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Macroeconomic determinants of responsible investments' performance under different market conditions: Evidence from South Africa

Fabian Moodley^{1*}, Babatunde Lawrence² and Damien Kunjal²

Abstract

Research aims: The study examines the effect of macroeconomic variables on JSE responsible investments returns under changing market conditions.

Design/Methodology/Approach: The study implemented a sample period comprising monthly data for the period 2015/11 to 2023/03. The dependent variable of the study comprised of JSE responsible investing indices whereas the independent variables consisted of macroeconomic variables. The study also implemented a two-state Markov regime-switching model to cater to the asymmetrical effect between the dependent and independent variable.

Research findings: The JSE responsible investment index returns were found to be significantly positively affected by short-term interest growth rates in a bull regime and significantly negatively in a bear regime. The JSE responsible investment top 30 index returns were significantly negatively affected by the money supply growth rate in a bull regime but not in a bear regime. Moreover, the JSE responsible investment index returns contained alternating efficiencies.

Theoretical contribution/Originality: The study is the first to consider the effect of macroeconomic variables on the performance of responsible investments under different market conditions in South Africa. Consequently, the study sheds light on responsible investing in emerging markets where research is limited.

Practitioner/Policy implication: Portfolio rebalancing is necessary when equity markets are bullish or bearish. Moreover, policymakers should reconsider market regulations, such that the equity market is adaptive and not efficient.

Research limitation/Implication: The study focused on six macroeconomic variables, where this does not affect the robustness of the study. More macroeconomic variables can be used in future research.

Keywords: Bull and Bear Regimes; ESG; Macroeconomic Variables; Responsible Investing



AFFILIATION:

¹Department of Risk Management, School of Economic Sciences, North-West University, South Africa

²School of Accounting, Economics and Finance, University of KwaZulu-Natal, South Africa

*CORRESPONDENCE:

fabian.moodley@nwu.ac.za

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Introduction

In recent years, there has been a shift towards responsible investing as investors are becoming more concerned about the sustainability of the environment and society. By definition, responsible investing refers to the incorporation of sustainability principles (in particular, environmental, social, and governance [ESG] considerations) into the investment process (Widyawati, 2020). According to Dicey (2023), global ESG investments are forecasted to grow to \$53 trillion by 2025, representing almost half of the

world's institutional assets under management. Given the increasing demand for ESG investments, companies continuously seek ways to adhere to the Principles of Responsible Investment (PRI) put forward by the United Nations and, locally, the Code for Responsible Investing in South Africa (CRISA). For investors, the primary motivations for ESG investing are social benefits, risk management, and enhanced long-term financial returns (Wen et al., 2022). However, existing research has yet to reach a consensus on the return prospects of responsible investments.

On the one hand, research shows that consistent with the "doing good while doing well" hypothesis, the sustainability criteria positively influence the returns of responsible investment funds because of the positive screening strategy, which benefits investors (Statman & Glushkov, 2009). Coherent with the "doing good while doing well" hypothesis, Tripathi and Kaur (2020) found that socially responsible investment (SRI) funds in BRICS countries outperformed their market indices during the entire sample period and under different market conditions. On the other hand, research exhibits a trade-off between social responsibility and financial returns. The sustainability criteria negatively impact financial returns, which may be due to the screening intensity (Lee et al., 2010). Also in line with the "doing good but not doing well" hypothesis, El Ghouli et al. (2023) reported that SRI funds underperformed relative to non-socially responsible funds. Interestingly, Peerbhai and Naidoo (2022) documented that South African SRI funds underperformed at the beginning of the sample period but outperformed in the latter periods. This outperformance was attributed to the "learning effect." While research on the performance of responsible investments is abundant, research on the factors influencing those returns needs to be more detailed, particularly macroeconomic factors.

Traditional asset pricing models, specifically, attempt to explain the relationship between financial returns and various risk factors. The Arbitrage Pricing Theory (APT) proposed by Ross (1976) is of greater relevance to the current study. The APT asserts that asset returns depend on several risk factors, including macroeconomic factors. These macroeconomic factors may include but are not limited to interest rates, exchange rates, inflation, money supply, and industrial production (Nyanga & Qutieshat, 2022). Paul (2017) uncovered that U.S-listed SRI fund returns are influenced by the business cycle; in particular, SRI funds perform better during economic contractions than expansions. Sharma et al. (2023) found that industrial production, money supply, real exchange rates, and crude oil prices influence the returns of Indian sustainability indices. However, interest rates have no significant impact.

On the contrary, Kaur and Chaudhary (2022) discovered that exchange rates, inflation, and interest rates have a long-run cointegration with the Indian sustainability index, and only interest rates influence the index returns in the short run. More locally, Muzindutsi and Sekhampu (2013) documented that there was a long-run association between the returns of the SRI index and inflation, interest rates, money supply, and the real exchange rate. Nevertheless, in the short run, the returns of the SRI index were only influenced by the long- and short-run interest rates. The limitations of these studies are that they do not account for the time-varying properties of asset returns under different market conditions. Lo's (2004) adaptive market hypothesis suggests that the degree of market

efficiency varies across different market conditions. Therefore, the patterns in asset returns vary across different market conditions. As a result, the effect of macroeconomic variables should not be uniform across different market conditions (Moodley et al., 2022).

On this basis, this study aims to investigate the effects of macroeconomic variables on the returns of responsible investments in South Africa under different market conditions. This study contributes to existing literature in the following ways. Firstly, the main contribution of this study is that it provides insight into the effects of macroeconomic variables on the performance of responsible investments under different market conditions, which has yet to be done before, to the authors' knowledge. In doing so, this study provides insight into the determinants of responsible investment performance. Another contribution of this study is that it sheds light on responsible investing in emerging markets where research still needs to be improved.

Literature Review and Hypotheses Development

Theoretical Review

Scholarly literature points out that there are at least two major theoretical accounts of macroeconomic factors and stock market outcomes. Among these hypotheses are the adaptive market hypothesis (AMH) and the efficient market hypothesis (EMH). According to Fama's (1965) efficient market hypothesis, capital markets are effective at reflecting information about specific stocks and/or the stock market as a whole. This theory is connected to the idea of a random walk, which defines subsequent price fluctuations as arbitrary departures from initial prices (Malkiel, 1989). The efficient market hypothesis is based on the view that new information is incorporated into security prices without a lag. Consequently, investors cannot earn higher returns through technical or fundamental analysis than what they could obtain by owning an individual stock portfolio chosen at random. This fundamentally suggests that stock returns cannot be predicted in relation to historical prices. A novel perspective on behavioral economics, encompassing concepts like natural selection, mutation, competition, and reproduction, is the foundation of the AMH (Ghazani & Ebrahimi, 2019).

The argument proposed by AMH is that the occurrence of efficiency and inefficiency tends to alternate with bull and bear markets in what is known as changing market conditions (Obalade & Muzindutsi, 2018). According to AMH, the primary factors influencing markets are the alternating inefficiencies and efficiency (Lo, 2004). AMH implies that macroeconomic variables should have an alternating effect that is under a bullish and bearish market. The effect of macroeconomic variables on stock market returns in an upper market condition is not expected to be the same in a lower market condition, as the stock market performs differently under each market condition. AMH also implies that market participants could earn excess returns as markets are not always efficient due to the behavior of various market participants and changing market conditions. Several critics of AMH raised the question that it is rather abstract and qualitative (See, Zhou & Lee, 2013; Urquhart & McGroarty, 2016). Nevertheless, what these scholars overlook is

that AMH has three very real and surprising implications for financial activity (Lo, 2004). The first is that if a relationship between risk and reward does exist, it is unlikely to hold steady over time. The second conclusion suggests that arbitrary chances do exist as time varies, which runs counter to the EMH. The final consequence, which is likewise regarded to be at odds with EMH, suggests that under AMH investing, strategies may experience a brief decline before returning to profitability when the environment for market players improves (Lo, 2004).

Therefore, the position of this study in establishing a relationship between macroeconomic variables and sustainability and the composition of the SRI in changing market conditions would emphasize the strong foundational emphasis of AMH that risk and reward are not steady over time in a market environment.

Empirical Review

Studies on the relationship between macroeconomic variables and the stock market for different nations are available (Mukherjee & Naka, 1995; Hashmi & Chang, 2021). Locally, the relationship between macroeconomic variables and the performance of the Johannesburg Stock Exchange (JSE) has also been investigated by many scholars (Pethe & Karnik, 2000; Parab & Reddy, 2020; Baranidharan & Dhivya, 2020; Moodley et al., 2022; Ndlovu, 2023). The rate of research on how macroeconomic factors affect sustainability measures, however, has not yet accelerated. Studies on sustainability indices are a relatively new concept in the field of stock indexes, with relatively few dimensions and perspectives. SRIs sometimes referred to as ethical, responsible, green, impact, or sustainable investment, began to gain traction in the financial sector in the 1990s and attracted the attention of academics in the early 2000s (Renneboog et al., 2008).

Dam and Heijdra (2011) examined the consequences of public abatement and socially conscious investment on the economy and environmental quality, utilizing a continuous-time dynamic growth model featuring optimizing households and businesses. In this model, environmental quality was employed as a renewable resource. Consumers can invest in government bonds or firm equity. Investors demand a higher return on equity because owning business shares makes them somewhat accountable for environmental degradation. The authors demonstrate that socially responsible investment behavior by households partially offsets the positive effects on the environmental quality of public abatement policies. According to Widyawati (2020), investor behavior, SRI development, and SRI performance are the three primary research areas in the SRI literature. The following lists more research on sustainability that has been published in the literature.

The electric-synthetic framework of international economics, strategic management, and corporate social responsibility (CSR) literature has been used by Boulouta and Pitelis (2014) to conceptually examine if and how CSR can impact the competitiveness of nations and examine empirically using a sample of 19 developed economies over six years. To investigate the role of social services as the key instrument of social investment strategy, an empirical examination of its effect on economic performance using 15 welfare states has been presented by Ahn and Kim (2015). The results indicate that increased social

service-orientedness, or the proportion of social service spending in total social expenditure, boosts economic growth and labor market performance. In contrast, increased welfare state size may have the opposite effect on employment.

Additionally, Zhou et al. (2020) look into whether macroeconomic performance in developed and emerging economies is impacted by the creation and adoption of firm-level environmental, social, and governance (ESG) policies. While further research is needed, these results may be particularly interesting to policymakers, as they suggest that encouraging SRI practices could support macroeconomic performance. In the South African terrain, Muzindutsi and Sekhampu (2013) employed the socially responsible investment (SRI) index (the proxy for South African SRI Sectors) to investigate its relationship with selected macroeconomic variables, such as consumer price index, real money supply, and effective exchange rate, using Vector Error Correction Model (VECM). The long-run findings demonstrate the importance of these macroeconomic factors in describing the South African SRI industry, including the money supply, interest rates, real exchange rate, and inflation.

In order to demonstrate the importance of the sustainability impact level on the economies of developing nations, Tuncay and Dorjnarant (2023) looked at the relationship between changes in the sustainability index and macroeconomic indicators in such nations. According to the findings, the impacts of changes in exchange rates and consumer price index on the sustainability indices are statistically significant. While exchange rates have a negative effect, consumer price indices positively affect the sustainability indices. Findings reveal that sustainability practices and the macroeconomic environment interact despite the limited available observation. As a result, the conclusions and the problem are unresolved and require more investigation. A consensus has yet to be reached on the relationship between macroeconomic variables and sustainability and the composition of the SRI. Furthermore, no literature examines the relationship mentioned above in changing market conditions. Hence, this study fills the literature gap by examining the relationships between macroeconomic variables and responsible investment performance in changing market conditions in South Africa.

Research Method

Data Collection and Sampling

The study elected to use monthly time series data from November, 2015 to March, 2023 as it caters to the COVID-19 pandemic, a significant global event. Furthermore, the choice of sample period was dictated by data availability since the JSE revised its formation of the responsible index in November, 2015. The JSE responsible index and JSE responsible top 30 index were used as a proxy for responsible investing in South Africa. The data were collected from the Bloomberg database. The macroeconomic variables included inflation (CPI) growth rate, gross domestic product (GDP) rate, real effective exchange growth rate (REER), long-term interest growth rate, and short-term interest growth rate. The variables were gathered from the South African Reserve Bank (SARB). In this case, it must be noted

that GDP data is not available monthly. In addition, the study used Dlamini's (2017) approach to transpose the quarterly data to monthly terms.

Empirical Model

The objective of the study is to determine the effect of macroeconomic variables on responsible investing in the presence of switching market conditions. Thus, a regime-switching model is considered whereby the parameters switch with the state of the equity market. Consequently, a two-state Markov regime-switching model with switching intercept, parameters, and conditional mean is considered and given by:

$$L_k = \mu_{ck} + b_{0ick}\Delta CPI + b_{1ick}\Delta M2 + b_{2ick}\Delta ST_{INT} + b_{3ick}\Delta LT_{INT} + b_{4ick}\Delta GDP + b_{5ick}\Delta REER + \varepsilon_{ck} \dots (1)$$

The responsible index return is given by I_k , the regime-specific intercept is μ_{ck} , and it is proposed that C_k measures 2 regimes, bull or bear market conditions. The growth rate in inflation, money supply, short-term interest rate, long-term interest rate, GDP, and REER is given by ΔCPI , $\Delta M2$, ΔST_{INT} , ΔLT_{INT} , ΔGDP and $\Delta REER$, respectively. The state-dependent variance was measured by ε_{ck} .

The transition probabilities matrix provides the bull and bear regime and is given by:

$$Prob(C_k = j | C_{k-1} = i) = Prob_{ij}(k) \dots (2)$$

The transition probabilities matrix can be further expanded to cater to a two-state regime:

$$Prob [C_k = 1 | C_{k-1} = 1] = Prob_{11} \dots (3)$$

$$Prob [C_k = 2 | C_{k-1} = 1] = 1 - Prob_{11} \dots (4)$$

$$Prob [C_k = 2 | C_{k-1} = 2] = Prob_{22} \dots (5)$$

$$Prob [C_k = 1 | C_{k-1} = 2] = 1 - Prob_{22} \dots (6)$$

The probability of the responsible investment returns being in a bullish state at K-1 is given by $Prob_{11}$, the probability of the responsible investment returns moving from a bullish regime to a bearish regime at time k is given by $Prob_{21}$, the probability of the responsible investment returns being in a bearish state at K-1 is given by $Prob_{22}$, and the probability of the responsible investment returns moving from a bearish regime to a bullish regime at time k is given by $Prob_{12}$ (Brooks, 2019).

Result and Discussion

Descriptive Statistic and Correlation Results

The descriptive statistics for JSE responsible index returns and macroeconomic variables are listed in Table 1. The JSE responsible top 30 index had the highest and maximum average return, whereas the JSE responsible index attained the lowest and minimum

average return. The findings suggest that the JSE top 30 index returns were positive and increasing for the sample period. However, the JSE responsible index returns were positive but increased at a decreasing rate for the sample period. The standard deviation confirms this as the returns of the JSE responsible top 30 index are more volatile than that of the JSE responsible index return. The findings align with the theory of risk and return, as higher returns attract higher volatility. Thus, risk-averse investors should not incorporate the JSE-responsible top 30 index in their portfolio; the opposite holds for risk-taking investors. The returns of the JSE responsible index and JSE responsible top 30 index were negatively skewed, and the kurtosis was greater than 3. Hence, the JSE responsible index and JSE responsible top 30 index returns peak and flatten frequently, indicating that the returns do not have a standard bell curve. The Jarque-Bera test of normality confirms the findings as the study failed to reject the null hypothesis for the JSE responsible top 30 index returns but was rejected for the JSE responsible index returns.

While long-term interest had the highest average growth, money supply had the lowest average growth. Gross domestic product had the maximum growth rate, whereas short-term interest had the minimum growth rate. Moreover, the inflation growth rate was the most volatile among the select macroeconomic variables as the growth rates fluctuated between a higher dispersion rate as indicated by the maximum and minimum values. The growth rate of money supply, short-term interest rate, and inflation were negatively skewed. In contrast, the growth rate of real effective exchange rate, gross domestic product, and long-term interest rate were positively skewed. Only the growth rate of the real effective exchange rate had a kurtosis of less than three and was not leptokurtically distributed. Consequently, the Jarque-Bera test illustrates that only the growth rate of the real effective exchange rate was not normally distributed.

It is evident from the correlation analysis (see Table 2) that the JSE responsible index returns and JSE responsible top 30 index returns were negatively affected by the growth rate of long-term interest rate, inflation, and real effective exchange rate. However, the findings indicate the existence of a linear relationship, and it does not confirm the time-varying effect, and as such, the nonlinear effects were then examined.

Table 1 Statistic Descriptive

	JSE-RESP	JSE-RESP30	ΔCPI	ΔM2	ΔGDP	ΔST-INT	ΔLT-INT	ΔREER
Mean	0.269	0.910	0.107	-0.536	-0.466	0.285	0.399	-0.045
Median	-0.042	0.922	0.000	-0.342	-0.291	0.375	0.000	-0.859
Maximum	13.220	19.976	20.000	2.097	20.643	13.481	17.786	9.384
Minimum	-13.851	-21.976	-21.212	-5.864	-17.931	-23.919	-9.939	-6.203
Std. Dev.	4.299	5.637	5.062	1.410	3.467	4.699	3.506	3.131
Skewness	-0.031	-0.423	-0.232	-0.696	0.929	-1.390	1.408	0.549
Kurtosis	4.069	6.098	7.762	4.070	23.923	10.471	9.329	3.236
Jarque-Bera	4.255	38.238***	84.873***	11.438***	1636.256***	235.677***	177.963***	4.682
Observations	89	89	89	89	89	89	89	89

Note: ***, ** and * indicate a 1%, 5%, and 10% statistically significance level, respectively; JSE-RESP: JSE responsible index; JSE-RESP30: JSE responsible top 30 index

Table 2 Correlation Result

	Δ CPI	Δ M2	Δ GDP	Δ ST-INT	Δ LT-INT	Δ REER
JSE-RESP	-0.301**	0.122	0.160	-0.014	-0.255**	-0.196*
JSE-RESP30	-0.194*	0.006	0.152	-0.023	-0.372***	-0.191*

Note: ***, ** and * indicate a 1%, 5%, and 10% statistically significance level, respectively; JSE-RESP: JSE responsible index; JSE-RESP30: JSE responsible top 30 index.

Unit Root and Stationary Result

It is evident from Table 3 that the unit root and stationarity tests for the JSE responsible investment returns and macroeconomic series are presented. The null hypothesis of the Augmented Dickey-Fuller (ADF) test, Phillips-Perron (P.P.) test, and ADF break-point test were rejected at all significance levels. The study failed to reject the null hypothesis of the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test at 1%, 5%, and 10% significance levels. Consequently, the JSE responsible investment return series and macroeconomic series were stationary. The study proceeded to regress the Markov regime-switching model.

Table 3 Unit Root and Stationary Result

	JSE-RESP	JSE-RESP30	Δ CPI	Δ M2	Δ GDP	Δ ST-INT	Δ LT-INT	Δ REER
<i>Unit Root and Stationarity Tests in Levels with an Intercept</i>								
ADF	-9.878***	-9.741***	-8.336***	-5.573***	-3.679***	-4.234***	-8.975***	-8.315***
KPSS	0.044***	0.060***	0.443**	0.142***	0.053***	0.238***	0.047***	0.045***
PP	9.885***	-9.958***	-8.290***	-10.469***	5.179***	-6.705***	-9.203***	-8.260***
<i>Structural Break Unit Root Test in Levels with an Intercept</i>								
ADF	-11.353***	-11.859***	-9.719***	-9.955***	-7.157***	-7.726***	-10.883***	-9.085***
<i>Order of Integration</i>								
	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)

Note: The critical values for the KPSS test at 1%, 5%, and 10% statistical significance levels are 0.739000, 0.463000, and 0.347000, respectively; ***, ** and * indicate a 1%, 5%, and 10% statistically significance level, respectively; JSE-RESP: JSE responsible index; JSE-RESP30: JSE responsible top 30 index.

Markov Regime-Switch Model Expected Duration and Transition Probabilities Results

The expected duration and transition probabilities for the JSE responsible indices returns are given in Table 4. The probability of the JSE responsible investment index return staying in a bull regime (0.8174) was greater than the probability of the return staying in a bear regime (0.0128). Thus, the JSE responsible investment index return had a higher average expected duration in a bull regime (5.4773 months) in relation to the bear regime (1.0129 months). However, JSE responsible investment top 30 index return stayed the longest in a bear regime (6.0426 months) as opposed to the bull regime (1.0956 months); the transition probabilities confirm this as the bear regime probability (0.8345) was greater than the bull regime probability (0.0873). The finding aligns with a studies by Moodley et al. (2022) and Moodley (2024), as alternating bull and bear market durations across JSE index returns were evident. Similarly, Bernatonyte et al. (2009) found that favorable economic conditions contribute to responsible investing returns, which results in positive returns over time.

Table 4 Markov Regime-Switching Model Expected Duration and Transition Probabilities Results

Transition Probabilities	Bull Regime	Bear Regime
<i>JSE Responsible Index (JSE-RESP)</i>		
Bull Regime	0.817	0.183
Bear Regime	0.987	0.013
Expected Duration	5.477	1.013
<i>JSE Responsible Top 30 Index (JSE-RESP30)</i>		
Bull Regime	0.087	0.913
Bear Regime	0.166	0.835
Expected Duration	1.096	6.043

Markov Regime-Switching Model Results

The Markov regime-switching model results are presented in Table 5. It is seen that the bear market condition of the JSE responsible investment index returns was volatile in a bear market condition (-2.150) and not in a bull market condition (1.311). Findings are supported by a study conducted by Moodley et al. (2022), as it was found that JSE index returns are more volatile when the market is in a bearish state, as returns are decreasing over time, which increases risk. However, the opposite held for the JSE responsible investment top 30 index returns, as the volatility in a bull regime (-1.310) was higher than in a bear regime (1.438). Consequently, the JSE responsible investment index returns (JSE responsible investment top 30 index returns) were negative (positive) in a bull regime and positive (negative) in a bear regime. The findings are reinforced by a study conducted by Paul (2017), which uncovered that US-listed SRI funds performed better during economic downturns than in economic expansions. Hence, investors should reconsider including the JSE responsible top 30 index in their portfolio when the equity market is in a bullish condition as the returns of the index are more prone to business cycle fluctuations, which increases portfolio risk.

Moreover, the growth rate of inflation exerted a significantly negative effect on JSE responsible investment index returns in a bull and bear regime. However, in a bear regime, the growth rate in the real effective exchange rate and money supply (growth rate in the gross domestic product) significantly negatively (positively) affected the JSE responsible investment index returns. Short-term interest growth rate had a significant positive effect on the JSE responsible investment index returns in a bull market condition but a significant negative effect in a bear market condition. The opposite held for long-term interest growth rates, as it is evident that it significantly negatively affected the JSE responsible investment index returns in a bull regime but significantly positively in a bear regime. The findings are supported by a study conducted by Krajnakova et al. (2018), who found that economic conditions dictate the effect macroeconomic variables have on responsible index returns due to alternating efficiency. Similarly, Tuncay and Dorjnarant (2023) revealed that inflation, exchange rate, interest rate, and gross domestic product have an alternating effect on responsible index returns.

The growth rate of gross domestic product, long-term interest rate, and inflation had a significantly positive effect on the JSE responsible investment top 30 index returns in a

bull market condition but significantly negatively in a bear market condition. The money supply growth rate significantly negatively affected the JSE responsible investment top 30 index returns in a bull regime, not a bear regime. However, the real effective growth rate significantly negatively affected the JSE responsible investment top 30 index returns in a bull and bear market condition. Moreover, the short-term interest growth rate had a significant negative effect on the JSE responsible investment top 30 index returns in a bull regime but a significant positive effect in a bear regime. The findings contradict a study by Moodley et al. (2022) and Moodley (2024), as the authors found that money supply does not influence equity market returns in a bull and bear market condition. Nevertheless, the results are supported by Sharma et al. (2023) as they uncovered that money supply, industrial production (a proxy for GDP), and real effective exchange rate significantly influence responsible investing.

Table 5 Markov Regime-Switching Model Results

Variable	JSE-RESP		JSE-RESP30	
	Coeff.	z-Stat	Coeff.	z-Stat
<i>Bull Regime</i>				
C	-0.097	-0.170	0.836***	4.467
ΔCPI	-0.321**	-2.150	0.126***	5.683
ΔM2	-0.079	-0.206	-0.976***	-9.100
ΔGDP	-0.267	-1.465	0.840***	18.787
ΔST-INT	0.338***	2.617	-0.178***	-7.724
ΔLT-INT	-0.334**	-2.465	0.187***	6.955
ΔREER	-0.065	-0.394	-0.0470*	-1.859
LOG(SIGMA)	1.311***	14.260	-1.310***	4.959
<i>Bear Regime</i>				
C	0.092*	1.914	-0.0971	-0.142
ΔCPI	-0.166***	-28.033	-0.245*	-1.848
ΔM2	-0.091**	-2.214	-0.269	-0.597
ΔGDP	0.107***	6.023	-0.534**	-2.261
ΔST-INT	-0.210***	-20.068	0.436**	2.467
ΔLT-INT	-0.216***	-10.628	-0.772***	-4.058
ΔREER	-0.846***	-49.076	-0.381*	-1.823
LOG(SIGMA)	-2.150***	-8.469	1.438***	15.428
P11-C	1.499***	3.800	-2.347*	-1.883
P21-C	4.348	0.640	-1.618***	-3.552
<i>Residual Diagnostic Test</i>				
	F-Stat	Prob	F-Stat	Prob
	1.764	0.178	1.282	0.283

Note: ***, ** and * indicate a 1%, 5%, and 10% statistically significance level, respectively; JSE-RESP: JSE responsible index; JSE-RESP30: JSE responsible top 30 index.

The robustness of the model in examining the effect of macroeconomic variables on responsible investing is confirmed by the Breusch-Godfrey LM test. The null of no autocorrelation in the residuals could not be rejected as the p-values exceeded all significance levels. Hence, no autocorrelation was evident in the residuals of the parameters.

The findings of the study have two main implications: theoretical and practical. Regarding the former, the implications are that the study revealed that the effect macroeconomic variables have on responsible investing is adaptive and in line with AMH. This suggests that traditional theories such as EMH do not hold in this regard, as the study found that economic conditions dictate the observed effect. Consequently, the South African equity market is not efficient as proposed by EMH; rather it contains alternating efficiency such that market conditions dictate the efficiency of the equity market. This implies, unlike EMH, that excess returns can be earned by timing the market. Regarding the latter, the implications are such that investors should consider the state of the market when formulating portfolios by including companies that form part of the responsible index. That means asset selection should be done in line with the state of the market and fluctuating macroeconomic variables. Moreover, if investors contain companies that are listed under the responsible indices, they should conduct portfolio rebalancing consistent with the findings of the study, as alternating efficiency is evident. Lastly, when policymakers conduct macroeconomic policy adjustments, they should consider that it will have a significant effect on responsible index returns and increase the risk of holding stocks that form part of the responsible indices. Hence, they should consider that the effect varies with market conditions.

Conclusion

At the onset of the study, the authors determined how the JSE responsible investing index returns are affected by macroeconomic variables. The introduction of AMH allowed for the re-examination of the effect macroeconomic variables have on responsible investing, as it should be time-varying and regime-specific. Consequently, an asymmetrical model was needed to account for regime changes, which resulted in the two-state Markov regime-switching model being considered. Monthly data for December 2015 to March 2023 was considered for the JSE index returns and macroeconomic variables. The model's findings demonstrated that macroeconomic variables have a time-varying and regime-dependent effect on responsible investing. Specifically, the JSE responsible investment index returns are significantly positively affected by short-term interest growth rates in a bull regime and significantly negatively in a bear regime. The JSE responsible investment top 30 index returns are significantly negatively affected by the money supply growth rate in a bull regime but not in a bear regime.

Moreover, the JSE responsible investment index returns are categorized as bullish, but the JSE responsible investment top 30 index returns are classified as bearish. AMH supports the findings of alternating efficiency, time-varying, and regime dependency, as the theory caters to behavior biases, whereas EMH does not. Thus, portfolio rebalancing is necessary when equity markets are in bullish or bearish states, as the effect is regime-specific. Furthermore, policymakers should reconsider macroeconomic policy adjustments as macroeconomic variables have a time-varying effect on JSE responsible index returns, which dictates portfolio diversification. A proposed limitation of the study is that only six macroeconomic variables are considered, whereas there exist many more factors. Consequently, to enhance future research, it will be recommended that scholars

consider additional macroeconomic variables and not limit their study to the selected variables.

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About the Authors

Fabian Moodley (F.M.) is a lecturer in the department of Risk Management, North-West University, South Africa. Email address: fabian.moodley@nwu.ac.za

Babatunde Lawrence (B.L.) is research assistant in the School of Accounting, Economics and Finance, University of KwaZulu-Natal, South Africa. Email address: lawrenceb@ukzn.ac.za

Damien Kunjal (D.K.) is a senior lecturer in the School of Accounting, Economics and Finance, University of KwaZulu-Natal, South Africa. Email address: KunjalD@ukzn.ac.za

Author Contributions

Conceptualisation, F.M. and D.K.; Introduction, D.K.; Literature review, B.L.; Methodology, F.M.; Investigation, F.M.; Analysis, F.M.; Original draft preparation, F.M., B.L. and D.K.; Review and editing, F.M., B.L. and D.K.; Visualization, F.M., B.L. and D.K.

Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.



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