Real Interest (ex post) [RHO(t)], Change in Expected Inflation [DEI(t)], Risk Premium [URP(t)], Term Structure [UTS(t)]*. The results of statistical tests conducted by Chen, et al are Except for market indices, the strongest correlation is between UPR and UTS. This can be expected because both use the long-term bond series, LGB(t). The production series, YP and MP, correlate with each other and with every other variable except DEI and UI, which are also strongly correlated. These last two series are correlated because they both contain the EI(t) series, and the negative correlation between DEI and UTS occurs for the same reason. Autocorrelation for *state* variables calculated during the entire sample period, January 1953 - November 1983. No surprises here; as expected, YP has a high autocorrelation. The variables generally showed mild autocorrelation, and many were seasonal at 12 months lag. The MP series, in particular, has a peak at a 12-month lag (repeated at 24 months), which warns that this variable is highly seasonal.

Chen et al in this article introduce a multivariate calculation model based on the results of statistical tests described earlier, namely:

$$R = a + b_{MP}MP + b_{DEI}DEI + b_{UI}UI + b_{UPR}UPR + b_{UTS}UTS + e$$

The statistics found that the rate of change in consumption did not have a significant relationship to asset pricing, and found that changes in petroleum prices did not have a significant and overall effect on asset pricing. Chen et al's conclusion is "that stock returns are exposed to systematic economic news, that they are priced according to their exposure, and that the news can be measured as innovations in circumstance variables whose identification can be achieved through simple and intuitive financial theory".

The advantage of this research article is that it provides insight into the relationship between macroeconomic factors on stock pricing and stock and portfolio returns. However, there are several weaknesses in Chen et al's article, namely:

a. The statistical testing conducted in this article uses a multivariate method that may not provide complete information about the complexity of the relationship between the economic variables studied and stock returns.
b. Although the authors describe their efforts to group stocks into portfolios based on company size, the statistical tests conducted in this article do not discuss the sensitivity of economic factors to portfolio groups based on company size.
c. The authors in this article acknowledge that there is a weak relationship between the basic variable of inflation and the derivative variable of inflation to explain changes in stock prices. This has led to doubts about the effectiveness of the economic variables used in this study to explain changes in stock prices in pricing models.

2.3 *The Cross-Section of Expected Stock Returns* was written by Eugene F. Fama and Kenneth R. French (1992)

Fama and French in this article prove that the two most easily quantifiable variables, market and book to market equity, can be combined to capture cross-sectional variations in average stock returns related to market β, size, leverage, book-to-market equity, and price-earnings ratios. At the beginning of this article, the authors discuss The Asset Pricing Model or Sharpe (1964), Lintner (1965), and Black (1972) which are the main models used by academics and practitioners in the world of capital markets in calculating average returns and risks. The essence of the SLB model is that the market portfolio that must be invested is a portfolio that is efficient on a *mean-variance* basis according to Markowitz (1959). The efficiency of a market portfolio implies that (a) the expected return of a security is a positive linear function of its market βs (the slope in regression of a security's return against the market's return), and (b) the market's βs is sufficient to describe the cross-section of the expected return.

Fama and French in the next paragraph explain the weaknesses of the SLB model based on the results of research that has been done, namely:

a. Size *effect* research by Banz (1981). He found that market equity, ME (share price multiplied by the number of shares outstanding), added to the explanation of the average cross-section of returns given by market βs. The average returns on small stocks (low ME) are too high based on their β estimates and the average returns on large stocks are too low.

b. Bhandari (1988) research found a positive relationship between *leverage* and average returns. It is possible that leverage is associated with risk and expected return, but in the SLB model, *leverage risk* is supposed to be captured by the β market. Bhandari found that *leverage* helped explain the average cross-section of stock returns in tests that included measures (ME) as well as β.
c. Stattman (1980) and Rosenberg, Reid, and Lanstein (1985) found that average returns on United States stocks were positively related to the ratio of the book value of common stock, BE, to its market value, ME. The same is true of the Japanese stock exchange conducted by Chan, Hamao, and Lakonishok (1991).
d. Basu (1983) found that the earning/price (E/P) ratio helped explain the cross-section of average returns of U.S. stocks in tests that also included size and β market. Ball (1978) argues that E/P is a proxy that includes all factors not mentioned in the expected return; E/P tends to be higher (lower price relative to earnings) for stocks with higher risk and expected returns, regardless of unspecified sources of risk. Ball's proxy argument for E/P can also be applied to size (ME), leverage, and book-to-market equity.

Fama and French in their research used all non-financial companies at the intersection of (a) NYSE, AMEX, and NASDAQ originating from the Securities Price Research Center (CRSP) and (b) COMPUSTAT's combined annual industry file consisting of income statement and balance sheet data, which is also maintained by CRSP. Fama and French exclude financial firms because the high leverage normal for these firms may not mean the same as non-financial firms, where high *leverage* is more likely to indicate difficulty. CRSP yields included NYSE stocks and AMEX shares until 1973 when NASDAQ returns also became available. COMPUSTAT data are for the years 1962-1989. The start date of 1962 reflects the fact that the book value of ordinary equity (COMPUSTAT item 60), was generally not available available before 1962. More importantly, COMPUSTAT data for previous years have a serious selection bias; Data prior to 1962 skewed towards large companies that were historically successful. Research asset pricing testing uses *a cross-sectional regression* approach from Fama and MacBeth (1973).

Fama and French summarize the results in this article:

a. When we allow for variations in β unrelated to size, there is no reliable relationship between β and average return.

b. The opposite role between market leverage and book leverage in average returns is well captured by book-to-market equities.
c. The relationship between E/P and average return seems to be absorbed by a combination of size and book-to-market equity.

In short, the β market appears to have no role in explaining the average returns on NYSE, AMEX, and NASDAQ stocks for 1963-1990, while book-to-market size and equity *capture* cross-sectional *variations in average stock returns related* to *leverage* and E/P.

In concluding their study, Fama and French explain that "The Sharpe-Lintner-Black model has long shaped the way academics and practitioners think about average returns and risk. Black, Jensen, and Scholes (1972) and Fama and MacBeth (1973) found that, as predicted by the model, there was a modest, positive relationship between average returns and market β during the early years (1926-1968) of the NYSE CRSP returns. Like Reinganum (1981) and Lakonishok and Shapiro (1986), we found that the simple relationship between β and average return disappeared during the period 1963-1990. The following appendix shows that the relationship between β and average returns has also been weak in the last half-century (1941-1990) of NYSE stock returns. In short, our tests do not support the main prediction of the SLB model, which is that average stock returns are positively related to the β market." Fama and French's main research results are that for the period 1963-1990, size and book-to-market equity *capture* cross-sectional *variations in average stock returns related to size, E/P, book-to-market equity, and* leverage*.*

Fama and French used their findings to develop a story of rational and irrational asset pricing as rewritten below:

a. *Rational Asset Pricing Stories.*
Fama and French explain that FM regression calculations are consistent with the multifactor asset pricing model developed by Merton (1973), and Ross (1976). Thus, their tests apply a rational asset pricing framework to the relationship between average return and size as well as *book-to-market equity.*
b. *Irrational Asset Pricing Stories*
Simple testing does not confirm that size and book-to-market effects in average returns are due to market overreaction, at least of the kind proposed by DeBondt and Thaler (1985). One overreaction measure used by DeBondt and Thaler is the last 3-year yield of a stock. Their overreaction theory predicts that stocks that have lost money in the last 3 years have strong post-rating returns compared to

stocks that have won in the last 3 years. In FM regression (not shown) for individual stocks, the 3-year lagged return shows no strength even when used alone to explain the average return. The univariate average slope for lagging returns is negative, - 6 basis points per month, but less than the standard error of 0.5.

Fama and French provide two recipes for using the evidence in this article: (a) whether it will last, and (b) whether it is the result of rational or irrational asset pricing. Fama and French doubt that there is a possibility that book-to-market size and equity could explain the *cross section* on average returns in their sample, but these two variables are not related to expected returns. Fama and French believe that their results can be used to evaluate long-term managed portfolios such as *mutual* funds and *pension funds* based on a comparison of average portfolio returns with average portfolio returns that are benchmarked with similar BE/ME sizes and characteristics. This can be done if the pricing of the asset is rational. Fama and French also explain that their results can be used on the formation of irrational asset prices by size and BE/ME is not a proxy of risk to evaluate portfolio performance and measure expected returns from alternative investment strategies.

The advantage of this Fama and French research article is that it is able to provide a reason why the asset pricing model developed by Sharpe, Lintner, and Black (SLM) can no longer be used to determine the expected return of assets, and company size and *book-to-market equity* are better at explaining asset pricing than relying solely on market beta. The weaknesses of Fama and French's research are:

a. Although their results are satisfactory in theory of asset pricing, they cannot explain economically why *book-to-market* size and equity play a role in explaining average returns.
b. Their FM model means that size variables and book-to-market equity can only be applied to evaluate long-term portfolios at rational asset prices. However, it cannot be applied to the same if the price of the asset is irrational.

2.4 *On Persistence in Mutual Fund Performance* written by Mark M. Carhart (1997)

In the first paragraph at the opening of his article, Carhart states that: "Persistence in mutual fund performance does not reflect superior stock-picking expertise. In contrast, common factors in stock yields and persistent differences in mutual fund fees and transaction costs explain almost all of the predictability of mutual fund returns. Only the strong and persistent poor performance of the worst-yielding mutual funds remains an anomaly."

Previous research on which Carhart's research was based:

a. Hendricks, Patel, and Zeckhauser (1993), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), and Wermers (1996) found evidence of persistence in short-term mutual fund performance, i.e. one to three years, and attributed that persistence to "hot hands" or common investment strategies.
b. Grinblatt and Titman (1992), Elton, Gruber, Das, and Hlavka (1993), and Elton, Gruber, Das, and Blake (1996) documented the predictability of mutual fund returns over a longer time frame, i.e. five to ten years, and attributed this to managers' differential information or stock-picking aptitude.
c. Jensen (1969), who did not find that good future performance follows good past performance.
d. Carhart (1992) points out that persistence in expense ratios drives most of the long-term persistence in mutual fund performance.

In the next paragraph, Carhart provides his analysis of previous research which reads as follows: "My analysis shows that Jegadeesh and Titman's (1993) one-year momentum in stock returns explains Hendricks, Patel, and Zeckhauser (1993) about the hot hand effect in mutual fund performance. However, mutual funds that yield a year higher are not because fund managers successfully follow momentum strategies, but because some mutual funds coincidentally have relatively larger positions in stocks that were winners last year. Mutual funds that have hot hands rarely repeat their abnormal performance. This is in contrast to Wermers (1996), who states that momentum strategies themselves produce short-term persistence, and Grinblatt, Titman, and Wermers (1995), who found that mutual funds that follow momentum strategies realize better performance before management fees and transaction costs. Although measuring whether a mutual fund follows a momentum strategy is not perfect in my sample, individual mutual funds that seem to follow a one-year momentum strategy produce abnormally lower returns significantly after fees. Thus, I conclude that transaction costs cost profit from following a momentum strategy in stocks."

Carhart explains the hypothetical weaknesses of the research he has outlined in the previous paragraph, as follows: "The problem of the combined hypothesis of testing conditional market efficiency on a forced return balance model obscures the little evidence available in this article to support the existence of mutual fund managers' stock-picking skills. Mutual funds with high past alpha show relatively higher alpha and return expectations in subsequent periods. However, these results are sensitive to model specification errors, as the same model is used to rank funds in both periods. In addition, this mutual fund generates alpha expectations in the future that do not differ significantly from zero. As such, the best past performing mutual funds seem to get back their expense fees and transaction costs even though most are underperforming their investment costs."

Carhart's study expands the existing literature by controlling for survivor bias, and by documenting common factor- and cost-based explanations for mutual fund persistence.

The mutual fund data used by Carhart in his research included a diversified equity fund on a monthly basis from January 1962 to December 1993. This data is free from survivor bias, as it includes all known equity mutual funds during this period. Carhart obtained data on extant mutual funds, and for mutual funds that have disappeared since 1989, from Micropal/Investment Company Data, Inc. (ICDI). For all non-surviving funds, data was collected from FundScope Magazine, United Babson Reports, Wiesenberger Investment Companies, Wall Street Journal, and printed reports from ICDI. Carhart in this study used two performance measurement models: the Capital Asset Pricing Model (CAPM) described in Sharpe (1964) and Lintner (1965), and Carhart's own 4-factor model (1995)).

The results of Carhart's research as a whole prove a consistent relationship with market efficiency, regardless of interpretation of size, *book-to-market*, and momentum factors. The results of this study do not only apply to mutual funds, but also apply qualitatively to the performance of pension funds in line with the conclusions of the results of research conducted by Christopherson, Ferson, and Glassman (1995). But, Carhart went on to state that: "the poor performance of a fund at the bottom may not have any practical significance, as it has always been the smallest mutual fund, with an average of only $50 to $80 million in assets, and because the availability of such funds for short positions is doubtful."

Based on the results of his research, Carhart suggested investors could implement a strategy of buying mutual funds that provided the highest returns in the previous year to capture the effect of Jegadeesh and Titman's (1993) one-year momentum in stock yields virtually without transaction costs, as actual trading costs are transferred to long-term mutual fund holders. Then Carhart adds that: "However, the current practice of mutual funds selling shares at NAV cannot become a long-term equilibrium once this strategy is widely followed: Equilibrium requires that mutual funds charge incoming and outgoing investors transaction fees to compensate for performance-disrupting effects. This practice has become common among many mutual funds that hold illiquid stocks such as the Vanguard Small Capitalization Index Fund and the Dimensional Fund Advisors Emerging Markets Index Fund."

At the end of his conclusion, Carhart provides three important rules for mutual fund investors who want to maximize wealth, namely: 1) Avoid mutual funds that perform continuously poorly; (2) last year's high-yield mutual fund had higher-than-average return expectations next year, but not in subsequent years; and (3), investment costs such as expense ratios, transaction costs, and expense charges all have a direct negative impact on performance.

The merit of this Carhart article is that this article acknowledges the existence *of suvivorship bias, but explains that persistence remains after including* suvivorship bias in testing, this article is able to prove the validity of efficient markets not only in mutual funds, but also in pension funds, this article proves that the persistence of mutual funds is caused due to the cost of mutual fund managers and the influence of momentum compared to the ability of managers who Manage the fund and advise mutual fund investors to avoid investing into types of mutual funds that will not help maximize investor wealth. The results of research conducted by James J. Choi and Kevin Zhao (2020), found that persistence performance was not found in the period *1994 - 2018, and even during the period 1963 - 1993 by replicating the research step as conducted by Carhart, it was found* that persistence performance weakened in the following years. The significant loss of *persistence* performance is due to lower returns on profitable styles, as well as less favorable style slopes and increased *style-adjusted performance* by funds that have performed well in the past.

2.5 Liquidity Risk and Expected Stock Returns written by Lubos Pastor and Robert F. Stambaugh (2001)

This article discusses the results of previous research that discusses the effect of liquidity on the expected returns from stocks, namely:

a. Campbell, Grossman, and Wang (1993) found that returns followed by high volume tend to be stronger, and they explain how these returns are consistent with a model in which some investors are compensated to accommodate liquidity demands from other investors.

b. Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), Brennan, Chordia, and Subrahmanyam (1998), Datar, Naik, and Radcliffe (19998), and Fiori (2000) used a variety of liquidity measures, the study generally found that less liquid stocks had high average returns.
c. Amihud and Jones (2000) document a time series relationship between measures of market liquidity and expected market returns. Instead of investigating liquidity as a relevant characteristic for pricing, this study uses market liquidity as a country variable that affects expected stock returns because its innovation has an effect that spreads across common stock. Chordia, Roll, and Subrahmanyam (2000a, 2000b) acknowledge the same as the discoveries of Amihud and Jones (2000)
d. Chordia, Subrahmanyam, and Anshuman (2000) found a significant *cross-sectional* relationship between stock returns and liquidity variability, where liquidity is proxied by measures of trading activity such as volume and turnover. The authors report that stocks with unstable liquidity have lower returns, an unexpected result. Liquidity risk in the study was measured as a company's specific variability in liquidity.

This article focuses on the systematic risk of liquidity to returns and finds that stocks whose returns are more exposed to fluctuations in liquidity have higher return expectations. The study focuses on dimensions related to temporary price changes that accompany order flow. For each month from July 1962 to December 1999, Pastor and Stambaugh constructed a measure of market liquidity as a weighted average of the liquidity measures of each stock on the NYSE and AMEX, using daily data for that month. Liquidity testing using *Ordinary Least Square (OLS) regression*. Stock liquidity estimates are included in a given month only if there are at least 15 consecutive observations that can be used to estimate the above regression (i.e., $D \geq 15$); shares with a share price of less than \$5 and greater than \$1000 are excluded; and volume is measured in millions of dollars.

Pastor and Stambaugh put forward the basic idea of "order flow", which is constructed here simply as volume signed by contemporary returns on shares that exceed the market, to be accompanied by returns that are expected to reverse partially in the future if those shares are not perfectly liquid. They assume that the greater the expectation of a reversal for a given dollar volume, the lower the liquidity of that stock.

Based on the results of their research, Pastor and Stambaugh found that stock yield expectations are *cross-sectionally* related to the sensitivity of stock returns to aggregate liquidity innovations. Stocks that are more sensitive to aggregate liquidity have much higher return expectations, even after accounting for exposure to market returns as well as size, value, and momentum factors. Pastor and Stambaugh using liquidity measures they found that the liquidity dimension associated with the inverse strength of returns was volume-related. Over the past four decades, this market-wide measure of liquidity has shown a number of sharp declines, most of which have coincided with market declines and quality declines. Their liquidity measures are also characterized by significant similarity across stocks, supporting the idea of aggregate liquidity as a price variable. Smaller stocks are less liquid, according to their size, and the smallest stocks have a high sensitivity to aggregate liquidity.

The merits of this article reinforce the evidence that liquidity has a relationship with the expected returns of stocks, and provide evidence that liquidity is better at explaining the expected returns of stocks than momentum. The weaknesses of this study as explained by Pastor and Stambaugh themselves in the final paragraph of the conclusion of this article that they make as a further study, namely:

a. This research article does not examine whether liquidity risk plays a role in various price anomalies in financial markets.
b. The research does not explain the reason why momentum strategies to buy rising stocks and sell falling stocks become less attractive from an investment standpoint when portfolio spreads based on liquidity risk are also available for investment.
c. The study only explains the sensitivity of stocks to overall aggregate liquidity. However, it does not explain expected returns related to a stock's sensitivity to fluctuations in other aspects of aggregate liquidity, such as effective bid-ask quotes and spreads, market depth, trading volume, and turnover.
d. This study only discusses the systematic risk of liquidity in the stock market. However, it has not addressed the systematic risk of liquidity in fixed income markets or international equity markets.

2.6 *A Five Factor Asset Pricing Model* written by Eugene F. Fama and Kenneth R. French (2015)

Fama and French explain previous research that proves why investment and profitability are included as factors related to average return:

a. Novi-Marx (2013) identifies proxies for expected profitability that are strongly related to average returns.
b. Aharoni, Grundy, and Zheng (2013) document a weaker but statistically reliable relationship between investment and average returns.
c. Other studies that have come to the same conclusion include Haugen and Baker (1996); Cohen, Gompers, and Vuolteenaho (2002); Fairfield, Whisenant, and Yohn (2003); Titman, Wei, and Xie (2004); and Fama and French (2006),(2008.),

Fama and French explain why investing and profitability are used in the 3-factor model because they are natural choices when using equations and

$$m_t = \sum_{r=1}^{\infty} E(d_{t+t})/(1+r)^t$$

$$\frac{M_t}{B_t} = \frac{\sum_{t=1}^{\infty} E(Y_{t+t} - dB_{t+t})/(1+r)^t}{B_t}$$

Fama and French took two steps in testing the Five Factor Model:

a. They apply the model to portfolios formed based on size, B/M, profitability, and investment. As in FF (1993), the portfolio returns to be described come from more refined versions of the types that produce those factors.
b. They moved into more hostile territory in Fama and French (FF, 2014), where we studied whether the five-factor model performed better than the three-factor model when used to explain average returns associated with prominent anomalies that the model did not target.

They also examined whether model failures were related to the same portfolio problem characteristics identified in many of the types examined here – in other words, whether asset pricing problems posed by different anomalies were some of the same phenomenon.

Fama and French combined central testing of a three-factor model on time series regression.

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + e_{it}$$

With equation number 2 above being

$$R_{it} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + r_t RMW_t + c_i CMA_t + e_{it}$$

In this equation, RMWt is the difference between the returns of a diversified stock portfolio and strong and weak profitability, and CMAt is the difference between the returns of a diversified portfolio of stocks of high-investment companies, which Fama and French call conservative and aggressive.

Fama and French divided their research data into two panels in table 1:

a. Panel A contains 25 value-weighted (VW) portfolios of various independent stock types into five Size groups and five B/M groups. The Size and B/M quintile breakpoints use only NYSE stocks, but the sample is all NYSE, AMEX, and NASDAQ stocks on CRSP and Compustat with stock codes 10 or 11 and data for Size and B/M. The period used is July 1963 - December 2013.
b. Panel B contains 25 VW portfolios of different types of independent stocks into size and profitability quintiles. The breakdown of these 5 & 5 sequences is the same as in Panel A, but the second type is on profitability rather than B/M. For portfolios formed in June of year t, profitability (measured by accounting data for fiscal years ending t-1) is annual revenue minus cost of goods sold, interest expense, and expense sold, General, general, and administrative, all divided by book equity at the end of fiscal year T at the end of fiscal year T - 1. They refer to this variable as operating profitability, OP, but this is the profitability of the operation minus minus interest expense. As in all Fama and French selections, OP's breakpoints only use NYSE companies.

Fama and French explain the approach they used in this study in table 3, namely: "We used independent sorting to assign stocks into two groups of Size, and two or three groups of B/M, operating profitability (OP), and investment (Inv). VW's portfolio defined by the intersection of those groups is the building block for those factors. We label this portfolio with two or four letters. The first letter always describes the Size group, small (S) or large (B). In types 2 & 3 and types 2 &2, the second letter describes group B/M, high (H), neutral (N), or low (L), group OP, strong (R), neutral (N), or weak (W), or group Inv, conservative (C), neutral (N), or aggressive (A). In types 2 &; 2 &; 2 &2, the second is the B/M group, the third is the OP group, and the fourth is the Inv group. The factors are SMB (small minus large), HML (high minus low B/M), RMW (strong minus weak OP), and CMA (conservative minus aggressive Inv)".

The results of Fama and French's research in this article can be explained using their own writings in this study, namely:

a. Our results show that HML is an exaggerated factor in the sense that its high average return is fully captured by its exposure to RM – RF, SMB, and especially RMW and CMA. Thus, in applications where the only importance is abnormal returns (measured by intercept regression), our tests show that the four-factor model dropping HML performs as well as the five-factor model. But if one is also interested in the slope of a portfolio with respect to investment size, value, profitability, and premium, the five-factor model is the one's choice. As a waiver to the evidence that suggests that HML is excessive, however, one can substitute HMLO for HML in a five-factor model
b. One of the more interesting results is that portfolios of small stocks with negative exposure to RMW and CMA constitute the largest asset pricing problem in four of the six sets of LHS portfolios studied here. Negative CMA exposure from non-performing portfolios is always in line with evidence that companies in these portfolios invest heavily, but negative exposure to RMW at types 5 & 5 Size-B/M and Size-Inv (Tables 7 and 10) does not correspond to low profitability. For these portfolios, we say that their returns behave like stocks of heavily invested companies despite their low profitability, but there are hints that for small stocks, high investment alone may be the main problem. For portfolios 2 & 4 & 4 Size-OP-Inv in Table 11, there is a bit of ambiguity. In this case, the negative slopes of RMW and CMA go hand in hand with low OP and high Inv, and we conclude that the killer portfolio contains small stocks of companies that invest heavily despite their low profitability. As a lure to potential readers of FF (2014), we can report that small stock portfolios with similar properties play a large role in five-factor model testing on prominent anomalous variables, in particular, accrual, net share issuance, and volatility

Fama and French also explain their reasons for not incorporating liquidity and momentum into FF5FM, but incorporating investments and portfolios based on *Left Hand Side* (LHS) portfolio research, both factors have a regression slope close to zero and thus result in trivial changes in model performance. Fama and French also gave opinions on research conducted by Hue, Xue, and Zhang (2012) which examined the four-factor model, namely RM - RF, SMB, RMW, and CMA by eliminating HML for which they did not explain why. Fama and French argue about their results: "Their investment model is more limited than ours, and they did not consider alternative definitions of factors. More importantly, they were primarily concerned with explaining the returns associated with anomalous variables not used to construct their factors, and they focused on VW's portfolio of univariate types on each variable. Portfolios with value weighting of univariate types on variables other than size are usually dominated by large stocks, and one of the key messages here and in Fama and French (1993, 2012, 2014) is that the most serious problems in asset pricing models are with small stocks."

Fama and French's research provides empirical evidence that profitability and investment have a relationship with average return, this study also concludes that momentum and liquidity have a regression slope close to zero, and are considered not to provide significant income if included in the FF3FM model, and this study concludes that the HML variable is an exaggerated variable and a high average variable can be fully captured by The other four factors.

The weakness of this study is that it cannot explain why small-cap stocks, which invest a lot despite low profitability, perform worse than the five-factor model predicts. However, large-cap stocks that invest heavily despite low profitability perform positively based on the calculation of the five-factor model.

3. CONCLUSION AND ADVICE

The conclusion of this article is:

1. Although the CAPM has limitations that prevent accurate returns on the expected returns of a security or portfolio that cause financial experts to look for models that can describe expected returns, it has the advantage of proving correctly the linear relationship between yield and risk. Thus, the multifactor calculation model discussed is an extension of the CAPM.
2. The multifactor calculation model shows that the value of a stock or portfolio is influenced by various factors, be it market index returns, capitalization value, book value, liquidity, profitability, momentum, investment or macroeconomic factors.
3. Multifactor models introduced to date show that there is still a difference of opinion from financial experts about the variables that can be used to predict the return of a security

or portfolio, is it enough to use only variables from the company's financial statements and the company's stock price (book value, market capitalization, profitability, and investment)? Can it be described by stock price movements and how often the securities are traded (momentum and liquidity)? or can macroeconomic factors and stock market movements as a whole determine accurate yield predictions (market indices, inflation, interest rates, and other marcoeconomic factors)? Or is it a combination of the previous three questions?

The suggestion from this article is that the author hopes that there will be a continuation of the literature review on the multifactor model that is better than the author's article, and the next literature review discusses CAPM derivatives such as CCAPM, ICAPM, and *zero-beta* CAPM with multifactor models.

REFERENCES

Ross, Stephen A. 1976. *The Arbitrage Theory of Capital Asset Pricing*. Journal of Economic Theory 13, pp: 341 - 360.

Chen, Nai-Fu, Richard Roll & Stephen A. Ross. 1986. Economic Forces and The Stock Market. The Journal of Business, Vol. 59, No.3, pp: 383 - 403.

Fama, Eugene F. & Kenneth R. French. 1992. The Cross-Section of Expected Stock Returns. The Journal of Finance, Vol. 47, No. 2, pp: 427 - 465.

Carhart, Mark M. 1997. On Persistence in Mutual Fund Performance. The Journal of Finance, Vol. 52, No. 1, pp: 57 - 82.

Pator, Lubos & Robert F. Stambaugh. 2001. Liquidity Risk and Expected Stock Returns. NBER Working Paper No. 8462, pp: 1 - 35.

Fama, Eugene F. & Kenneth R. French. 2015. A Five Factor Asset Pricing Model. Journal of Financial Economics, 116, pp: 1 - 22.

Choi, James J & Kevin Zhao. 2020. Did Mutual Fund Return Persistence Persist?.NBER Working Paper 26707, pp: 1 - 10.