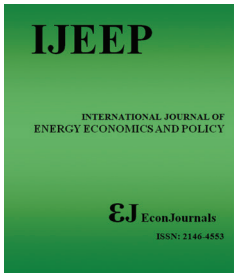

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Macroeconomic Determinants of South African Oil Prices: Evidence from Alternating Market Conditions

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ABSTRACT

The introduction of the adaptive market hypothesis (AMH) allows for the review of the relationship between macroeconomic variables and oil prices, such that the relationship is said to alternate with bull and bear market conditions. In an attempt to contribute to the revised literature, the study examines the influence of macroeconomy on South African (SA) oil index returns. The study incorporates six macroeconomic factors (inflation, money supply, short-term interest rates, long-term interest rates, gross domestic product (GDP), and exchange rate) and SA oil price index returns for the period February 1996-December 2024. Using the Two-State Markov regime switching mode, the findings indicate that macroeconomic variables have an alternating effect on SA oil index returns. It is evident when macroeconomic factors have a significant effect on SA oil index returns in a bull regime, the effect is insignificant in a bear regime. Hence, SA commodity market, more especially the oil market is not efficient as proposed by the efficient market hypothesis and is better model by asymmetrical models.

Keywords: Macroeconomic Factors, JSE, Market Conditions, Oil Returns, South Africa
JEL Classifications: E2, E4, E6, G1

1. INTRODUCTION

The key role oil plays in the world economy have justified the review of the consequences of macroeconomy on oil returns. Hamilton (1983) has supported the review and undertaking as he found macroeconomic fluctuations contributed to the United States (US) recession and financial crisis, which inevitably effected different sectors of the equity market, one being oil returns. Consequently, many scholars have undertaken research in this regard to justify the type of effect that should be evident (Pradhan et al., 2015; Taghizadeh-Hesary et al., 2016). However, till now there exist conflicting findings, as the effect macroeconomic factors have on oil returns varies among studies. For example, Ratti and Vespignani (2016) find interest rates to have a significant negative effect on oil returns and economic growth, money supply and inflation have a significant positive effect on oil returns. However, Taghizadeh-Hesary et al. (2016) finds no significant relationship between economic growth and oil returns. Given the conflicting findings among studies, there exists a debate that has not reach finality despite the large amounts of empirical literature.

The debate has since shifted to the time-varying effect of macroeconomic variables on oil returns since the formation of the adaptive market hypotheses (AMH). Lo (2004) formulate AMH after finding that equity markets are not efficient as proposed by the efficient market hypothesis (EMH). The basis of the argument is evident in the findings of the financial crisis. It is evident that the financial crisis arose from monetary authorities' alterations to macroeconomic variables, specifically, interest rates, inflation, economic growth and exchange rates (Moodley et al., 2022). The financial crisis started in the financial sector but later infiltrated other sectors of the equity market as investors moved their investments. However, due to the magnitude of the macroeconomic alterations by monetary authorities, it went

beyond the US equity market and effected all equity markets across the world. Consequently, resulting in the collapse of the world economy (Jiang et al., 2017). It is evident from the financial crisis that macroeconomy effects different sectors of the equity market differently. That being, when market conditions, i.e., bull and bear market conditions exist, there should be alternating efficiency, such that the effect macroeconomic variables have on oil returns in a bull regime is not the same under a bear regime (Lo, 2004). As a result, the linear debate has now shifted to the asymmetrical effect of macroeconomic factors on oil returns.

Despite the growing interest in the oil return relationship, there are limited studies that have examined the nonlinear relationship. Those studies that have, focused on return predictability and oil return volatility (Huang et al., 2005; Naifar and Dohaiman, 2013; You et al., 2017). However, the new debate advocates for the study of macroeconomy and oil returns under changing market conditions. To the best of the authors' knowledge there has been no study of this nature conducted in SA. In the attempt to contribute to the debate and empirical literature the study examines the effect of macroeconomic variables on South African (SA) oil returns in a bull and bear market conditions.

The paper is ordered as follows; section two of the paper deals with the theoretical and empirical review of literature, thereafter, section three highlights the data and empirical model used. Section four deals with the discussion of results and lastly section 5 concludes the paper.

2. LITERATURE REVIEW

2.1. Theoretical Considerations

The underlying theories that underpin the macroeconomic determinants of oil returns are the efficient market hypothesis (EMH) and adaptive market hypothesis (AMH). In 1965, Fama developed EMH after observing stock market returns deviating from its fundamental value. The basis of EMH is such that equity markets are efficient as they reflect all available price information. The basis relied on by EMH is known as the concept of random walk. The random walk process suggest that current price deviations are random and occur from previous prices. Hence, investors are not able to use technical or fundamental analysis to earn excess returns as new information is contained in security prices without any lag periods. This implies that security prices cannot be predicted from past prices, which has dominated literature since its formation in 1965. Given the debate and findings of equity markets being inefficient, Lo (2004) formulated AMH.

The notion proposed by AMH considers the revolutionary prospective of behavioural finance, which includes key principles namely: Natural selection, reproduction, competition, and mutation (Obalade and Muzindutsi, 2018). According to AMH, equity markets are exposed to inefficiency due to changing market conditions such that bull and bear markets have alternating efficiencies (Ghazani and Ebrahimi, 2019). Hence, the effect macroeconomic variables have on oil prices should alternate among bull and bear market conditions. That being said, the effect that macroeconomic variables have on oil prices in a bull regime will not be the same as in a bear regime since oil returns performance in a bull regime is independent to that of a bear regime. Thus, investors can earn excess returns due to equity markets not always being efficient as investor behaviour is not always rational.

2.2. Empirical Review

The review of empirical evidence indicates there exists many studies that have examined the linear effect of macroeconomic factors on oil returns both locally and internationally (Pradhan et al., 2015; Taghizadeh-Hesary et al., 2016; Yıldız et al., 2021). However, there exist limited studies that has attempted to investigate the nonlinear relationship which considers changing market conditions as the proposition of alternating efficiency is new (Huang et al., 2005; Naifar and Dohaiman, 2013; You et al., 2017). The findings under the linear and nonlinear effect of macroeconomic variables on oil returns are conflicting as the effect is not the same under linear and nonlinear studies:

Pradhan et al. (2015) examined the short-run and long-run relationship between macroeconomic variables and group 20 (G-20) countries oil returns for the period 1961-2012. The dependent variables used was oil returns of each country whereas the independent variables considered was economic growth, inflation, interest rates and exchange rates. Using a panel vector autoregression model, the findings indicate that economic growth, inflation, interest rates and exchange rates have a significant short-run and long-run effect on G-20 oil prices. Zhu et al. (2015) also considered a similar study, but the findings showed only exchange rate has a significant short-term and long-term effect on G-20 oil returns.

Ratti and Vespignani (2016) investigated the effect of global macroeconomic factors on Unites States (US), European and Chinese oil returns. Using monthly data for the period 1999-2013, the Vector Error Correction Model (VECM) was implemented. The findings showed that interest rates have a significant negative effect on oil returns. Whereas economic growth, money supply and inflation have a significant positive effect on oil returns. Taghizadeh-Hesary et al. (2016) also examined the effect of macroeconomic variables on oil prices. However, the study focused on US, Japan, and Chinese oil prices for the period 1996-2014. The VECM showed that inflation, GDP have a significant effect on Chinese oil returns but a significant positive effect on the US and Japanese oil returns. The deviation in findings is owing to China being an emerging economy. Hence, they import less oil as they make use of more nuclear energy, gas and renewables, the opposite holds true for US and Japan.

Malik et al. (2017) used VECM to examine the bidirectional effect of Pakistan oil returns on macroeconomic variables. The sample period consisted of high frequency data for the period 1960-2014 and include variables such as inflation, GDP and exchange rate. The findings of the study indicated that a significant negative bidirectional relationship exist between GDP and oil returns. However, a significant positive bidirectional relationship exists between inflation, exchange rate and oil returns. Shah et al. (2018) investigated the effect of oil returns on macroeconomic variables and renewable energy for the US, Norway, and United Kingdom

(UK). The dependent variables used in the Vector Autoregressive (VAR) model was oil returns and renewable returns, whereas the dependent variable was GDP and interest rates. The findings suggest that there exists a short-run and long-run relationship between GDP, inflation, and oil returns for the period 1996-2016. Moreover, renewable energy and oil returns have a significant relationship for the three countries. The findings are logical and empirically correct as the substitute of renewable energy for oil, will yield enhanced benefits as opposed to importing oil.

In a more recent study, Marathe (2020) used the VAR model to determine the bidirectional relationship between GDP, imports, exports and oil returns of Brazil, Russia, India China and South African (BRICS). The VAR model indicated that there exists no relationship between oil returns and GDP for the sample period of 1996-2018. The findings are not in line with Yıldız et al. (2021), as they also used the VAR model to determine the bidirectional relationship between macroeconomic variables and SA oil returns. However, Quarterly data for oil returns, inflation, interest rates and GDP was used from 1990 to 2019. The findings of the model suggest that interest rates, GDP and inflation have a short-run and long-run effect on oil returns, and the relationship is bidirectional. This suggest that monetary authorities play an import role in monitoring monetary policy and price fluctuations in oil prices impact monetary policy as well as monetary policy revisions impact SA oil returns.

Despite the growing empirical evidence surrounding the linear effect of macroeconomic variables on oil returns, there is still a continued debate surrounding the type of effect each specific macroeconomic factor should have on oil returns. However, given the adoption of AMH, the debate has now shifted to the nonlinear relationship as AMH justifies a nonlinear relationship between oil returns and macroeconomy. Despite that, such studies are limited both locally and internationally.

Huang et al. (2005) used the multivariate threshold model to determine the effect of economic activity on oil returns. The study used industrial production as a proxy for economic activity to determine the in sample and out sample effect for the period 1970-2002. The findings of the study suggest that the influence of oil returns on industrial production is dependent on how much oil the US, Canada and Japan import. That being, oil returns do not explain macroeconomy if it's above the threshold level but when it is below the threshold level it does have a significant influence.

Naifar and Dohaiman (2013) examined the nonlinear effect of macroeconomic variables on oil returns. The dependent variable comprised of oil return of Gulf Cooperation Council (GCC) countries and the dependent variables consisted of inflation and interest rates for the period of 1960-2011. Using the Markov regime switching model, the study found that the effect of macroeconomic variables on oil returns is regime dependent and alternates with regimes. Interest rate was found to significantly affect oil returns in a crises regime but not in a non-crises regime. However, inflation has significant effect on oil returns under both regimes. Similar finding is found in a study by You et al. (2017) as the scholars investigated the effect of macroeconomy on Chinese oil prices from 1995 to 2016. The quantile regression model suggest that interest rates effects oil returns differently in a bull and bear regime. That being, interest rates influence chines oil returns positively in a bear regime but negatively in a bull regime. Hence, the influence is regime dependent and alternating efficiencies are present.

Given the review of empirical literature, the notion proposed at the beginning of the section is much clearer as it is evident that there are limited studies that examine the asymmetrical effect of macroeconomy and oil returns. Where studies have considered the effect, it focused on determining the given type of relationship, i.e., short-term, or long term. Hence, the debate surrounding the influence of macroeconomic variables on oil returns under changing regimes has not reach finality. In an attempt to contribute to the debate found in literature, the study examines the effect of macroeconomic variables on SA oil returns.

3. MATERIALS AND METHODS

3.1. Data

The study used monthly time series data for the period 1 April 2009-31 October 2024. The sample selection and data frequency are selected in line with empirical literature and availability of data. The SA oil returns are used as the dependent variable and inflation growth rate, money supply growth rate, short-term interest growth rate, long-term interest growth rate, rand/dollar exchange rate growth rate and GDP growth rate is used as the selected macroeconomic variables. It is further evident that GDP is not available in monthly frequency, the study therefore uses the quadratic average interpolation approach to convert quarterly frequency to monthly frequency (Dlamini, 2017). All data was obtained from the South African Reserve Bank (SARB) and Eviews software is used to examine the macroeconomic determinates of SA oil returns.

3.2. Empirical Model

The study sets out to investigate the effect of macroeconomic factors on SA oil price returns under bull and bear regimes. The required objective entails using a regime switching model that caters for switching states of the SA economy (Zhang and Zhang, 2015; Bazzi et al., 2017; Moodley et al., 2022), namely a bull (1) and bear (2). Consequently, the two state Markov regime-switching model is considered and given by:

$$Oil\ \ Returns = \mu_{Kt} + B_{0iKt}\Delta CPI + B_{1iKt}\Delta M2 + B_{2iKt}\Delta ST_{INT} + B_{3iKt}\Delta \mathrm{LT}_{INT} + B_{4iKt}\Delta EX_{RATE} + B_{5iKt}\Delta GDP + \varepsilon_{K_t} \quad (1)$$

Where $\varepsilon_{K_{t,}}$ i.i.d $(0,\sigma^2_{K_{t,}})$

μ_{Kt} is the mean and measures oil returns performance in a bull regime (1) and bear regime (2), the independent variables comprise of change in macroeconomics factors, which are inflation growth rate (ΔCPI), money supply ($\Delta M2$), short-term interest rate (ΔST_{INT}), long-term interest rate (ΔLT_{INT}), R/$ exchange rate (ΔEX_{RATE}) and gross domestic product (ΔGDP). The variance of oil returns in each regime is given by ε_{K_t}.

The transition probabilities and duration of a bull regime and bear regime is given by

$$Prob\ [K_t = 1 | K_{t-1} = 1] = Prob_{11} \quad (2)$$

$$Prob\ [K_t = 2 | K_{t-1} = 1] = 1 - Prob_{11} \quad (3)$$

$$Prob\ [K_t = 2 | K_{t-1} = 2] = Prob_{22} \quad (4)$$

$$Prob\ [K_t = 1 | K_{t-1} = 2] = 1 - Prob_{22} \quad (5)$$

Where $Prob_{11}$ is the probability that the oil returns is in a bull regime at $t-1$ and remains there at time t, $Prob_{21}$ is the probability that the returns is in a bull regime at $t-1$ and moves to a bear regime at time t. $Prob_{22}$ is the probability that the returns is in a bear regime at time $t-1$ and remains there at time t $Prob_{21}$ is the probability that the returns is in a bear regime at $t-1$ and moves to a bull regime at time t.

3.3. Preliminary and Diagnostic Tests

The study has elected to use the Augmented Dickey Fuller (ADF) test in levels and structural breaks, Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, and correlation analysis. Moreover, the Breusch–Godfrey autocorrelation test is implemented to determine the robustness of the model output. The above tests are considered because a requirement of the Markov regime-switching model is that the variables need to be stationary in levels and with structural breaks.

4. RESULTS

4.1. Descriptive Statistics

Table 1 provides the descriptive statistics of the SA oil returns and the macroeconomic variables. It is evident that the SA oil returns have the highest average return among the selected variables, which is followed by money supply growth rate, GDP growth rate and exchange rate growth rate. The findings suggest that oil returns are on average increasing and positive. This is confirmed by the oil returns having the highest and lowest return from the selected variables. However, higher returns are associated with elevated risk, and such is evident as the oil returns is the most volatile among the selected variables as presented by the standard deviation. This is followed by inflation growth rate, short-term interest growth rate and exchange rate growth rate. The findings are in line with the theory of risk and reward, such that the higher risk is compensated with higher returns. It is further evident that money supply growth rate, long-term interest growth rate, exchange rate growth rate and GDP growth rate is positively skewed. However, oil returns, inflation growth rate and short-term interest growth rate is negatively skewed. The positive skewness indicated that the mean lies to the right of the median and mode, whereas the negative skewness suggests that the mean lies to the left of the median and mode. Hence, there exist more positive growth rates than negative growth rates. All selected variables have a kurtosis that is greater than three which indicate that oil returns and macroeconomic growth rates follows a leptokurtic distribution, the findings are supported by the Jarque-Bera test of normality as the null hypothesis is rejected for all selected variables. Hence, oil returns and macroeconomic growth rates are normally distributed.

The study further conducted tests such as Baum et al. (1987) (BDS) test and the variance inflation (VIF) test. The study administers the BDS tests to determine if there are nonlinearities among the selected variables. Moreover, VIF test is administered to determine if the independent variables (macroeconomic variables) are collinear. It is evident from the BDS test results that all values are significant at a 1%, 5% and 10% levels of significance. Consequently, the study confirms that there exist nonlinearities among the selected variables. Hence, a nonlinear model will be better administered to capture the nonlinear relationship. It is evident from the VIF test that all values lie between 1 and 2. Hence, the study confirms that there exists no multicollinearity among the independent variables.

4.2. Correlation Analysis

The correlation analysis of the SA oil returns, and SA macroeconomic variables is presented in Table 2. It is evident that inflation growth rate, short-term interest growth rate and GDP growth rate has a positive significant relationship with oil returns. However, money supply growth rate, long-term interest rate and

Table 1: Oil returns and macroeconomic factors descriptive statistics

Variables	Oil Returns	CPI	M2	ST_INT	LT_INT	EX_RATE	GDP
Mean	0.799	−0.169	0.551	−0.148	0.242	0.405	0.491
Median	1.383	0.000	0.423	0.002	−0.097	−0.097	0.488
Maximum	33.751	20.000	6.286	13.730	17.735	11.950	24.353
Minimum	−38.800	−21.212	−3.083	−24.203	−10.120	−9.713	−20.064
Standard deviation	11.784	5.299	1.363	3.967	3.286	3.476	2.751
Skewness	−0.223	−0.098	0.585	−1.485	1.171	0.350	1.443
Kurtosis	3.838	6.302	4.082	12.313	9.161	3.601	54.930
Jarque-Bera	6.124**	74.298***	17.255***	648.991***	295.110***	5.788***	18372.17
BDS	0.019***	0.089***	0.007***	0.031***	0.071***	0.073***	0.071***
VIF	-	1.029	1.119	1.139	1.403	1.529	1.146

Source: Author's estimations (2023). *BDS has two dimensions

Table 2: Oil Returns and macroeconomic variables correlation results

Variables	CPI	M2	ST_INT	LT_INT	EX_RATE	GDP
Oil returns	0.358*** (0.001)	−0.058*** (0.000)	0.174*** (0.008)	−0.096*** (0.003)	−0.126*** (0.000)	0.136*** (0.000)

Source: Author's estimations (2023). *Note: The parenthesis indicates the p-values, whereas *** indicate a 1%, level of significance respectively.

Table 3: Oil returns and macroeconomic variables unit root and stationarity results

Variables	Oil returns	CPI	M2	ST_INT	LT_INT	EX_RATE	GDP
Unit root and stationarity tests in levels with an intercept							
ADF test	−10.398***	−11.513***	−7.156***	−6.103***	−10.781***	−9.547***	−5.268***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
KPSS test	0.118***	0.154***	0.160***	0.181***	0.128***	0.239***	0.205***
Break point unit root test in levels with an intercept							
ADF test	−13.030***	−12.608***	−13.906***	−10.737***	−11.845***	−10.215***	−10.111***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Source: Author's estimations (2023). *Note: The parenthesis indicates the p-values, whereas ***, indicate a 1% level of significance respectively.

exchange rate growth rate has a negative significant relationship with oil returns. The findings suggest that as inflation growth rate, short-term interest growth rate and GDP growth rate deviate from there fundamental value, it will result in oil returns increasing over time whereas the opposite holds true for money supply growth rate, long-term interest rate and exchange rate growth rate.

Table 4: Lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−3017.904	NA	49195392	37.576	37.710*	37.631
1	−2909.190	206.624	23443352	36.835	37.906	37.270*
2	−2856.861	94.908*	22566145*	36.793*	38.803	37.609

Source: Author's estimation. *indicate the optimal information criteria

4.3. Unit Root and Stationarity Tests

The ADF and KPSS stationarity and structural break test results are presented in Table 3. The ADF stationarity test statistic for all variables (oil returns, inflation growth rate, money supply growth rate, short-term interest growth rate, long-term interest growth rate, exchange rate growth rate and GDP growth rate) is more negative than the critical values at a 1%, 5% and 10% significance level. Thus, the null hypothesis of the oil returns and macroeconomic variables containing a unit root can be rejected in favour of the selected variables being stationery in levels which indicate integrated order I (0). The KPSS test confirms the findings of the ADF test as the test statistics of the selected variables is less than the critical values at all significance levels. The ADF structural break test indicate the selected variables are stationery in the presence of structural breaks as the test statistic is more negative than the critical values at all levels of significance. Having found the variables to be stationery in levels and structural breaks, the empirical model is presented.

4.4. Regime Specification

The study found that there exists nonlinearity between the oil prices and macroeconomic variables. Moreover, it was found that the independent variables did not depict any form of multicollinearity. Consequently, the next step was to determine the appropriate regime switching model to administer. The study follows the process of Muzindutsi et al. (2023) as they also used unrestricted lag length criteria to determine the number of regimes and in turn the appropriate Markov regime-switching mode. Consequently, Table 4 presents the unrestricted lag length criteria for the given variables. It is noted that the appropriate number of regimes to administer is two. That being, all lag length criteria confirm this beside SC and HQ. The study will proceed with estimating a two-state Markov regime-switching model.

4.5. Empirical Model

The two state Markov regime-switching model is presented in Table 5. It is evident that oil returns are positive and significant in a bull regime. The inflation growth rate and short-term interest growth rate has a positive significant effect on oil price returns in a bull regime. However, long-term interest growth rate and exchange rate growth rate has a negative significant effect on oil returns in a bull regime. Money supply growth rate and GDP growth rate is found to have no significant effect on oil returns in a bull regime. The oil returns are found to be negative and insignificant in a bear regime. Inflation growth rate and long-term interest growth rate has a positive significant effect on oil prices in a bear regime. However, short-term interest growth rate has a negative significant effect on oil returns in a bear regime. Money supply growth rate, exchange rate growth rate and GDP growth rate have no significant effect on oil returns in a bear regime. The Breusch–Godfrey autocorrelation LM test statistic is seen to have a P value that is greater than all significance levels. Hence, the null hypothesis of presence of autocorrelation can be rejected in favor of the alternative hypothesis of no autocorrelation. Hance the empirical model does not contain autocorrelation and is robust to the inputs of the selected variables.

It is evident from the results of the study that the effect of short-term interest growth rate on oil returns is regime dependent. As short-term interest rate has a positive significant effect on oil returns in bull regime but a negative significant effect on oil returns in a bear regime. The findings are confirmed by a study conducted by Naifar and Dohaiman (2013) as the authors found regime dependency between short-term interest rate and oil returns. It is further seen that alternating efficiency is presented in the study, such that exchange rate growth rate has a significant effect on oil returns in a bull regime but no significant effect in a bear regime. The alternating efficiency is explained by the AMH, such that the effect of macroeconomic variables on oil returns may not be the same in a bull and bear regime. Hence AMH caters for regime dependency and alternating efficiency as presented in the findings of this study. The robustness of the model is tested by implementing the Durbin-Watson (DW) autocorrelation test in the residuals of the model and the Breusch-Godfrey LM autocorrelation test in the errors of the regression. It is evident that the DW test confirms that the is no autocorrelation in the residuals of the model as it is 2. Moreover, the LM test confirms there is no autocorrelation in the errors of the regression as we fail to reject the null hypothesis as indicated by the P-value.

4.5.1. Transition and expected duration probabilities

Table 6 presents the results of the transition and expected duration probabilities associated with the oil returns. The oil returns

Table 5: Markov regime-switch model results

$$Oil\ Returns = \mu_{Kt} + B_{0iKt}\Delta CPI + B_{1iKt}\Delta M2 + B_{2iKt}\Delta ST_{INT} + B_{3iKt}\Delta LT_{INT} + B_{4iKt}\Delta EX_{RATE} + B_{5iKt}\Delta GDP + \varepsilon_{K_t}$$

Variables	μ	B^0	B^1	B^2	B^3	B^4	B^5	σ^2
Regime 1: Bull market condition								
Oil	1.317***	0.620**	1.180	0.701*	−0.931*	−1.132**	−0.005	2.476***
returns	(0.00)	(0.026)	(0.388)	(0.070)	(0.097)	(0.041)	(0.990)	(0.000)
Regime 2: Bear market condition								
Oil	−1.224	0.826***	−0.176	−1.025*	0.894**	0.756	−0.233	1.910***
returns	(0.388)	(0.007)	(0.809)	(0.071)	(0.014)	(0.154)	(0.746)	(0.000)
Diagnostic test								
LM test			0.009				(0.980)	
DW-stat			2.014				-	

Source: Author's estimations (2023). *The parenthesis indicates the P-values, whereas ***, ** and *indicate a 1%, 5% and 10% level of significance respectively

Table 6: Oil return transition and expected duration probabilities results

Variables	P_{11}	T_{11}
Regime 1: Bull market condition		
Oil returns	0.905	0.926
Regime 2: Bear market condition		
Oil returns	10.494	13.424

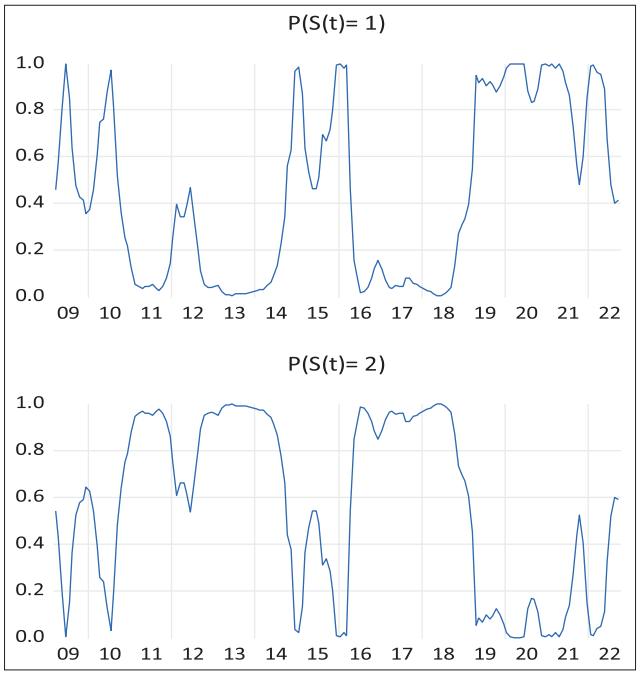
Source: Author's estimations (2023)

probability of staying in a bear regime (0.926) is higher than that of the bull regime (0.905). Consequently, the oil returns stayed longer in a bear regime (13.424 months) as opposed to the bull regime (10.494 months). Thus, the oil returns were categorized as bearish and volatile for the sample period. The findings of the study are supported by a study conducted by Moodley et al. (2022). The study looked at stock index returns, and it was found that the most prominent market condition that prevailed among the selected stock index returns was the bearish market condition. The sample period of the study caters for the 2007/2008 financial crisis and 2020 covid-19 pandemic. Hence, during these historical events, oil prices was affected negatively due to alleviated volatility which caused decreasing returns over the selected period. Given that these two events cater for majority of the sample period it is accurate to find the bearish market conditions to exist in the oil returns.

4.5.2. Smooth regime probabilities

The smooth and regime probabilities graph associated with oil returns is presented in Figure 1. It is evident that the oil returns remained in bull regime from 2009 to 2010, 2014 to 2016, 2019 to 2022 and in a bear regime between 2010-2014 and 2016-2019. This finding was supported by the high transition probabilities and the constant expected duration of the oil price returns. Moreover, given the 2007-2008 financial crises and Covid-19 pandemic, the periods of bull and bear regimes is consistent with these historical events. It is evident that the oil prices were not significantly affected by the 2007/2008 financial crises as we see that the oil price returns in 2009 was increasing. This suggests the cotangent effect of the 2007-2008 financial crises did not affect oil returns. This is further seen during the period 2019-2022. In 2019 the returns of oil were considered as decreasing, this can be attributed to the start of the COVID-19 were a lot of uncertainty existed in the market, which had a negative effect on oil prices. However, during the COVID-19 period, it is evident that the oil price returns was not affected as it was increasing.

Figure 1: Markov switching soothed regime probabilities



6. CONCLUSION

At the commencement of this study, the academic aimed at investigating the macroeconomic determinates of SA oil price returns under changing market conditions for the period 2009/04-2024/10. The SA oil returns were used as the dependent variable and inflation growth rate, money supply growth rate, short-term interest growth rate, long-term interest growth rate, rand/dollar exchange rate growth rate and GDP growth rate was considered as the independent variable. The study commenced with a descriptive statistical analysis, correlation analysis and stationarity tests with structural breaks on the selected variables. Having found the selected variables to be stationary in levels and with structural breaks, the Markov regime-switching model of conditional mean with constant transition probabilities was estimated as the study had to cater for switching regimes, i.e bull and bear market conditions.

The findings of the empirical model indicated that the macroeconomic determinants of oil returns are regime dependent

and contain alternating efficiency. The findings confirm the theoretical notions presented by the AMH and suggest that when macroeconomic adjustments are conducted by the SARB, authorities need to consider that such changes have an alternating effect on SA oil returns whereby it is regime dependent.

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