A TEST OF THE LOW VOLATILITY PREMIUM ON THE JSE

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1 INTRODUCTION

1.1 BACKGROUND

The Market portfolio theory formalized by Harry Markowitz in 1952 has been one of the most widely used models in finance. The theory postulates that high risk is compensated with higher expected return. A further extension of this theory, the Capital Asset Pricing model (CAPM), describes the relationship between risk and expected return as positive. Both CAPM and the Efficient Market Hypothesis (EMH) assume that investors are not influenced by exogenous factors and emotions and behave rationally. Through a new screen of literature, it was found that this is not the case. Low volatility securities have positive returns and high volatility securities have negative returns, known as the low volatility premium/anomaly. The relationship between risk and return is much flatter than CAPM predicted and markets are riddled with behavioural biases. This research paper will test this anomaly on the Johannesburg Stock Exchange (JSE).

1.2 CORE RESEARCH QUESTION

The purpose of this research is to determine if the low volatility premium/anomaly been identified on the JSE in modern times.

1.3 RESEARCH OBJECTIVES

- To determine if low beta stocks on the JSE are underperforming high beta stocks.
- To establish to what extent this anomaly is prevalent in modern times, primarily the 21st century.

- Lastly, to assess whether low volatility strategies are efficient, profitable and recommended in the current market.

1.4 IMPORTANCE AND BENEFITS OF THE PROPOSED STUDY

Relevant studies on the low volatility anomaly (premium) have been widespread when regarded from a global point of view in financial markets. However, there has been limited research conducted from a South African perspective. This research will expound on the well-defined notions and evaluate the present literature, which will then be used to perform a study on the JSE.

2 DELIMITATIONS

The research conducted took place during the Covid – 19 pandemic, when information was difficult to attain owing to the limited access to the university's terminals. This must be accounted for with regards to the timing of the research. Further time constraints were observed as only data from the years 2000 to 2019 were gathered.

The limitation based on market capitalization is in order to ensure a liquid universe when conducting portfolio sorts and asset pricing tests

3 DEFINITION OF KEY TERMS

Volatility	Statistical degree of the distribution of returns for a particular security or market index
beta	Factor for measuring risk
Bull market	A financial market where prices are rising or are expected to rise, particularly pertaining to a group of securities

Bear market	A financial market where prices are declining
Efficient market hypothesis (EMH)	Asset prices reflect and react to all available information immediately
Arbitrage	The buying and subsequent selling of an asset, aiming to profit from a change in the asset's price between markets
Size effect	Where the performance of smaller companies is seen to be greater than those of large companies

4 LITERATURE REVIEW

4.1 BACKGROUND

The low volatility anomaly explores the question of why lower beta stocks have historically produced stronger risk-adjusted returns than higher stocks or the broader market (benchmark). Strategies of low volatility investing have been largely adopted in the 12 years since the 2008 financial crisis. The low volatility anomaly refutes the convectional framework of risk and returns coined by Markowitz (1952). According to the traditional mean-variance framework, low volatility securities should exhibit lower risk. However, Chan and Lazzara (2019) reported that low volatility stocks outperformed their benchmarks over time, and this phenomenon was persistent universally across the globe. Low volatility strategies are deemed efficient as they offer to protect investors in bearish markets while exhibiting participation in the bullish market conditions. The concept of low volatility was first explored by academics more than four decades ago, while the body of knowledge around the concept is rooted in the rationale of efficient asset pricing models (efficient markets) and the behavioural finance fields.

4.2 EFFICIENT MARKETS EXPLANATION

Markowitz (1952) developed a framework that predicts the relationship between risk and returns, the relationship was found to be linearly positive. Empirical tests by Fama and MacBeth (1973) and Jensen, Black, and Scholes (1972) concluded that results were significantly different from the rational approach claim, as their results demonstrated a flatter or even a negative relationship between risk and return. The time series regression model by Jensen et al. (1972) reported that high beta securities exhibited negative returns and the low volatility securities gave positive returns. This anomalous observation refutes the traditional notion of asset pricing that was originally established by Treynor (1961), and Sharpe (1964). The traditional asset pricing was further developed by several academics *inter alia*; Linter (1965), Mossin (1966), and Fama (1968). According to Jensen et al. (1972), there is substantial evidence pointing to the robust existence of low volatility anomalies between 1947 and 1965. Additionally, Fama and Macbeth (1973) acknowledged that besides portfolio risk, there should be other parameters that explain the cross-sectional expected returns in securities. Two decades later, the seminal work by Fama and French (1992) explored the relationship between beta and returns; they reported a flat relationship between risk and returns over the period from 1963-1990. Several subsequent works including studies by Haugen and Baker (2010) and Bradley and Wurgler (2011) further confirmed the observed flat relationship between risk and return. Furthermore, international studies by Frazzini and Pedersen (2010) and Baker and Haugen (2010), reported low volatility anomaly presence in emerging and developed stock markets. According to Blitz and van Vliet (2007), when considering the explanation of the low volatility anomaly, the simple volatilities produced a better result compared to the approach of complex CAPM betas. These studies report that the volatility anomaly was observed more in stock markets especially within smaller firms, notwithstanding the presence of the anomaly also in other asset classes.

4.3 BEHAVIOURAL FINANCE EXPLANATION

Fama and Shiller (holding different views on the nature of the markets) shared the Nobel Prize for their contributions to understanding asset pricing. Fama is rooted in the Efficient Market Hypothesis (EMH) and views markets as rational, while Shiller is inclined to markets being

riddled with behavioural biases. Lo (2004) argues that the disputes of EMH and Behavioural Finance are unimportant because both approaches are two sides of the same coin, therefore, neither side is wrong. However, neither side has the full picture either. The core framework of the behavioural framework is a combination of irrational behaviour and limits to arbitrage, this is outlined in the literature by; Shleifer (2000), and Barberis and Thaler (2003). Most documented explanations for the volatility anomaly point towards several irrational behavioural biases that impede any attempt of rational decision assembly. The Nobel-prize-winning seminal work by Kahneman and Tversky (1979) that is clarified by Blitz and Van Vliet (2007), Falkstein (1996), and Ocdean (2008) carefully highlighted a succinct combination. This is comprised of the preference for lotteries, representative biases, overconfidence bias, mental accounting, and attention-grabbing effect as the main drivers of preference for high volatility stocks. The outlined combination is not grounded in rational fundamentals, but rather comes from irrational behavioural traits that grossly affect investors (Bradely & Wrugler, 2010).

Literature by Bali and Whitelaw (2011) and Mitton and Vorkink (2010) cautiously suggest a significant link between the idiosyncratic volatility (IVOL) problem and the fact that investors tend to select properties that are “lottery-like”. The authors conclude that the IVOL puzzle should be more robust for securities held by agents who prefer lottery-like payoffs. According to the study by Kumar (2009), lottery-like payoffs vary countercyclically, therefore the idiosyncratic volatility problem is observed more in bearish markets. Tversky and Kahneman (1979) explain representation bias to be common when making financial decisions. Furthermore, the representation heuristic hinders the process of decision-making - this results in relying more on narratives compared to statistical evidence. The study by DeBondt and Thaler (1985) acknowledged the existence of an overreaction phenomenon and this notion explains how investors may overweight the newly obtained information when making decisions. For example, IPOs are largely viewed as potential performers despite the poor average performance documented for new listings. This behaviour is persistent because investors are either not aware, or they choose to ignore all the statistical properties of securities. Falknstein (2009) also gives a related explanation on investor confidence; the argument developed is that people who attempt to pick stocks feel the need to prove this and convince others. Thus, investors tend to favour more volatile assets in search of higher alphas, this irrational behaviour is deeply rooted in overconfidence.

To have an acceptable theory on overconfidence, literature notes the need for a connecting assumption to the preference of volatile stocks. The assumption is that when compared to optimists, pessimists should display aggressive behaviour in the financial markets. This assumption can be demonstrated with investor's reluctance to short securities relative to buying them. A subsequent paper by Miller (1977) applied the connecting assumption and established that in the financial markets, prices are set by optimists. He also stated that stocks with wider options attract optimistic shareholders, therefore, sell at upper prices, this leads to lesser returns in the future. Blitz and Vliet (2007) explore the mental-accounting explanation for the volatility effect. The argument acknowledges that investors make less risky decisions (to avoid poverty) but are capable to be risk-neutral or even risk-seeking. Black (1993) further explains how the mental accounting concept assists in explaining why investors trade away the volatility effect by executing a strategy that involves assuming low betas at the expense of the risk-free stocks. The argument of the attention-grabbing effect also explains the preference for high volatility. Studies by Falkstein (1996) and Odean (2008) both concluded that private investors are net buyers of the attention-grabbing stocks, or the stocks reported in the media. The authors argued that attention-based buyers inflate the securities prices, leading to sour subsequent returns. It is noteworthy that attention-seeking securities are found in high volatility markets which leaves the low-volatility securities to suffer from investor neglect.

The low volatility anomaly gained momentum from 1945 in the US, when the strategy was widely adopted after the financial crisis of 2008. According to Bradley and Wurgler (2011), the main reason why institutional investors do not fully utilize the low volatility anomaly strategy (shorting highly volatile securities which are mostly small stocks) is because of the high cost of borrowing attached and the low volume of securities to borrow. Given these parameters, institutional investors cannot overweight the low volatility because of benchmarking which involves the maximisation of the information ratio relative to a benchmark, without exploring any leverage (Brennan, 1993).

4.4 REST OF THE WORLD DISCUSSION

In the USA, the S&P 500 was the first index to adopt the low volatility concept systematically, the comparison performance is shown in Appendix A, Exhibit 1. It is noteworthy that the low volatility index outperformed the benchmark at a substantially lower level of volatility. The

study by Chan and Lazzara (2019) reported that low volatility stocks outperformed their benchmarks over time and the authors claim that this phenomenon was persistent universally across the globe. Contrary to fundamental expectations, Li and Garcia-Feijoo (2013) found that the low volatility-based strategies were vastly popular for the period of 1963-2010, as the strategies generated abnormal returns in the U.S and international markets. However, the authors concluded that the existence of the low volatility anomaly was more limited than widely believed. Institutional traders are faced with limits to arbitrage which tend to have a significant negative impact on the performance of the low volatility effect (Li & Garcia-Feijoo, 2013). The report by Baker and Wurgler (2010) highlights that the performance pattern shown by low volatility anomalies is hard to explain with traditional asset prices because, in principle, beta could be a wrong measure of risk as widely published in the body of knowledge. Additionally, Xi and Garcia-Feijoo (2013) conducted a study over a 46 year period (1966-2011), their results indicate that the superiority of low-volatility strategies cannot be purely attributed to the rewards of systematic risk factors. This abnormal performance can be explained by other asset pricing models that are connected with the riskiness of the security.

4.5 SOUTH AFRICAN DISCUSSION

In the South African context, the anomaly of the mean-variance framework is well documented by the Van Rensburg and Robertson (2003) study. This study highlighted the various irregularities of CAPM with the major shock being that investors were compensated more for taking less risk, otherwise known as the low volatility anomaly. The subsequent study by Auret and Basiewicz (2009) utilizing the same database as Van Rensburg and Robertson (2003) reported different results, this difference was attributed to misspecification of the dataset and the accuracy of the asset pricing. Auret and Basiewicz (2009) claim that the asset pricing model might exhibit serious estimation errors for the beta. The composition of JSE is noteworthy when investigating return patterns, Banz (1981) reported the average returns of small capitalisation stocks are especially high for it to be explained by their beta estimates while Basu (1983) concluded that the model posited by Banz (1981) was incorrectly specified after reporting that the size effect is a proxy for the effects of price to earnings ratio (E/P). Evidence on the JSE paints a more mixed picture than the evidence above with De Villiers et al. (1986) and Bradfield (1989) amongst others finding no evidence of the size effect. Page (1996) finds

that E/P effects persist in various models with increasing factors up to 5 factors and is robust. A possible reason for South African results not exhibiting a size effect is owing to the small sample size and the overall distribution on the JSE which can be seen through the findings of Davis (1994) who excluded small firms in the sample and found no size effect.

The previous literature shown proposes different outcomes and findings, as well as differing reasoning and postulations that give both contradictory as well as reassuring results regarding the low volatility anomaly. This could be owing to diverse methodologies being applied throughout the unique studies performed which may produce non-standardized results. In turn, the literature evaluated is the basis for conducting this research. It seeks to determine whether low risk, low volatility stocks do indeed produce superior performance and returns and if this anomaly exists on the JSE.

5. METHODOLOGY

5.1 SAMPLING AND DATA COLLECTION

The data collected and used for the purpose of this research is sourced from Bloomberg and will consider price, market capitalization, volume and accounting ratio data for all shares listed on the JSE over the period considered. The research will assess the financial information from the appropriate limited cross-section of the top 100 shares listed on the JSE from January 2000 until December 2019. The limitation based on market capitalization is in order to ensure a liquid universe when conducting portfolio sorts and asset pricing tests. Monthly returns will be calculated for every share and adjusted for corporate actions such as dividends, unbundlings and share splits. The limitation of the universe of shares to the top 100 will be conducted at each sorting period, allowing for shares to enter and exit the data based on their underlying size and liquidity. The market proxy and risk-free rate to be applied in time-series regression tests will be the J203 ALSI (total return) and the 90 day RSA government treasury bill rate sourced from the SARB (South African Reserve Bank) website.

5.2 DESCRIPTION OF OVERALL RESEARCH DESIGN

This section aims to determine whether the low volatility anomaly exists on the JSE. Shares which do not fall within the sub-section of the top 100 shares (based on market capitalization) on the JSE with regards to a distinct year, will be omitted from the set of data collected. Portfolios will be sorted annually where at each sorting period, the volatility of each share will be calculated using the prior 12 months of returns based on univariate standard deviation and standard deviation calculated on returns in excess of the market. Shares will then be ranked from 1 to 100 based on their historical volatility and grouped into one of five portfolios based on quintile splits where portfolio 1 is the highest volatility portfolio while portfolio 5 represents the lowest volatility portfolio. Within each portfolio, constituent shares will be assigned an equal weight (1/20) and grown at their respective returns over the proceeding 12 months, after which the sorts are repeated. The portfolio value is then calculated as the sum of respective portfolio weights and portfolio returns are calculated on a buy-and-hold geometric basis. This can be seen through the formulae below with regards to the cross-sectional standard deviation of portfolio returns.

Formula i:

$$\sigma_i = \frac{\Sigma_{i=1}^{n}(r_i - \bar{r})}{(n-1)} \times \sqrt{12}$$

Formula ii:

$$\sigma_i = \frac{\Sigma_{i=1}^{n}(r_i - r_m)}{(n-1)} \times \sqrt{12}$$

Where: σ_i is the standard deviation;

r_i is the observed share return of stock i;

$\bar{r}$ is the observed average share return of all stocks;

r_m is the observed mean return of the market;

n is the number of shares observed in the market;

$\sqrt{12}$ denotes the annualization of the variance to attain the standard deviation.

The outcome of the portfolio sorts will be 5 time-series returns representing portfolios sorted on volatility. Portfolio cumulative performance, nominal and risk-adjusted returns (using the Sharpe and Treynor ratio) will be evaluated in order to determine whether there is a low-volatility premium present on the JSE as well as whether portfolio performance is influenced by the method of estimating volatility. Lastly, time-series regressions consistent with those described in Page et al. (2016) will be conducted in order to determine whether CAPM is able to explain the variation in portfolio returns through the evaluation of market betas and assess time-series alphas of each portfolio.

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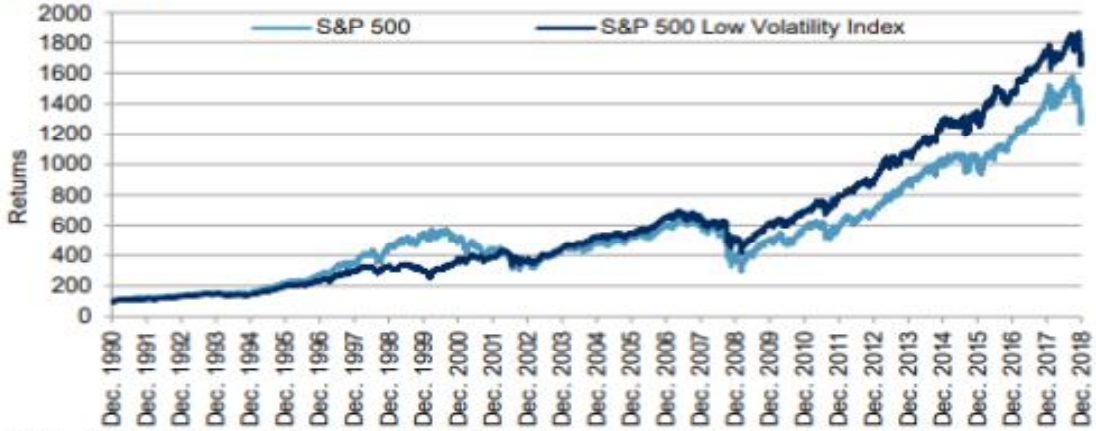
7. APPENDIX A

Exhibit 1: Relative Performance of the S&P 500® Low Volatility Index versus the S&P 500



Source: S&P Dow Jones Indices LLC. Data from Dec. 31, 1990, to Dec. 31, 2018. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.