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Viability of Risk-return Trade-off within a South African Context

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Abstract
Research aims: This study aimed to determine whether systematic risk and return are related to each other. It answered the research question: Is it realistic for investors to expect high returns when their investments are associated with more riskiness?
Design/Methodology/Approach: Quantitative analysis was applied through a correlational research design. Secondary data were collected from the Integrated Real-time Equity System (IRESS). The Statistical Package for Social Sciences (SPSS) was utilised to measure a Pearson correlation coefficient and execute multiple regression analysis. This was done to test for the relationship between financial measurements of systematic risk and return, of sampled entities.
Research findings: This research found that measures of systematic risk and return are not necessarily related when empirically analysed for sampled entities.
Theoretical contribution/Originality: This paper indicated that the principle of the modern portfolio theory (MPT) should not be accepted as general truth. It should not be assumed that risk and return are linearly related in all financial markets under all economic circumstances. This premise is contrary to general financial management practice, where the MPT is universally accepted and even forms the basis of other financial theories.
Research limitation: The use of the IRESS database posed a limitation in terms of sampling, as the database was frequently unable to present a complete set of data needed for statistical testing. Consequently, only 33 companies were sampled, as IRESS only made a complete set of required data available for these entities.
Keywords: JSE listed companies; Risk-return trade-off; Systematic risk; Return; Financial management

Introduction

The phrase ‘the higher the risk, the higher the return’ emanates from the modern portfolio theory (MPT), developed by a Wall Street broker, Harry Markowitz, in 1952 (Rusoff, 2019). As a foundational concept, the MPT dominates thoughts around how returns and systematic risk levels are interrelated (Miller, 2019). Markowitz’ theory posits that investors should analyse risk relative to the returns they intend to generate (Iyiola et al., 2012). According to the MPT, the investor would ideally opt to generate the highest possible return, while minimising risk associated with the investment. This theory issues a caveat: increases in returns are associated with increases in risk. Thus, the rational investor should opt to find a ‘sweet spot’ where enough returns are generated, while the riskiness associated with the investment does not exceed the risk level that the investor is willing to absorb (West, 2004). This investment compromise between risk and return is often referred to as the 'risk-return trade-off'. The MPT is applied in other financial theories such as the capital asset pricing model (CAPM), free cash flow valuations (FCFV), dividend discount model (DDM), arbitrage pricing theory (APT) and net present value methods (NPVVM), where the CAPM free cash flow valuations (FCFV), dividend discount model (DDM), arbitrage pricing theory (APT) and net present value methods (NPVVM), where the CAPM is applied as discount rate (Piccoli et al., 2018; Szczygielski, 2018; Correia et al., 2019). Researchers such as Taillard (2020) argue that despite the MPT's popularity, risk-return trade-off is highly simplistic, which does not accommodate many changing factors in the investment environment. Wood (2016) posits that historical data do not support the risk-return trade-off assumption, suggesting higher risk investments are associated with lower returns and losses. Seminal research studies by Hurdle (1974), Armour and Teece (1978), Treacy (1980) and March and Swanson (1984) confirm systematic risk and return are either unrelated or inversely related. Wang and Yang (2013), Wang and Khan (2017) and Nugroho et al. (2021) have all found that the risk-return trade-off is indeed viable in samples that were empirical tested.

From preceding arguments, it can be submitted that there exists uncertainty around the viability of the risk-return trade-off principle. Nevertheless, scholars and investment managers universally adopt the risk-return trade-off, oblivious of whether the relationship between systematic risk and return exists empirically within the respective investment markets. This study intends to fill a gap in research by clarifying whether systematic risk and return measures are empirically associated with each other within the South African investment environment, when Johannesburg Stock Exchange (JSE) listed companies are sampled. The study answers the research question: Is it realistic for investors to expect high returns when their investments are associated with more riskiness, in a South African context?

This research paper contributes to current academic knowledge by turning attention to the fact that the basic principle of the MPT is not universal and should not be accepted as such. Limited research has been done to challenge the MPT and its underlying assumption. From a South African perspective, only one other similar study was undertaken by Chawana (2011). Internationally, limited recent research has been performed on this topic. The novelty of this research lies, not only in bringing a 70-year-old portfolio theory into question, but also in implying that a new approach to systematic risk modelling may be required. In terms of theoretical contributions, this paper extends the interpretation of 'returns' beyond profitability measures, by also considering market ratios and the market value of the share, as a possible proxy for returns. Empirically, this research indicated that systematic risk and return measures were not significantly related to each other, in the case of sampled companies. Empirical findings highlight the fact that the prediction of systematic risk may not entail universal solutions. Open-minded and modern approaches are needed, as far as systematic risk estimation is concerned.

Literature Review and Hypotheses Development

This section provides a discussion of the existing literature to explain the context and to set the backdrop against which the hypotheses of the study is formulated.

Risk in financial perspective: unsystematic and systematic risk

Considering risk from a financial perspective, risk relates to the level of uncertainty posed by an investment and how it may result in losses to the investor (Ahmad & Ramzan, 2016). The financial literature focuses mostly on two different types of risk: unsystematic risk and systematic risk. Unsystematic risk is the risk pertaining to micro factors within a company. Micro factors are fully within the control of the company (Thakur, 2020). As these risks can be managed; companies can take strategic steps to prevent such risks from resulting in significant losses. This can be done through proper planning, insurance and pro-active actions (Marx et al., 2017). The main categories of unsystematic risks consist of compliance risk, reputational risk, security risk, competition risk, governance risk, strategic risk, technological risk, project risk and quality risk (Boitnott, 2022; Henderson, 2020; Kirvan, 2021). More often, researchers turn their attention to the analysis of systematic risk. Chhapra et al. (2020) describe systematic risk as 'distress risk', for these risks are caused by market fluctuations that are beyond a company's control and can be harmful to companies, placing them in financial distress. Systematic risk cannot be mitigated through diversification, as this risk originates from fluctuations in market conditions. Market conditions are affected by external economic factors and estimating systematic risk is a key factor in investment decisions (Puspitaningtyas, 2017).

Estimating systematic risk in stock markets

Systematic risk is measured through monitory volatility in share prices behaviour (Ahmad & Ramzan, 2016). It is therefore argued that systematic risk is determined through the analysis of financial information in the form of share prices and share price movements. Volatility is defined as the level and regularity of fluctuations in share prices (Ahmad & Ramzan, 2016). Nasstrom (2013) puts forward that volatility is the magnitude by which share prices decrease and increase within a specific time frame. According to Tsay (2010), volatility measures the dispersion of a share price around its mean value. From the preceding definitions, it is submitted that volatility is the extent to which share prices variate, resulting in a distribution of share price values around the share's mean value. From a mathematical standpoint, there are four different methods through which systematic risk can be measured. The first method pertains to the measurement of standard deviations. A standard deviation is an indicator of how share price data deviates from a mean score. The larger the standard deviation, the greater the volatility of share price behaviour. Investors can use the standard deviation size to match their risk appetite. Investors who are less willing to face risk, will opt for shares that generate smaller standard deviations from the mean (Levy, 2002; Sofalof, 2015). Secondly, systematic risk can be estimated through calculation of alpha.

Alpha is a measure that compares the performance of a share to the performance of a benchmark (normally a share index). Alpha assumes a baseline of zero. Any alpha value above zero indicates that the share outperformed the index. Similarly, an alpha value below zero, indicates that the share underperformed. An alpha value of 1 percent, for example, indicates that the share outperformed the index by 1 percent (Wilkinson, 2013; Sofalof, 2015). The third calculation method is by means of R-squared measurement. R-squared is used to model benchmark returns against share price returns. The higher the R-squared value, the closer the share returns are moving towards the benchmark. Similarly, lower R-squared values indicate deviation from the benchmark and potential investment distress (Levy, 2002; Wilkinson, 2013). Lastly, systematic risk can be measured through the calculation of beta.

Beta compares the performance of the company to that of the industry. It assumes a baseline value of one. If the company has a beta value greater than one, its share price behaviour is more volatile than the industry. A beta value less than one indicates that the share price behaviour is less volatile than the industry (Amihud & Goyenko 2018). For the purpose of this study, beta was selected as a proxy, which represents systematic risk. The selection of this proxy is in line with prior research performed by Green & Zhao (2021) and Rutkowska-Ziarko (2022). Where beta is applied for the estimation of systematic risk, two different types of beta values can be calculated: leveraged beta and unleveraged beta. Leveraged beta is a beta measurement that accommodates the capital structure of a company. It takes into account that systematic risk is increased when debt is obtained by the company, therefore, leveraged beta is somewhat higher than unleveraged beta (Lesseig & Payne, 2017). Leveraged beta is applied in financial modelling (Sarmiento-Sabogal & Sadeghi, 2014). Unleveraged beta represents a beta measurement through which company debts are ignored. Unleveraged beta estimates systematic risk in the instance where the company is only funded by means of equity contributions (Mehta, 2021). Unleveraged beta is normally a lower risk figure than leveraged beta. Not incorporating debt into a beta measure decreases systematic risk, as debt renders the company more vulnerable to macro-economic effects (such as inflation and interest rates) (Abidin et al*.,* 2021). For the purpose of this study, both leveraged and unleveraged beta values were included for testing to avoid any oversights on the part of the researchers.

Interrelation between profitability, earnings, dividends and share price

Understanding return is deemed a critical success factor of this study, since there are so many interpretations of return. In delineating return, Barnes (2003) argues there is no singular definition relating to the term return and that the concept should remain open-ended and all-inclusive, depending on the investment, the investor and the investment portfolio. According to Fadjar et al. (2021), a return is the output or yield obtained through investing. Thus, returns are measured as the difference between the value of a portfolio at an earlier time, versus the current point in time. It can therefore be posited that a return is the yield generated by the investor when investments are made, leading to increases in the value of an investment portfolio.

Returns consist of a current compensation (such as interest or dividends) and share price growth, which is created through shareholder wealth. Returns in the form of current compensation are normally paid within the short term, such as annually or semi-annually. Share value growth represents capital gains over the longer term. However, such capital gains can only be realised upon the sale of the share (Feeny, 2021). The quantification of returns needs to consider both short- and longer-term compensation for the investment. Prior research (Bower & Bower, 1969; Lewellen, 2004; Chen & Shen, 2009) extended focus towards profitability, dividends, earnings and share price analysis as the main source of analysing returns. Hall (2018) argues that short-term returns such as earnings and dividends are interrelated with long-term returns such as share price growth, by indicating that earnings per share (EPS), return on equity (ROE), return on assets (ROA) and dividends per share (DPS) are predictors of shareholder wealth. Figure 1 serves as a further explanation around the interrelatedness of these concepts.

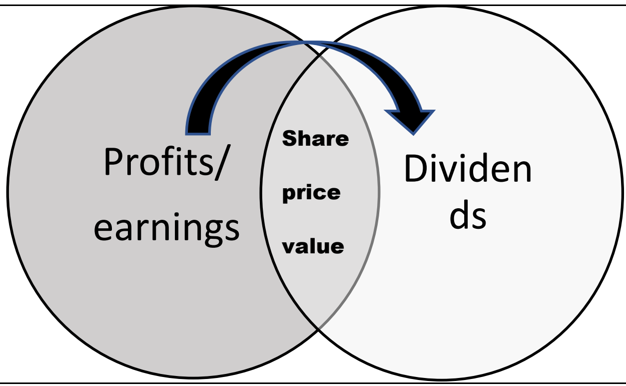

Figure 1 Profits/earnings, dividends and share price value interrelation

Figure 1 indicates that the generation of profit or earnings lead to the company's ability to distribute dividends to shareholders. Researchers such as Dimitropoulos and Asteriou (2009), Farsio et al. (2004) and Skinner and Soltes (2011) postulate that there is a casual relationship between earnings and dividends. If a company is able to generate earnings and distribute dividends, the market value of shares (share price) should increase, based on a greater demand for the share, leading to the creation of shareholder wealth (Bhasin & Shaikh, 2013). As systematic risk is measured through volatility in share prices (Ahmad & Ramzan, 2016), there can potentially be an association between systematic risk behaviour and shareholder wealth creation.

H_1**:** *Market price per share is significantly related to systematic risk.*

Panda and Nanda (2017) researched the interrelatedness of short-term- and long-term returns and concluded that short- and long-term returns were interrelated on stock exchanges for sampled countries like Britain, Denmark, Finland, Germany, Portugal, Spain, Sweden, Switzerland, Greece, Ireland, Luxembourg and Norway. It would seem that short-term profits and long-term value creation are not independent from each other, and it should be noted that the unsustainable generation of short-term earnings will eventually lead to the plundering of long-term value creation (Bernow et al., 2017).

***H_2*:** *Profitability ratios are significantly related to systematic risk.*

In addition, it can be argued that if a causal relationship exists between earnings and dividends, while short-term profits and long-term value creation dependent upon each other, there should also be an association between dividends and long-term value creation.

***H_3*:** *Market ratios are significantly related to systematic risk.*

From the preceding arguments it can submitted that that earnings, dividends and share price values are interrelated and representative of both short-term returns (income) and long-term returns (capital gains). As capital appreciation and risk are often associated with each other (Bernow et al., 2017), the fundamental assumption of the MPT (that risk and return measures are related) is again reflected here. It seems that the MPT is deeply enmeshed in the determination of returns.

***H_4*:** *In combination, return variables can significantly predict systematic risk behavior.*

In the section hereafter, the research methods used to test the identified hypotheses, are described elaborately.

Research Method

The study applied a correlational research design in order to determine whether systematic risk and return are related to each other. The top 100 JSE listed companies were populated and a sample was selected through the application of judgement sampling. A total of 33 companies were sampled based on the following sampling criteria:

Criterion 1: All applicable data for the sampled company should be readily available on IRESS for all years under review;

Criterion 2: The company should be listed on the JSE for all years under review; and

Criterion 3: The company should not operate within the financial sector, as such entities do not publish accountancy related measures that are consistent and comparable to those of other sectors.

Secondary data were collected from IRESS and analysed through the application of SPSS (version 27). Data were collected for a total of five consecutive years, 2015 to 2019. Due to the COVID-19 pandemic, which began in South Africa during March 2020, more recent data had not been collected. It is posited that the effects of the pandemic would be reflected in such financial data and distort findings. As the pandemic does not represent ordinary financial circumstances, its effects were not considered in this paper.

Two different data sets were collected: the first data set served as a proxy for the measurement of systematic risk and consisted of the collection of leveraged beta (LB) and unleveraged beta (UB) figures. The second data set represented the measurement of return. The ratios relating to profitability, dividends, share price and earnings, available from IRESS, were retrieved from IRESS, representing the independent variables. IRESS identified 18 ratios, classified into three groups: 12 profitability ratios, five market ratios and one share price measure (refer to Table 1).

Data analyses entailed that three different statistical phases were applied. During the first phase, normality testing was done by means of the Shapiro Wilk test. The Shapiro Wilk test puts forward that a probability value (p) larger than 0,05 indicates normal distribution. After normality testing was done, data sets were mathematically transformed, where data distributions were non parametrically distributed. After normality testing and data transformation were done, phase 2 of the research process could be executed. During the second phase, a Pearson correlation coefficient (r) was measured. The interpretation of the correlation coefficient was as follows (Pallant, 2013):

- A correlation between 0 and 0.3 indicates a low correlation;
- A correlation between 0.31 and 0.6 indicates a medium correlation; and
- A correlation between 0.61 to 1.00 indicates a strong correlation.

The third phase of the research process involved the execution of multiple regression analysis. This was done to determine whether return measures have predictive value when applied in estimating systematic risk proxies. This phase necessitated testing for multicollinearity. Multicollinearity is a phenomenon where independent variables are highly correlated with one another, and the statistical substance of the regression model is compromised (Einspruch, 2015). The effects of multi-collinearity were avoided during the construction of the multiple regression models, by applying the stepwise multiple regression setting, on SPSS.

This article followed all ethical standards for carrying out research and ethical clearance was obtained from the North West University. The results to the research, together with the interpretations, are displayed in the paragraphs hereafter.

Result and Discussion

Normality test

Normality testing entails that the researcher tests whether the collected data were normally or abnormally (also referred to as non-parametrically) distributed. This is an important consideration, as the type of statistical testing performed can be greatly influenced by the distribution of data (Fetters, 2020). As mentioned in previous paragraphs, the research results were obtained through the execution of two different statistical phases. During the first phase, the data sets were tested for normality. Where it was found that the data were not normally distributed, the data had to be transformed through the calculation of a natural log transformation. Table 1 displays the outcomes of the normality test, using the Shapiro Wilk test. It further indicates where data were log-transformed together with the code that was used after transformation.

Table 1 Results for Shapiro Wilk test

Ratio category/ measurement	Variable	Variable code	P-Value	Natural log transformation where P < 0,05 (code)
Systematic risk	Leveraged beta	LB	0.052	N/A
Systematic risk	Unleveraged beta	UB	0.057	N/A
Profitability	Net profit margin	NPM	0.000	ln_NPM
Profitability	Operating profit margin	OPM	0.000	ln_OPM
Profitability	Return on assets	ROA	0.000	ln_ROA
Profitability	Return on equity	ROE	0.000	ln_ROE
Profitability	Return on capital employed	ROCE	0.000	ln_ROCE
Profitability	Return on average assets	ROAA	0.000	ln_ROAA
Profitability	Return on average equity	ROAE	0.000	ln_ROAE
Profitability	Inflation adjusted return on assets	Inf adj ROA	0.000	ln_Inf adj ROA
Profitability	Inflation adjusted return on equity	Inf adj ROE	0.000	ln_Inf adj ROE
Profitability	Inflation adjusted return on average assets	Inf adj ROAA	0.000	ln_Inf adj ROAA
Profitability	Inflation adjusted return on average equity	Inf adj ROAE	0.000	ln_Inf adj ROAE
Market ratio	Dividend per share	DPS	0.000	ln_DPS
Market ratio	Dividend yield	DY	0.000	ln_DY
Market ratio	Earnings per share	EPS	0.000	ln_EPS
Market ratio	Earnings yield	EY	0.000	ln_EY
Profitability	Inflation adjusted profit per share	Inf adj p/share	0.000	ln_Inf adj p/share
Market ratio	Price-earnings ratio	PE	0.000	ln_PE
Market price	Market price per share	Price/share	0.000	ln_Price/share

Table 1 represents the findings of the Shapiro Wilk test. All significance values were rounded to three decimal places, as this is the automatic output generated by SPSS. As per Table 2, only LB ($p = 0.052$) and UB ($p = 0.057$) were normally distributed, where $p > 0,05$, which indicates parametric distribution. All other variables were non-parametrically distributed, with a probability value smaller than 0,000. As $p < 0,05$ for NPM, OPM, ROA, ROE, ROCE, ROAA, ROAE, infl adj ROA, infl adj ROE, infl adj ROAA, infl adj ROAE, DPS, DY, EPS, EY, Inf adj p/share, PE and Price/share, these variables required transformation in order for the distribution to be corrected. As parametric distributions cannot be rendered non-parametrically, all necessary variables were transformed to reflect parametric distributions. By ensuring that all variables were normally distributed, all variables could be subjected to the same testing.

Measuring correlation coefficients (r) in observing the relationship between risk and return measures

The second phase of the statistical process entailed that correlation analysis be applied to the variables. After all variables were either already normally distributed or transformed, correlation testing was possible. A Pearson correlation analysis was performed in order to measure correlation coefficients (r). These coefficients enable the interpreter to observe whether a relationship exists between risk and return measures, for the sampled JSE companies. In addition, the R-squared for each correlation, was also displayed. Findings are reported on in Table 2.

Table 2 Correlation results

Code	N	LB (r)	LB (R^2)	UB (r)	UB (R^2)
ln_NPM	165	-0.059	0.003	-0.002	0.000
ln_OPM	165	0.044	0.001	0.049	0.002
ln_ROA	165	-0.037	0.001	-0.073	0.005
ln_ROE	165	-0.294	0.086	-0.294	0.086
ln_ROCE	165	-0.283	0.080	-0.221	0.049
ln_ROAA	165	-0.026	0.000	-0.034	0.001
ln_ROAE	165	-0.245	0.060	-0.271	0.073
ln_Inf adj ROA	165	-0.100	0.010	-0.125	0.016
ln_Inf adj ROE	165	-0.246	0.061	-0.243	0.059
ln_Inf adj ROAA	165	-0.026	0.000	-0.034	0.001
ln_Inf adj ROAE	165	-0.206	0.042	-0.226	0.051
ln_DPS	165	0.224	0.050	0.183	0.033
ln_DY	165	0.146	0.021	0.161	0.026
ln_EPS	165	0.300	0.090	0.286	0.081
ln_EY	165	0.037	0.001	0.108	0.012
ln_Inf adj p/share	165	0.192	0.037	0.179	0.032
ln_PE	165	-0.037	0.001	-0.108	0.012
ln_Price/share	165	0.224	0.050	0.152	0.023

Table 2 illustrates correlation findings for all variables, as it relates to sampled JSE companies. The number of observations was n = 165 [five years (2015 to 2019) of observation multiplied by 33 sampled JSE companies] and p < 0,05 (as SPSS measured significance at a 95 percent confidence level). From Table 2, it can be observed that all correlation coefficients obtained were small and insignificant in nature. Some correlations resulted in positive associations, while others resulted in negative associations.

In terms of inverse correlations, both ln_ROE and LB and In_ROE and UB resulted in r = -0.294. Per R^2, it can be posited that ln_ROE and systematic risk moved in opposite directions, where movement is ln_ROE can only predict 8.6 percent of changes in systematic risk. Similarly, ln_ROCE also resulted in inverse correlations, where ln_ROCE and LB generated a correlation of r = -0.283 and ln_ROCE and UB generated a correlation of r = -0.221, resulting in small negative associations with beta values. ln_ROAE and LB (r = -0.245) and ln_ROAE and UB (r = -0.271) proved to provide somewhat better negative correlation coefficients, proving that only 6 percent of changes in LB, could be attributed to ln_ROAE. Likewise, 7.3 percent of changes in UB, could be attributed to ln_ROAE. ln_Inf adj ROE and LB (r = -0.246) and ln_Inf adj ROE and UB (r = -0.243) indicated that more or less 6 percent of changes in systematic risk can be accredited to inverse movements in ln_Inf adj ROE. ln_Inf adj ROAE and LB (r = -0.206) and ln_Inf adj ROAE and UB (r = -0.226) did not reflect noteworthy associations, as only 4 percent to 5 percent of changes in systematic risk are explained by inverse changes in ln_Inf adj ROAE.

As it relates to positive associations, correlation testing resulted in the following observations: ln_DPS and LB resulted in r = 0.224 and ln_DPS and UB lead to r = 0.183. Therefore, ln_DPS proved to share positive small associations with systematic risk, where between 3 percent to 5 percent of changes in systematic risk are attributable to ln_DPS. ln_EPS resulted in the highest shared associations with systematic risk, where ln_EPS and LB lead to r = 0,300 and ln_EPS and UB resulted in r = 0.286. Per statistical interpretations, these associations are still small, as ln_EPS can predict only 9 percent of changes in LB and 8.2 percent of changes in UB. Such affects are not statistically significant. Lastly, ln_Price/share and LB (r = 0.224) and ln_Price/share and LB (r = 0.152) were positively but insignificantly associated with each other. ln_Price/share affects only 2 percent to 5 percent of movements in systematic risk.

After considering findings displayed in Table 2 and the preceding discussions, two conclusions can be drawn. First, variables that represent return measures were not significantly associated with the variables that are proxies for systematic risk. Thus, for data collected for the sampled companies, risk and return measures were not significantly related. Secondly, the majority of the correlations (11 out of 18; or 61 percent) measured in Table 2 proved to be inverse. Both these findings are contrary to the MPT, which posits that systematic risk and return are directly related to each other. For data relating to the sampled JSE companies, systematic risk and return were neither significantly or directly related.

Based on the findings displayed in Table 2, H1, H2 and H3 are rejected. For H1, the shared variance between ln_Price/share and LB equalled 5 percent, while the shared variance between ln_Price/share and UB totalled 2.3 percent. The shared variances between ln_Price/share and the selected systematic risk measures were positive, small and insignificant. For this reason, H1 is rejected. As it relates to H2, profitability ratios and systematic risk measures resulted in shared variances ranging between 0% and 8.6 percent. These figures do not constitute significant interrelations among variables. In addition, all correlations shared between profitability ratios and systematic risk variables were negative in nature, which clearly demonstrates that systematic risk and profitability measures were not positively or significantly associated with each other.

Market ratios and systematic risk variables generated shared variances ranging between 0.1 percent and 5 percent. Again, these shared variances failed to be indicative of significant associations between the selected variables. Although insignificant, the associations were positive. Consequently, H3 is rejected as well. In the section hereafter, multiple regression modelling is applied, in order to test for the acceptability of H4.

Multiple regression modelling

Per the third phase, multiple regression modelling was applied to determine whether independent variables, which represent the concept of 'return', can predict the value of dependent variables (i.e. leveraged and unleveraged beta). For testing to be executed successfully, independent variables were scrutinised for multicollinearity. This was done by identifying independent variables with shared correlations of higher than 0.70 (Pallant, 2013). These independent variables could not be selected as simultaneous independent variables, during multiple regression analysis. The multicollinearity results are displayed in Table 3 and the multiple regression outputs can be observed in Table 4.

Table 3 Multicollinearity testing

Correlation between codes	Shared correlation coefficient (r)
ln_DPS and ln_EPS	0.829
ln_NPM and ln_OPM	0.743
ln_Price/share and ln_DPS	0.827
ln_Price/share and ln_EPS	0.910
ln_Price/share and ln_Inf adj p/share	0.866
ln_Inf adj ROA and ln_ROAE	0.715
ln_ROA and ln_ROAA	0.933
ln_ROA and ln_Inf adj ROA	0.807
ln_ROA and ln_Inf adj ROAA	0.933
ln_ROAA and ln_Inf adj ROA	0.772
ln_ROAE and ln_ROCE	0.871
ln_ROCE and ln_Inf adj ROE	0.889
ln_ROE and ln_ROCE	0.937
ln_ROE and ln_ROAE	0.949
ln_ROE and ln_Inf adj ROE	0.931
ln_ROE and ln_Inf adj ROAE	0.886

The shared correlations among independent variables indicated in Table 3 were considered when multiple regression was performed. Due to the high shared correlations, the independent variables could not function as simultaneous predictors of the dependent variables. In order to overcome this mathematical predicament, stepwise testing was performed by means of SPSS. By applying this setting, SPSS automatically tests for and avoids multi-collinearity, during the process of generating multiple regression models that best fit the data at hand. The outcome of these models can be observed in Table 4.

Table 4 Multiple regression outputs

Model for leveraged beta (LB)			
R^2		0.202	
Standard error (SE)		0.532	
F ratio		8.587	
Significance value (sig)		0.000	
Degrees of freedom (df)		5;145	
Independent variable	**Unstandardised beta**	**t value**	**P value**
Constant	-0.488	-1.036	0.000
ln_EPS	0.170	4.918	0.000
ln_NPM	0.011	0.244	0.000
ln_ROE	-0.217	3.956	0.000
ln_DY	0.148	1.948	0.000
ln_PE	0.171	1.739	0.000
Model for unleveraged beta (UB)			
R^2		0.169	
Standard error (SE)		0.416	
F ratio		5.696	
Significance value (sig)		0.000	
Degrees of freedom (df)		5;145	
Independent variable	**Unstandardised beta**	**t value**	**P value**
Constant	0.125	0.478	0.000
ln_EPS	0.115	4.208	0.000
ln_ROE	-0.128	-2.826	0.000
ln_DY	0.110	1.818	0.000
ln_EY	-0.110	-1.381	0.000
ln_OPM	0.028	0.690	0.000

Table 4 illustrates the multiple regression outputs for both dependent variables. In the case of LB, the regression model indicated:

LB = -0.488 + 0.170 (In_EPS) + 0.011 (In_NPM) – 0.217 (In_ROE) + 0.148 (In_DY) + 0.171 (ln_PE)

The preceding model can estimate 20.2 percent ($R^2 = 0.202$; SE = 0.532) of changes in LB. The model can predict LB reliably, as $F(5;145) = 8.587$, and the p value is smaller than 0.05. As it relates to independent variables, all independent variables resulted in significance where $p < 0.05$. Although the prediction model for LB was statistically significant, it failed to explain 79.8 percent of the changes in LB.

For UB, the regression model indicated:

UB = 0.125 + 0.115 (In_EPS) – 0.128 (In_ROE) + 0.110 (In_DY) – 0.110 (In_EY) + 0.028 (ln_OPM)

The second regression model can estimate 16.9 percent ($R^2 = 0.169$; SE = 0.416) of changes in UB. Prediction accuracy is indicated by $F(5{:}145) = 5.696$, and $p < 0.05$. In terms of the selected independent variables, $p < 0.05$, which confirmed statistical significance. Despite the model attaining statistical significance, it was unable to explain 83.1 percent of the changes observed in UB.

For the sampled companies, the multiple regression models did not result in convincing proof that identified return variables can be used to predict significant changes in LB or UB. According to Sarstedt and Mooi (2014), R^2 values of lesser than 0.25 indicate weakness in explaining changes in dependent variables. In both instances (i.e. for LB and UB), the observed R^2 was smaller than 0.25 or 25 percent. For this reason, it is posited that the identified independent variables were unable to explain enough variability in the dependent variables. Based on the findings displayed in Table 4, H4 is rejected. Return measures could predict only 20.2 percent of changes in LB and 16.9 percent of changes UB. Consequently, the multiple regression models were unable to significant predict systematic risk behaviour.

Statistical findings of this research indicate that the MPT is not a generalisable theory as it relates to the sample under review, and that the theory does not necessarily apply to all financial markets, under all economic circumstances during all periods in time. At least six other recent research papers resulted in findings that are somewhat like the results contained in this paper. From a South African perspective, Chawana (2011) undertook a similar study and sampled 14 random South African investment portfolios. It was found that the returns generated by the selected portfolios were not sensitive to fluctuations in macro-economic variables. Internationally, other researchers such as Mulli (2013), Li (2016), Ramarow (2017), Vongphachanh and Ibrahim (2020) and Tekin (2021) nominated specific profitability ratios as return proxies, and statistically measured the relationship between these ratios and beta values.

In a Nairobian study, Mulli (2013) tested for the association between the NPM and beta but was unable to obtain proof of significance. Vongphachanh and Ibrahim (2020) sampled Malaysian companies, and tested for the relationship between return measures and beta values. These return measures included earnings before interest and tax (EBIT) growth, ROA and OPM). According to findings, none of the return measures were interrelated with beta. In a Turkish study performed by Tekin (2021), it was found that ROA and ROE cannot significantly predict beta, either. Based on results displayed in Table 3 and Table 4, ln_NPM, ln_OPM, ln_ROA and ln_ROE were not significantly associated with beta values, nor could it significantly predict beta values, as it pertains to this research. These findings are in line with previous research alluded to earlier in this paragraph. It should be noted that the relationship between EBIT and beta was not tested for in this research, as the EBIT ratio was not made available by IRESS.

Li (2016) and Ramarow (2017) found certain, but limited, associations between return measures and beta. Li (2016) sampled Dutch entities and indicated that a negative association exists between ROA and beta, but that EBIT growth and beta were unrelated. Ramarrow (2017) found a statistically significant association between ROA and beta, and

ROCE and beta, respectively. Other return measures (ROE, EPS and ROI) were unrelated to beta. Although the findings of Li (2016) and Ramarow (2017) are not on par with the findings of this research, it shares some commonalities. This research paper also failed to find significant associations between ln_ROE and beta values, and ln_EPS and beta values. It is interesting to observed that previous research findings, as described in the preceding two paragraphs, only contemplated the association between systematic risk and profitability ratios. Unlike this study, the researchers did not account for the association between market ratios and systematic risk. From Table 3 and Table 4, it is apparent that market ratios were not more adept in associating with systematic risk, within the selected sample. Testing for the association between liquidity ratios and systematic risk, or solvency ratios and systematic risk remain unexplored within previous research as well as the current study. Liquidity and solvency ratios may hold potential for associating with systematic risk behaviour.

As a conclusionary note, it should be highlighted that the findings generated by this research holds consequences for the application of other financial management theories such as the CAPM, DDM, FCFV, APT and NPV discounting. The latter theories are all based on the assumption that systematic risk and return are related. For the sampled companies, this is not the case; thus, the applicability of these theories will be limited.

Conclusion

The purpose of this paper was to answer the research question: Is it realistic for investors to expect high returns when their investments are associated with more riskiness, in a South African context? This research found that for sampled JSE companies, systematic risk and return measures were not necessarily related and that the return measures could not predict variability in systematic risk measures, at an acceptable level. After rejecting all four hypotheses listed in this paper, it became clear that the MPT did not apply to the sampled data. Consequently, it could be posited that it would be unrealistic for investors to expect higher returns when absorbing more risk, should they invest in the sampled companies.

Based on findings contained in this paper, it is posited that users of financial statements will need to do on-going research in order to keep track of how systematic risk and its behaviour changes under different circumstances, over different timespans and on different financial markets. Where financial managers and stock brokers adopt the risk-return trade-off oblivious of scientific and empirical testing, systematic risk and its estimation may not be tracked in a manner that is helpful to the investor. Thus, it can be posited that the risk-return trade-off is not necessarily viable and South Africans who invest in risky investments, will not necessarily earn high returns.

As with all research, this study has several limitations. Firstly, the sample size of the study was limited to 33 companies, due to the unavailability of required data on IRESS. In addition, the sample was selected from a single stock exchange. Secondly, this research relied heavily on the integrity of audited financial data published on IRESS. Statistical findings can potentially be distorted where material misstatement or error occurred. Lastly, the number of profitability and market ratios selected for testing were limited to the ratios made available by IRESS. There may be many more profitability and market ratios which can potentially be applied for similar statistical testing. Despite the limitations encountered by this study, its findings were reflected in other previous research. Thus, the limitations were not considered ruinous to the research findings.

The findings of this paper leave an interesting research gap, as it would seem that a new approach to systematic risk modelling is necessitated by the research results. It is posited that further research should be executed to identify financial measures which are better able to associate with the behaviour of systematic risk. Measures such as liquidity and solvency ratios or financial models such as market value added (MVA) or economic value added (EVA) can potentially apply as independent variables, where systematic risk is estimated.

In conclusion, it is submitted that the results of this research places focus on the need for renewed thinking, as it relates to systematic risk behaviour. In accordance with findings generated by this study, the MPT displays little potential to assist with the comprehension of systematic risk, especially as it relates to sampled entities. This opens a plethora of new possibilities for researcher to explore.

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