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The Relationship Between Macroeconomic Variables and JSE Socially Responsible Investments

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Abstract: Socially responsible investing (SRI), grounded in environmental, social, and governance (ESG) principles, has gained momentum globally as investors seek to align financial returns with ethical and sustainable practices. However, limited research exists on the impact of macroeconomic variables on ESG-aligned indices in emerging markets like South Africa. This study investigates the short- and long-run effects of selected macroeconomic indicators—real GDP, inflation, interest rates, exchange rates, and money supply (M3)—on the FTSE/SE Responsible Investment Index and the Responsible Investment Top 30 Index, using monthly data from November 2015 to December 2024. An ARDL approach with robust standard errors reveals that exchange rate volatility significantly and negatively affects both indices in the short run. Real GDP shows a significant and positive long-run relationship with both indices, while inflation positively influences the Top 30 Index—suggesting its diversified composition buffers inflationary shocks. The repo rate negatively impacts the Top 30 Index in the long run, with a 1% increase leading to a 0.06% decline in index value. Error correction terms (-0.216 and -0.2219) for the two indices indicate moderate speeds of adjustment to long-run equilibrium at approximately 22% per month. These findings underscore the importance of macroeconomic stability for ESG investment performance and provide practical insights for investors, asset managers, and policymakers aiming to foster sustainable finance in South Africa. This study fills a gap in the literature by offering current, empirical evidence on how key economic variables interact with responsible investment indices in an emerging market context.

Keywords: ESG; Macroeconomic variables; Johannesburg Stock Exchange; ARDL

JEL Classification: G11; G14; E44

1. Introduction and Background to the Study

The current global landscape faces several challenges, including global warming, pollution, biodiversity loss, inequality, poverty, unfair labour practices, and human rights violations. To address

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these challenges, investors across the globe have begun taking initiatives by investing in ESG (Environmental, Social, and Governance) compliant companies. By integrating ESG principles, socially responsible investments aim to combat pressing issues such as carbon emissions, resource depletion, labour exploitation, and unethical corporate behaviour while promoting sustainable development and equitable growth. According to the Forum for Sustainable and Responsible Investment (2006), socially responsible investing is defined as an investment strategy that considers ESG components when making investment decisions to make a positive societal impact while ensuring long-run financial returns. Socially responsible investments have roots dating back to the late 1600s when the Quakers, a Christian group, forbade investments in gambling and alcohol. It gained momentum in 1960; however, according to Heese (2005), the exclusion of South African companies from investment portfolios propelled responsible investing into the mainstream investment arena. SRIs have increasingly gained popularity over the past decade, as a result of the social and economic volatility caused by increasing political instability, natural disasters, and epidemics across the globe (Tuncay & Dorjnaran, 2022). A report from the Forum for Sustainable and Responsible Investment (2024) found that approximately three-quarters of survey respondents foresee strong growth in sustainable investing within the next two years, fuelled by client demand, regulatory evolution, and advances in data analytics. Furthermore, according to Dicey (2023), global ESG investments are expected to reach $53 trillion by 2025, accounting for nearly half of all institutional assets managed globally. Despite the growing significance of socially responsible investments, the macroeconomic impact on the performance and appeal of socially responsible investments on the JSE is still poorly understood. This is especially important in developing nations like South Africa, where structural issues and economic volatility can have a major impact on investor behaviour and market results. For investors and policymakers hoping to promote sustainable finance in such settings, it is essential to comprehend how these macroeconomic factors interact with SRI performance.

The Johannesburg Stock Exchange (JSE) plays a pivotal role in the growing global and local movement toward sustainable and responsible investing through its SRI Index, which tracks companies meeting specified sustainability standards, thereby providing a platform for responsible investing within South Africa's unique economic landscape (Moodley et al., 2024). In May 2004, the JSE launched the FTSE/JSE SRI Index to promote sustainable and transparent business practices. This index was later replaced by the FTSE/JSE Responsible Investment index series in 2015, which includes the FTSE/JSE Responsible Investment index and the FTSE/JSE Responsible Investment Top 30 index. These indices focus on companies with high ESG ratings. The replacement of the SRI index may pose challenges for studies conducted on the index before 2015. This replacement signifies a shift in how responsible investment is defined and measured and may also represent a change in the criteria used for ESG in the African stock market. Studies that were conducted before this change may misinterpret the effect of macroeconomic variables on the FTSE/JSE SRI Responsible Index.

For investors to profit from these sustainable indices, an answer to the following questions must be provided and understood with precision and accuracy. Do macroeconomic variables have a positive or negative effect on the FTSE/JSE Responsible Investment Index series' closing prices in the short and long run? Furthermore, how long does it take for these indices' prices to return to equilibrium after short and long-run disturbances? To answer these questions, this study analyses the impact of selected macroeconomic variables, including inflation, exchange rates, interest rates, money supply (M3), and real GDP, on the performance of the FTSE/JSE Responsible Investment Index series using more recent data to reflect the current economic and ESG landscape. Furthermore, it aims to determine whether these variables significantly influence the index's performance, while also addressing gaps or

omitted factors in prior research models. To facilitate the achievement of this primary objective, the empirical portion of the study comprises the following objectives. Firstly, this study will evaluate the short- and long-run effects of macroeconomic variables on the closing prices of the FTSE/JSE Responsible Investment Index series. Secondly, this study will evaluate the short- and long-run deviation in equilibrium levels of the same indices' closing prices.

The importance of this study lies in its contribution to understanding how the selected macroeconomic variables influence the performance of socially responsible investments on the JSE, an under-explored area. Although previous studies examined the relationship between macroeconomic factors and general equity market returns or specific industry sectors of the JSE, relatively few have specifically targeted the SRI index, particularly considering recent social, environmental, and economic shifts. Understanding these relationships is crucial, as SRIs reflect companies' commitments to environmental, social, and governance (ESG) values, which ultimately influence investment decisions and economic growth in South Africa. Furthermore, the study's results can guide legislators, portfolio managers, and investors on how macroeconomic conditions influence sustainable investment performance, thereby improving risk management and policy development aimed at supporting ethical investment behaviour.

2. Literature Review

The following section is isolated to the theoretical underpinning of the study as well as the empirical review of the relationship between macroeconomic variables and JSE responsible investing indices.

2.1. Theoretical Review

The first concept associated with socially responsible investments is the Efficient Market Hypothesis (EMH) proposed by Fama (1970). This investment concept posits that the prices of financial instruments accurately reflect all available market information. There are three distinct forms of the Efficient Market Hypothesis: the weak form, in which prices represent all historical trading data; the semi-strong form, in which prices represent information that is accessible to the public; and the strong form, in which prices represent all information, both public and private. However, only the weak form has been confirmed so far (Ang et al., 2018). The weak form of the EMH is closely linked to the random walk theory introduced by Fama (1995). According to this theory, changes in stock prices occur randomly and do not correlate with past prices because the current market price of publicly listed stocks consistently reflects the most recent information (Abraham et al., 2018). As a result, attempting to predict future prices to achieve abnormal returns is futile. However, Ang and Weber (2018), along with Khan et al. (2021), discovered that the weak form of the EMH is invalid for SRIs. This implies that the future price of the SRI index is correlated with the current price. This means that the future price of the SRI index can be predicted, and investors can therefore make abnormal returns.

Although the Efficient Market Hypothesis is a foundational investment theory for understanding market behaviour and guiding broad investment strategies to passive investing, investors should be aware of its limitations, such as not considering the psychological component of investors, as it assumes investors are rational. This is where behavioural finance becomes a critical complement to Fama's EMH theory. Behavioural finance adds a psychological dimension to Fama's economic

framework, showing that while markets tend toward efficiency, investor behaviour can cause price anomalies and market inefficiencies.

Kahneman and Tversky (1979) introduced the theory of behavioural finance, which demonstrated how psychological factors and cognitive biases influence decision-making under risk. Unlike traditional finance theories that focus solely on risk-return trade-offs, behavioural finance acknowledges that investors often consider ethical, social, and environmental impacts alongside financial returns when making investment choices. The two challenged the central assumption proposed by Fama (1970) in the EMH, that investors are rational. Kahneman and Tversky drove away from traditional investment theories and believed that the rational investor does not exist. Although this theory was introduced in the late 1970s, it was not until 2008 that it became mainstream, due to the 2008/2009 Global Financial Crisis. During this period, investors did not follow the traditional advice of buying low and selling high. Investors began selling due to panic to avoid further losses. The call for responsible market behaviour has reached unprecedented momentum in the aftermath of the 2008/2009 Global Financial Crisis (Puaschunder, 2017). Research shows that non-financial attributes such as ESG ratings have a significant impact on investment decisions, accounting for approximately 38% of the decision-making process (Massazza, 2021). Additionally, investors are not only motivated by financial returns but also by the desire to contribute to social change. Psychological factors like perceived consumer effectiveness and belief that one's investments can positively impact the environment, and trust in socially responsible investments also play crucial roles (Roos et al., 2024).

2.2. Empirical Review

The findings of studies with an explicit focus on the relationship between macroeconomic variables and Socially Responsible Investments:

2.2.1. The Case of South African Responsible Investment Indices

Muzindutsi and Sekhampu (2013) use the Error Correction Model (ECM), the Granger causality test, and the Engle-Granger cointegration test to analyse the interaction between socially responsible investments and macroeconomic indicators in South Africa. Several macroeconomic factors, such as private consumption, employment growth, government spending, gross domestic investment, exports, and imports, were found to have a substantial long-term link with the Socially Responsible Investment sector. The employment rate, government spending, gross domestic product, investments, exports, and imports were found to be insignificant, suggesting that they had no short-term impact on the sustainable index (FTSE/JSE SRI Index). Private consumption is the only variable in this analysis that indicated a significant short-term impact on the index. The results suggest that the expansion of the SRI sector and long-term economic growth are highly correlated.

Moodely et al. (2024) examine the macroeconomic determinants of socially responsible investments' performance under different market conditions in South Africa, and their findings depict that, in bull market conditions, short-term interest rate growth had a significant positive impact on the returns of the JSE Responsible Investment Index, while in bear market conditions, it had a significant negative impact. Additionally, in a bullish market environment, an increase in the money supply growth rate was found to significantly decrease the returns of the JSE Responsible Investment Top 30 Index. In contrast, in a bearish regime, this effect was not seen. Additionally, over time, the JSE Responsible Investment Index returns have shown varying levels of market efficiency. This study employed a two-

state Markov regime-switching model to account for the asymmetrical effect between the dependent and explanatory variables.

South African Responsible Investments Indices are influenced by a variety of macroeconomic factors with strong long-term economic ties, and their reactions change among market regimes. Barriers typical of developing SRI markets have hampered growth, but regulatory and stakeholder drivers have boosted it. The sector's risk-adjusted performance is comparable to traditional investments, indicating potential for additional expansion as investor knowledge and demand grow.

2.2.2. The Case of Developing Economies

Tuncay and Dorjnaran (2023) explore the relationship between socially responsible investing and key macroeconomic indicators through an analysis of panel data gathered from seven developing nations, which include Malaysia, Indonesia, Turkey, India, Brazil, South Korea, and China, between 2015 to 2022. Their findings, derived from a panel regression approach, show that fluctuations in the consumer price index (CPI) and exchange rates meaningfully influence sustainability indices. Notably, rising CPI values tend to have a positive impact on these indices, whereas increases in exchange rates have a detrimental effect. The study did not identify significant impacts from other variables, such as economic growth or the current account balance relative to GDP. The authors emphasize that managing the harmful effects of exchange rate swings is important for sustaining responsible investment performance and recommend additional research to drill down into the specific aspects of inflation that encourage sustainability improvements.

In a more context-specific study, Kaur and Chaudhary (2022) examine the interaction between the sustainable stock market index and macroeconomic variables, including CPI, exchange rates (USD/IND), and interest rates in India, using a cointegration analysis, variance decomposition analysis, and a Vector Error Correction model for the period January 2013 to September 2020. The findings reveal a cointegrating relationship among the variables, indicating a long-run equilibrium relationship between macroeconomic variables and sustainable stock prices. In the short run, only the interest rate significantly influences stock prices, whilst other variables do not affect the sustainable stock market. Furthermore, Sharma et al. (2023) conducted a similar study in India, using the ARDL model to determine the impact of macroeconomic variables on sustainability indices found no long-run cointegration between sustainability indices and the macroeconomic variables. However, it was found that both indices analysed, including the S&P BSE GREENEX and S&P BSE CARBONEX, are positively related to money supply (M3), industrial production, and the real effective exchange rate in the short run; however, changes in crude oil prices had a negative relationship with both indices. Interest rates had no significant relationship with the indices.

Wijayanti et al. (2024) examine how shocks to macroeconomic factors affect the Sharia and sustainable indices, which are represented on the Indonesia Stock Exchange by the Sharia index (ISSI and JII) and the sustainable index (SKEHATI). Using a Vector Autoregression (VAR) and Vector Error Correction Model (VECM) methodology over 7 years (2016 to 2023), the study finds that the JII responds more quickly to macroeconomic shocks compared to ISSI and SKEHATI. The Sharia indices (ISSI and JII) are significantly influenced by the SKEHATI sustainable index, indicating that sustainable market variables are also significant in Islamic indices. These findings indicate that Sharia-compliant stocks are influenced considerably by sustainable investing factors, which are also crucial for investor decision-making, particularly in the face of shifting macroeconomic situations.

Overall, studies show a complex relationship in which CPI, exchange rates, and interest rates influence sustainability investing in different ways depending on context, location, and period. The CPI's positive correlation may reflect inflationary pressures associated with changes in consumption and investment patterns that favour sustainability. Managing exchange rate volatility is critical to maintaining responsible investment performance in developing markets.

2.2.3. The Case of Developed Economies

Sariannidis et al. (2009) examine the effect of macroeconomic factors, including changes in crude oil prices, long-term interest rates represented by 10-year bond value returns, exchange rate fluctuations (using the JPY/USD), and non-farm payrolls, a key indicator of employment in the U.S. economy, on Dow Jones Sustainability (DSJI) and Dow Jones Wilshire 500 indexes. The findings indicate that fluctuations in the returns of crude oil prices and exchange rate volatility negatively impact the US stock market. In contrast, changes in the returns of the 10-year bond value affect the US stock market positively. Both macroeconomic indicators have the same effect on the DJSI with a one-month delay. Moreover, the non-farm payroll can be characterized as a stabilizing factor for DJSI. These results were obtained using a GARCH model and monthly data for the period January 2000 to January 2008. A similar study updated to include large and mid-cap Dow Jones (DJUSL and DJUSM), and obtained the same results, using the same model over the same period.

All these studies reflect a significant long-run relationship between macroeconomic variables and socially responsible investments, although the variables differ between countries and regions. In the short run, only a selected number of macroeconomic variables have a significant impact on socially responsible investment; however, just as in the long run, these variables differ across countries. For instance, in India, interest rates alone have a short-run impact on socially responsible investments; however, in South Africa, private consumption has a significant short-run impact on the index. These studies collectively demonstrate that SRIs are indeed sensitive to a set of macroeconomic variables, that these effects often manifest more significantly over the long run, and that the direction and intensity of the relationships can vary by economic context, regime, and specific macroeconomic variables.

3. Methodology

3.1. Data

Monthly time series data will be used from 1 November 2015 to 31 December 2024. Using data over a decade will help observe different phases of the economic cycle, including periods of growth, recession, inflationary pressures, and monetary policy shifts. This data will include the closing prices of the FTSE/JSE Responsible Investment Index, which comprises all eligible companies that achieve the required minimum FTSE Russell ESG rating as set out in the ground rules from time to time (JSE, 2015). This data will also include the closing prices of the FTSE/JSE Responsible Investment Top 30 Index, which comprises the Top 30 companies ranked by FTSE Russell ESG Rating (JSE, 2015). The study period, spanning from November 2015 to December 2024, is primarily justified by the revision of the FTSE/JSE Responsible Investment Index Series in October 2015, as well as the need to capture the economic impacts and market disruptions associated with the COVID-19 global pandemic. This data will be collected from the IRESS BFA and Bloomberg.

Furthermore, monthly data of various macroeconomic indicators such as inflation (CPI), exchange rates (USD/ZAR), money supply (M3), real GDP, and interest rates will be collected for this analysis. This data will be collected from the SARB, Trading Economics, and Investing.com. However, Muzindutsi and Sekhampu's (2013) findings exhibited that the inflation rate, exchange rates, and money supply were insignificant in predicting short-run changes in the SRI Index. The purpose of including these variables despite their being found insignificant is to assess whether they would still be insignificant given the change in the macroeconomic landscape from the time the study was conducted to date. Some of the macroeconomic data are not published monthly, but rather share different frequencies; therefore, an interpolation method (an option available on EViews), will be used to convert the data from annual or quarterly to monthly.

3.2. Empirical Model

The study has elected to use the ARDL methodology as the preferred method of analysis. The selection of the model is justified by the hypothesised mixed order of integration. That being said, it is postulated that the current dependent and independent variables will attribute stationary properties in levels and first differences. Thus, the ARDL model will be best suited for the analysis as it can cater to such properties. Accordingly, the mathematical description of the model is given by:

$$y_t = a_0 + a_1 t + \sum_{i=1}^{p} \psi_i y_{t-i} + \sum_{j=1}^{k} \sum_{lj=0}^{qj} \beta_{j,lj} x_{j,t-lj} + \epsilon_t \qquad (1)$$

Where y_t is the dependent variable- that is, the FTSE/JSE Responsible Investment Index Series, $x_{j,t}$ are the explanatory variables (GDP, CPI, interest rates, money supply, and exchange rates), p and q_j are the lag orders, and ϵ_t is the error term.

The use of the ARDL model will help identify whether macroeconomic variables, such as the CPI, interest rates, money supply, or exchange rates, have a long-run impact on the FTSE/JSE Responsible Investment Index Series, or if their effects are only temporary. Since macroeconomic and financial time series have mixed integration orders, this method is suitable as it does not require all variables to be stationary at the same order. This makes it robust for analysing JSE data where variables may be stationary at level I (0) or stationary at first difference I (1).

Furthermore, the ARDL model incorporates an error correction term that measures the speed at which any short-term disequilibrium between the performance of the FTSE/JSE Responsible Investment Index Series and macroeconomic variables adjusts back to the long-run equilibrium. This will help develop an understanding of how quickly the FTSE/JSE Responsible Investment Index Series responds to macroeconomic shocks.

A standard equation for the Error Correction Model is as follows:

$$\Delta y_t = \beta_0 + \beta_1 \Delta x_t + \gamma(y_{t-1} - \theta x_{t-1}) + \mu_t \qquad (2)$$

Where:

- Δ denotes the first difference operator, capturing the short-run changes
- $y_{t-1} - \theta x_{t-1}$ reflects the error correction term representing the lagged deviation from the long-run equilibrium relationship between the FTSE/JSE Responsible Investment Index Series and the macroeconomic variables

- γ represents the speed of adjustment coefficient, indicating how quickly the FTSE/JSE Responsible Investment Index Series corrects back to equilibrium after a shock in the macroeconomic variables.
- μ_t represents the error term, which incorporates all other variables that were not included in the model.

Table 1 below provides a summary of the dependent and independent variables used in the study. In this study's analysis, the data for both the dependent and independent variables are logged, as displayed in

Table **1**, with the primary motivation of transforming the interpretation of the coefficients from a level-level relationship to an elasticity relationship. This is particularly relevant for the ARDL model, as the long-run coefficient is interpreted as a long-run elasticity of the dependent variable with respect to the independent variable. Furthermore, logging the data reduces heteroscedasticity in the model, thus making the variance of the error term more constant. After all the variables were logged, pre-diagnostic tests were conducted, including correlation analysis, descriptive statistics, and unit root tests, such as the Augmented Dickey-Fuller and Kwiatkowski-Phillips-Schmidt-Shin stationarity tests. However, before these tests are conducted, it is important to understand the model assumptions (a priori expectations), i.e., what we expect the effect of each independent variable to have on the dependent variable based on macroeconomic theory.

Table 1. Summary Table of the Variables

	Dependent Variables
LTOP30	FTSE/JSE Responsible Investment Top 30 Index
LRII	FTSE/JSE Responsible Investment Index
	Explanatory Variables
LGDP	Real GDP
LREPO	Repo Rate
LMSM3	Money Supply
LINFL	Inflation Rate
LUSDZAR	Rand to US Dollar Exchange Rate

Source: Authors' own depiction (2025)

4. Results and Discussion

4.1. Preliminary Tests

The following subsection includes the preliminary tests associated with the estimation of the ARDL model. These include the descriptive statistics, unit root tests, the Variance Inflation Factor test (VIF), and unconditional estimation.

4.1.1. Descriptive Statistics

Table 2 displays a detailed analysis of the data for both dependent and independent variables. An observation of the dependent variables (Responsible Investment Indices), we realize that they share some similarities; however, we can clearly distinguish the two. For instance, the Top 30 index has a higher standardized deviation compared to the broader Responsible Investment index; however, it offers higher returns as it has a larger maximum value of 9.96, which aligns with the risk-return investment theory, i.e., the higher the risk, the higher the return. indicates that only LINFL and LUSDZAR can be considered normally distributed. Most of the other variables are not normal, which is common for financial/economic data, but should be noted if statistical methods that assume normality are to be used. However, this is not expected to come across as a problem, as the model used in this study (ARDL model) to determine the short and long-run relationship between macroeconomic variables and socially responsible investments does not assume normality. Normality should be taken into consideration when conducting standard statistical inferences on the coefficients of the variables. Furthermore. Additionally, the negative skew in LREPO visually confirms a long-term downward trend in interest rates. The symmetry in LUSDZAR and the indices suggests they followed a more random path around a clear upward (depreciating/appreciating) trend.

Table 2. Descriptive Statistics

	LGDP	LINFL	LMSM3	LREPO	LUSDZAR	LRII	LTOP30
Mean	26.66982726	1.604715213	1.875944015	1.797641272	2.738462033	9.354494639	9.518889501
Median	26.69109728	1.589235205	1.93874166	1.909542505	2.71687779	9.329444313	9.422929218
Maximum	26.76562994	1.916922612	2.413231613	2.1102132	2.981876727	9.627867771	9.962695171
Minimum	26.50272924	1.16315081	-2.120263536	1.252762968	2.467107514	9.067720951	8.952316773
Std. Dev.	0.069003576	0.19669991	0.517673208	0.290063802	0.129690823	0.123638863	0.276924905
Skewness	-0.928567079	-0.477695342	-4.650624178	-0.93309118	0.065915529	0.079329902	0.061199408
Kurtosis	2.805145156	2.983081762	34.39881968	2.412966953	2.026093491	2.298132086	1.656721325
Jarque-Bera	15.83640875	4.146803204	4870.479237	17.38206831	4.386674646	2.351636406	8.263013267
Probability	0.000364	0.125757	0.000000	0.000168	0.111544	0.308566	0.016059
Observations	109	109	109	109	109	109	109

Source: Authors' own estimation (2025)

4.1.2. Unit Root and Stationarity Test

In Table 3, when using the Augmented Dickey-Fuller, it was found that only GDP is stationary at level, I (0), while the other variables, including the dependent variables, are stationary at first difference, I (1). However, the KPSS stationarity test indicates that the money supply, exchange rate, and Responsible Investment Indices are stationary at the level, I (0), while GDP, inflation, and the repo rate are stationary at the first difference, I (1). This meets the prerequisites of running the ARDL model, as this model requires a combination of variables stationary at level, I (0), and first difference, I (1).

Table 3. ADF and KPSS Tests

	ADF		KPSS	
Variables	I (0)	I (1)	I (0)	I (1)
LGDP	-3.802063**	-	-	0.058984
LINFL	-	-10.26261**	-	0.103912

LMSM3	-	-14.73426**	0.050550	-
LREPO	-	-2.897365**	-	0.106053
LRII	-	-10.27082**	0.112607	-
LTOP30	-	-10.36544**	0.109659	-
LUSDZAR	-	-11.12116**	0.117338	-

*Notes: 1. **, indicate 5 percent levels of significance. 2. The associated critical values of the KPSS test are 0.216000, 0.146000, and 0.119000.*

Source: Authors' own estimation (2025)

4.1.3. Variance Inflation Factor Test

Table 4 presents the VIF test, which is used to confirm whether multicollinearity is present among the independent variables. The results clearly indicate that there is no multicollinearity among the independent variables, as the centered VIFs are all close to 1 and less than 10. Thus, the null hypothesis of no collinearity among the variables is not rejected. Collectively, the independent variables used in the study express no multicollinearity.

Table 4. Variance Inflation Factor

Variable	LRII	LTOP30
	CENTERED VIF	CENTERED VIF
LGDP	1,15894923	1,163157722
LINFL	1,949655537	1,93585569
LMSM3	1,332014682	1,338603004
LREPO	2,088554534	2,083559934
LUSDZAR	1,118664907	1,114559244

Source: Authors' own estimation (2025)

4.1.4. Correlation Analysis

Based on Table 5 all of the paired independent variables display a weak to moderate correlation with one another; therefore, it is unlikely that the regression model will experience multicollinearity problems. However, inflation and the repo rate display a somewhat strong positive correlation of 0.67; however, the relationship is not strong enough to make it difficult for the model to tell their individual effects apart. The strong positive relationship makes perfect intuitive sense as the South African Reserve Bank uses the repo rate to control inflation. When inflation rises, the central bank typically raises the interest rate.

Table 5. Correlation Analysis

Probability	LGDP	LINFL	LMSM3	LREPO	LUSDZAR
LGDP	1				

LINFL	-0.084184289	1			
	0.3819	-----			
LMSM3	-0.321161253	0.046578202	1		

	0.0006	0.6290	-----		
LREPO	-0.053863789	0.677245503	0.255007113	1	
	0.5762	0.0000	0.0072	-----	
LUSDZAR	0.055173597	0.013768499	0.268083351	0.15665467	1
	0.5670	0.8865	0.0046	0.1022	-----

Source: Authors' own estimation (2025)

4.2. Empirical Model Results

4.2.1. Bound Test of Cointegration

The result is inconclusive at the 5% significance level. Thus, it is difficult to definitively confirm or deny a long-run relationship between your macroeconomic variables and the Responsible Investment Index at this common significance level. However, the conclusion for the Top 30 index indicates a clear and significant result. Thus, the null hypothesis (no long-run relationship) at the 5% significance level is rejected as the F-statistic is significantly greater than the lower bound I (0). Furthermore, the F-statistic is significantly greater than the upper bound, I (1), suggesting strong statistical evidence of a stable, long-run relationship between the macroeconomic variables and the FTSE/JSE Responsible Investment Top 30 Index.

Table 6. ARDL Bounds Test

F-Statistic	Significance Level	I(0) Bound	I(1) Bound
		LRII	
2.46	10%	2.08	3.00
	5%	2.39	3.38
	1%	3.06	4.15
		LTOP30	
3.84	10%	2.08	3.00
	5%	2.39	3.38
	1%	3.06	4.15

Source: Authors' own estimation (2025)

4.2.2. Responsible Investment Index Results

Table 7 displays a summary output of the short and long-run dynamics and the error correction mechanism, indicating the effects of selected macroeconomic variables on the Responsible Investment Index (LRII). The sample covers monthly data from November 2015 to December 2024, with automatic lag selection using SIC, yielding an ARDL (1,0,0,0,0,2) model. Robust standard errors (Huber-White-Hinkley) address potential heteroskedasticity. In the short run, a single variable, namely the exchange rate (LUSDZAR), exhibits significant short-term effects on the index. In the long run, it is established that real GDP has a positive relationship with the FTSE/JSE Responsible Investment

Index. While all the other variables are positive, they remain statistically insignificant, thus making it difficult to determine the extent of this positive relationship, in layman's terms, to conclude whether it is good for the Responsible Investment Index. Furthermore, the coefficient is statistically significant, indicating that GDP has positive effects on the Responsible Index in the long run. Furthermore, short-run dynamics reveal disequilibrium adjustments. Immediate changes in exchange rate (D(LUSDZAR)) negatively impact LRII by -0.289% (significant at 5%), and the first lag (D (LUSDZAR (-1))) by -0.259% (significant at 1%), suggesting short-term ZAR volatility depresses real interest income, possibly via imported inflation or uncertainty eroding investor confidence. The error correction term (COINTEQ = -0.216, significant at 1%) indicates that deviations from long-run equilibrium adjust at 21.6% per month, implying full adjustment in 4-5 months, a moderate speed.

Table 7. Short and Long-Run Dynamics of the Responsible Investment Index

Variable	Coefficient	t-Statistic	Prob.*
Short Run Relationship			
D (LUSDZAR)	-0.289122	-2.18454	0.0311
D (LUSDZAR (-1))	-0.259275	-2.731021	0.0074
COINTEQ	-0.216266	-3.739764	0.0003
Long Run Relationship			
LGDP	0.292665	2.4735	0.0151
LINFL	0.003594	0.162806	0.871
LMSM3	0.002764	0.595732	0.5527
LREPO	0.000989	0.061918	0.9508
LUSDZAR (-1)	0.12856	3.450253	0.0008

Source: Authors' own estimation (2025)

4.2.3. Responsible Investment 30 Index Results

Table 8 depicts the short and long-run dynamics of macroeconomic variables on the Responsible Investment Top 30 Index. The results suggest that real GDP and inflation have a positive long-run effect on the Top 30 Index, i.e., a 1% in real GDP or inflation will result in a 0.57% and 0.09% increase in the Index's market price, respectively. The significant relationships are supported by the p-values of the variables mentioned, which are well over 0.05. In terms of real GDP, the results obtained align with the priori expectations as an increase in GDP implies increased economic activity, which is translated into corporate earnings. Although expectations suggest that a negative relationship should exist between inflation and the Top 30 Index, due to the index's diversified composition, it is somewhat immune to inflationary pressures. Furthermore, the results indicate that the repo rate is negatively correlated with the Top 30 Index, i.e., a 1% increase in the repo rate would result in a 0.06% decline in the market price of the index. This relationship is significant (at a 5% significance level) as the p-value of the variable is less than 0.05. Additionally, the USD/ZAR exchange rate displays a positive relationship with the Top 30 Index; however, the relationship is insignificant, suggesting little to no effect on the index. However, in the short run, this relationship is significant, implying that exchange rate fluctuations have a strong effect on the index. Furthermore, the error correction term (COINTEQ = -0.2219, significant at 1%) indicates that deviations from long-run

equilibrium adjust at 22.1% per month, implying full adjustment in 4-5 months, similar to the Responsible Investment Index.

Table 8. Short and Long-Run Effects on the Responsible Investment Top 30 Index

Variable	Coefficient	t-Statistic	Prob.*
Short Run Relationship			
D(INFL)	-0.064071	-0.584599	0.5601
D(LUSDZAR)	-0.368810	-2.206197	0.0298
D (LUSDZAR (-1))	-0.331651	-3.038605	0.0031
COINTEQ	-0.221909	-4.631309	0.0000
Long Run Relationship			
LGDP	0.568221	4.73958	0.0000
LINFL (-1)	0.090952	2.703637	0.0081
LMSM3	0.003267	0.42865	0.6691
LREPO	-0.062361	-2.418264	0.0175
LUSDZAR (-1)	0.359496	4.46321	0.0000

Source: Authors' own estimation (2025)

4.2.4. Residual Diagnostic Tests

Table 9 displays the residual diagnostic tests, which include heteroskedasticity and serial correlation. These tests were conducted to verify whether the assumptions behind the models are true. The results obtained reflect that the models do not suffer from serial correlation, which implies that the residuals are independent of each other. Similarly, the heteroscedastic test reveals no presence of heteroscedastic as the null hypothesis of homoskedasticity is not rejected. These findings further confirm the robustness of the model.

Table 9. Residual Diagnostics Test

Test	Statistic	Prob.	Null Hypothesis	Consensus
		LRII		
Heteroskedasticity Test	F-Stats	0.0730	Homoskedasticity	Fail to Reject
Serial Correlation LM Test	F-Stats	-0.1896	No Serial Correlation	Fail to Reject
		LTOP30		
Heteroskedasticity Test	F-Stats	0.0915	Homoskedasticity	Reject
Serial Correlation LM Test	F-Stats	0.6430	No Serial Correlation	Fail to Reject

Source: Authors' own estimation (2025)

Furthermore, the model's stability is assessed using the CUSUM stability test. The primary purpose of this test is to monitor changes in the cumulative sum of recursive residuals over time (Moodley &

Pillay, 2024). Figure 2 and Figure 3 indicate the CUSUM tests of the ARDL model for the dependent variable: the Responsible Investment and the Top 30, respectively. These figures indicate that the models are stable and non-spurious, as the CUSUM test (blue line) lies within the 5% significance level.

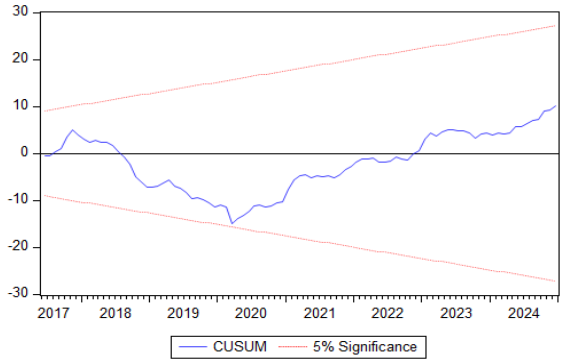

Figure 2. LRII

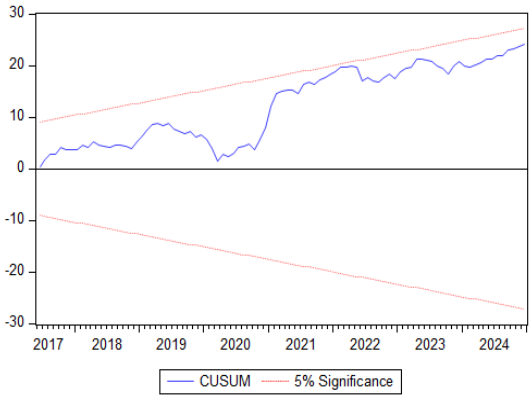

Figure 3. LTOP30

Source: Authors' own estimation (2025)

5. Conclusion and Implications

This study examined the macroeconomic determinants of the FTSE/JSE Responsible Investment Index and the Responsible Investment Top 30 Index, using monthly data from November 2015 to December 2024. Amid increasing global attention on ESG investing, the research contributes empirical insight into how macroeconomic variables—namely real GDP, inflation, interest rates (repo rate), exchange rates (USD/ZAR), and money supply (M3)—affect the performance of ESG-oriented indices within the South African financial market.

Key findings highlight that exchange rate volatility significantly and negatively affects both indices in the short run, while real GDP consistently supports long-run index performance. Inflation surprisingly exhibits a positive long-run effect on the Top 30 Index, likely due to the portfolio's diversified nature, which mitigates inflationary shocks. The repo rate exerts a negative long-run effect on the Top 30 Index, revealing its sensitivity to interest rate changes. Both indices demonstrate moderate speeds of adjustment to long-run equilibrium (approximately 22% per month), suggesting partial resilience to shocks.

These findings advance our understanding of sustainable investment behaviour in emerging economies and offer valuable insights for enhancing ESG-focused financial resilience. In relation to policy implications, macroeconomic policy should aim to stabilise the exchange rate and inflation while fostering economic growth. Exchange rate volatility has a clear negative effect on ESG index performance, highlighting the need for exchange rate-targeted interventions. Policymakers should incentivise sectors contributing to ESG outcomes—such as renewable energy, green tech, and inclusive business models—to leverage the positive impact of GDP growth on ESG investments. Regulatory bodies such as the South African Reserve Bank (SARB) and Financial Sector Conduct Authority (FSCA) should incorporate ESG risk metrics into macroprudential regulation and investment guidelines to protect and promote sustainable finance. Mandating consistent ESG disclosures for listed companies can reduce information asymmetry and improve the functioning of ESG indices by enabling more accurate risk assessments and investor decisions.

Future studies could examine sectoral breakdowns within the ESG indices to better understand which industries contribute most to index performance under different macroeconomic conditions. An analysis of how global ESG policies (e.g., EU taxonomy, carbon taxes) and cross-border investment flows impact local ESG index performance would provide a broader macro-financial perspective. Incorporating investor sentiment or ESG awareness metrics into the model could shed light on the psychological and informational drivers of ESG asset pricing in emerging markets. With the data ending in December 2024, future work should extend the dataset to include more recent events, allowing for forecasting models and stress-testing under different macroeconomic scenarios.

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