The Macroeconomic Determinants of the South African Bond Performance under Different Regimes

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ABSTRACT

The study aims to determine the macroeconomic variables that influence the performance of the South African bond market in different market regimes. Monthly time-series (secondary) data were examined using the Two-Stage Markov Switching regression model. Three dependent variables were examined, namely the all-bond Index (ALBI for the period 1999-2020), corporate bonds index (CBI:1997-2019) and government bond index (GBI:2003-2019) based on data availability. Overall, the results show that the performance of the CBI under the bear regime is largely influenced by exports, fiscal balance, domestic debt, GDP per capita, exchange rate, government debt and inflation while its performance during the bull regime is influenced by changes in the interest rate, exchange rate, exports, government debt, GDP per capita, domestic debt and inflation. The performance of the GBI in the bull regime is highly dependent on the changes in exports and interest rates, whereas its performance in the bear regime does not depend on the macroeconomic variables. The ALBI's performance in the bear regime is owed to changes in the domestic debt, interest rate and inflation whereas, in the bull regime, the volatility is explained by changes in fiscal balance, inflation, domestic debt, GDP per capita, exchange rate and interest rate. It is clear from the result of the study that different macroeconomic variables affect different indices in the South African Bond market under different market conditions.

Keywords: Bond performance, macroeconomic variables, regime changes, Markov Models.

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1. INTRODUCTION

Bonds are debt instruments that allow the lending of money under set terms. Typically, the issuer who, is the borrower, is obligated to pay the holder or the lender interest in the form of

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fixed payments at specified dates referred to as the coupon (CFI, 2021). The principal amount borrowed is paid at the end of the period often referred to as the maturity date. An efficient bond market contributes to sustaining economic stability and reduces foreign risk (Mu, Phelps and Stotsky, 2013). From an investor point of view, bonds provide an alternate investment opportunity for investors to earn a return at or greater than inflation without the extreme volatility of the stock market (Campbell, 2019). Bonds also help investors to diversify their portfolios.

Mu *et al.* (2013) states that African bond markets have been steadily growing in recent years, but nonetheless remain undeveloped. On the contrary the South African Bond Market is well developed and accounts for many of the transactions across the African markets (Mu et al., 2013). Although South Africa lags in terms of competitiveness, it was ranked 59 out of 63 countries for overall global competitiveness (Global Competitiveness Report, 2020); - it performed extremely well in terms of financial markets performance (Fanta and Makina, 2018).

In terms of government bonds, the main determinants: of bond performance and yield include the government debt-to-GDP ratio, potential growth, money market rate (monetary policy effect), and inflation, (Poghosyn, 2012). Like government bonds, corporate bond prices are influenced by the general economic climate, prevailing interest rates and the creditworthiness of the issuer (Kenny, 2021). Additionally, Lui (2013) points out that corporate bond and stock prices respond quickly to company information on company earnings releases, release of information on company assets, as well as credit ratings announcements.

Events or trends that widely affect and/or influence the economy as a whole are referred to as macroeconomic factors (CFI, 2020). They are normally categorised as positive or negative. Positive factors are those that contribute to economic growth and stability, while the negative is those that bring uncertainties in the economy. Macroeconomic factors are important as they are indicative of the current state or performance of the economy and are used to forecast future economic activities. Gross Domestic Product (GDP), interest rates, inflation, unemployment levels, money supply, stock markets and exchange rates, are among the key macroeconomic variables that mostly appear in financial literature (Gupta, 2013). The macroeconomic environment is vital since it significantly influences the behaviour of financial markets, including the bond market. For instance, rapid economic growth- usually leads to an increase in demand- which in turn, results in price increases- which further leads to an increase in the potential earnings of investors.

Moreover, a slow economic growth which can usually be indicated by a rise in the unemployment rate-which lowers the level of confidence in investors, a decrease in demand-which then decreases the GDP of a country- may all lead to a decline of prices of tradable instruments a result of which will be a decline in the potential earnings of investors in a financial market (Mosteanu, 2017). There are very few studies that investigate the determinants of bond market performance, particularly the macroeconomic determinants (Ahwireng-Obeng and Ahwireng-Obeng, 2020).

The bond market, similar to any other financial market, is sensitive to shifts from one type of behaviour to another and back again, in the context of this study; these changes are referred to as regime changes. Regime changes can lead to either a rise or decline in bond prices-these are known as price reversals (Chen, 2009). The majority of previous financial literature which studies the interdependence of the bond market and the stock market of a particular country, concludes that the stock and bond markets are negatively correlated with one another (Cheng and Yang, 2017). This means that when the stock markets are experiencing bearish trends-the bond markets will in turn, experience a rise in prices, this is mostly evident in times of crises

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in the economy. This is due to the fact that during uncertain times, investors tend to move their funds to bonds as they are perceived to be safer investments than stocks during crises.

During this global pandemic, interest rates in South Africa were cut by 300 basis points in total in 2020 (Businesstech, 2020). The consequence of this is an increase in the demand for bonds that are already on the market, as they offer higher yields than the newly issued bonds-which the effect of which is the rise in bond prices. A rise in inflation, however, causes a decline in the price of bonds, due to a deteriorated purchasing power of future cash flows expected from the bon (Campbell, Shiller and Viceira, 2009). These scenarios may explain changes in bond markets, certain changes are caused by unobservable factors. Farag and Cressy (2010) state that unobservable factors, either temporary or permanent, no matter if they are from the macro or microenvironment- are the most important when analysing price reversals in the financial markets.

Despite the tendency of the bond market to undergo shifts in behaviour, most of the studies on macroeconomic determinants of bond market performance/behaviour do not consider regime changes in bond market behaviour. This study, therefore, assesses the determinants of bond performance under changing regimes, using the Markov-switching models to capture the behavioural or regime shifts. The Markov-switching models have been prominent in Finance as they have a clear impact in handling the shift in behaviour (Brooks, 2019). The use of the Markov-switching model helps to detect potential regime shifts in the financial market returns and investigates the impact of crises on the volatility of these markets.

According to Muzindutsi and Obalade (2020)**,** bond markets undergo changing behaviour, known as regime changes. These changes increase the volatility of the market (Haynes, 2017). An increase in market volatility of a financial market increases the risk to all stakeholders of that particular market (O'Mahony, 2018). In particular, increased market volatility in the South African bond market causes price risks relating to prices and yields of bonds (Domanski and Neuhaus, 2014). All stakeholders of the South African bond market will be exposed to these risks. In order to protect these stakeholders against such risks, it is essential to study the changes in regimes, while studying the macroeconomic determinants of the South African bond market performance. It was also observed that the few studies that address the macroeconomic determinants of bond market performance do not consider them solely and they are combined with other factors.

2. LITERATURE REVIEW

2.1 Theoretical Framework

In the literature reviewed, various theories of determinants of bond performance were studied. One of the theories relevant to this paper- is the Arbitrage Pricing Theory (APT) which by definition is a mathematical model which contains multiple factors that describes how forecasted return and risk of financial market securities are related and it measures a security's predicted return which is derived from the sensitivity of the security to different macroeconomic conditions (Adam, 2020). APT considers many macroeconomic variables including the interest rate, energy prices and inflation rates to name a few, and how these factors affect security returns such as the stock markets returns, and bond markets returns (Adam, 2020). Since the bond market is also affected by these factors, the APT is relevant to the proposed study because the study is based on the macroeconomic determinants that affect the bond market under the changing regimes

It was found that there are various variables that have an impact on bond performance. In terms of sovereign bonds these are interest rates, inflation, economic growth, liquidity, volatility and a country's credit rating (Meyer et al. 2020). According to Perego (2013), an international study

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conducted between 2003-2009, it was revealed that global perception of local markets impacted on yield spreads. When analysing corporate bonds, it is evident that in addition to these external factors there are internal factors such as firm size, bond rating and term of the bond (Ahwireng-Obeng and Ahwireng-Obeng, 2020). These are independent variables whilst the dependent variable is yield spread.

The bond's market is affected by many factors including both the institutional factors such as, macroeconomic aspect, institutional factors, transaction costs, power between rich and poor countries, rule of law, return on investment, cooperation between institutions and culture (Ferrini, 2012), but in this study, we will focus on macroeconomic aspects. The influences of the macroeconomic factors have imposed some challenges on the bond's market like an exchange rate which has proved to have countervailing effects on the bond's market (Mu et al., 2013). Further, a fixed exchange rate on the bond's market induces some shifts or movements on the market since investors will be motivated to buy more bonds (Mu *et al.*, 2013). Inflation rate is another macroeconomic variable. Inflation rate is defined as an increase in general price level (Friday, 2020). A low inflation serves as an encouragement to the investors, and it encourages fixed income securities in the market since there is a high correlation between interest rate and inflation rate (Christensen, 2004). A high inflation causes a negative shift on the bonds market due to its effects on investors (Friday, 2020). Milaljek, Scatigna and Villar (2002) discovered that high inflation rates and fiscal deficits also discourage short term and long-term investments which results in a negative shift in the bond's market.

2.2. Empirical Review:

i. International

Studies conducted on international markets include an older study by Matthew and Robert (1999) which suggests that the volatility of bond returns and the expected returns change radically during regime switches. A global study done by Timmermann (2011) discovered that changes in the state of the economy, investor expectation, consumption, or dividend growth results in a regime change. Furthermore, Chkili and Nguyen (2014) analysed two regime changes namely the Low volatility (first regime) and the high volatility (second) regimes which the stock returns for the BRICS (Brazil, Russia, India, South Africa, and China) countries undergo. The study further concluded that, irrespective of the market, the odds of lingering in the second/high volatility regime are lower than that of being in the first/low volatility regime. According to the study, in the BRICS countries' stock markets, the low volatility regime tends to persist for longer periods than the high volatility regime. It concluded that stock returns are not significantly affected by exchange rate movements in both regimes due to the availability of currency derivatives used to hedge against currency risks.

Min (1999) concluded that high solvency and liquidity ratios have a negative impact on bond yields while deteriorating macroeconomic factors such as domestic inflation and debt-to GDP cause inverted yield curves in Latin countries. Eichengreen and Luengnaruemitchai (2004) conducted a study on the factors responsible for the underdevelopment of the bond market in Asia and it focused on the financial crises that Asian countries faced in 1997-1998. This study showed that the slow pace of the development of the local bond markets in Asia is a phenomenon with multiple dimensions such as corruption, bureaucracy, market size, and poor standard of living for the country's citizens. Nonetheless, Bhattacharyya (2013) examined the factors that affect the bond market development in Asian economies by determining the relationship of the bond issuance with selected financial and economic factors. Based on the findings of the study, the openness of an economy, the level of economic development, the economy's size, banking system and exchange rate variability were very significant at determining the bond market development in Asian economies. The study even found that even

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though the Asian's bond market has recently experienced growth, the size of the bond market has remained low.

A similar study by Poghosyn (2014) found that growth rates are one of the most significant of all the explanatory variables on yields, whilst Perraudin, and Taylor (2003) in their study using Eurobonds found liquidity to be the key explanatory variable on corporate spreads. On the other hand, Alfonso, Arghyrou and Kontonika (2012) conducted research among ten-euro countries and concluded that sovereign ratings have, over time, become a significant determinant of bond performance. Utama and Agesy (2014), and Anderson and Lavoie (2004) found that an increase in interest rates and exchange rates would cause bond yields to increase. The level of investor risk also influences the yield of bonds. When investors are more risk averse, they tend to hold onto bonds, thus decreasing its yield. When investors become more risk seeking, they sell their bonds and invest in more risky investments, thus increasing its yield as it is now more liquid once again.

In Malaysia, Yeaned and Chen (2019) evaluated the factors that affect the government bond yield of Malaysia by using an autoregressive distributed lag model in order to conduct data analysis. According to the findings of the study GDP growth rate explained the variation in Malaysian government bonds significantly. In addition, exchange rate, foreign interest rate and GDP have a positive effect on the Malaysian government bond yield. In the long run study further found that there are only three factors that affect the Malaysian bond yield namely second lagged FED rate, first lagged value of GDP growth rate and first lagged value of bond yield.

Similarly, Ameer (2017) examined the effects of expected inflation rate, interest rate changes, and stock market return on aggregate state and bond issuance in two Asian countries namely Malaysia and Korea using VAR and Variance decomposition techniques. Based on the findings of the study there is a bivariate relationship between interest rate changes and bond issuance in the case of Korea while in the case of Malaysian, the stock returns have a strong impact on the bond issuance instead of the equity issuance.

In developed markets, Guidolin, Orlov, and Pedio (2014) investigated the effects of shocks to the Treasury yield curve and employed a three-state Markov switching and a single-state both are vector autoregressive (VAR) models. The authors conclude that the non-switching VAR does not capture the dynamics of the data. It is further concluded that, none of the shocks (excluding operation twist) are capable of persistently lowering spreads-they attribute this finding to the fact that when there are shocks to the treasury yield curve, there will be negative expectations about the business cycle-which will then affect bond risk premia. However, because the operation twist has the ability to flatten the risk-free yield curve while concurrently not creating expectations of a rise in future inflation levels, it is thus capable of lowering corporate yield.

Grandes, Samoa and Akindele (2017) investigated the structural, financial, development, institution and macroeconomic factors that influence the bond market development of countries that are developing and emerging such as South Africa or Colombia. Based on the Prais Winston and system GMM procedures, a combination of structural, institution, and financial factors had a major impact on bond markets. The study further found that economic size, GDP per capita and trade openness, had a positive relationship with the bond market size, on the other hand factors such as fiscal policy and interest rate had a negative relationship with the development of the bond market.

Bao, Van, and Bao (2020) employed the M-GARCH model to assess the relationship between Vietnam stock and bond market during the 2010s-decade and COVID-19, as reflected by

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volatility spill-overs and returns. They found that from 2010-2019, bond yield was negatively affected by past VN Index returns. However, during the COVID-19 period, their findings revealed a negative bidirectional relationship between past return, a significant and positive co-movement between bond price and stock returns, and a flight to quality effect in Vietnam financial markets was found, after the VN Index and bond yield pseudo portfolio was assessed.

SImoski (2019) studied the impact of short-term, long term and inflation rates as well as economic activity on government debt across Brazil, Mexico and Columbia. One of the key findings of the study was that like in many other studies interest rates is an important long-run determinant of government bond yields. In addition, economic activity had a positive relationship with government bond yields whilst the inflation rate and government debt to deficit ratios had mixed effects on government bond yields across the different countries and different bond terms. In the examination of domestic sovereign bond yields in twelve (12) emerging countries Hari Naidu et al. (2016) similarly found that of the seven (7) explanatory variables used in their study, the US 10-year benchmark bond yields, government debt to GDP ratio, the volatility index and real interest rates -had a positive and significant impact on the government bond yields, whilst the Federal Reserve rate and the oil price was negative and significant. The influence of inflation was negative but insignificant.

Gill (2018) conducted a study across the Eurozone's and found that the GDP growth rate, the debt-to-GDP ratio, inflation, interest rate, deficit to GDP ratio and market expectations as measured by the VSTOXX are key determinants of bond yields across the Eurozone (France, Italy, Spain, Germany, Britain and Greece). Gill commented that the disparity is due to country specific factors, with Greece an anomaly due to the financial crisis that it faced at the time. Perego and Vermeulen (2013) analysed the correlation between two zones within the euro zone using government finance, GDP, interest rates and the current account as explanatory variables and geographical location as the dependent variables. The results of the study indicated that inflation, GDP and the current account had an influence on the correlation coefficient.

Hamid et al. (2019) conducted a study on a sample of 36 corporate bonds on the Indonesian Stock Exchange. The results of their study indicated that company size and yields have an inverse relationship, this can be explained by the fact that investors looking to invest in smaller companies are looking for high yield. In terms of liquidity, it is common for issuing companies to have a high value hence the result that liquidity had no impact on bond yields. The authors suggest that the negative correlation between leverage and yields is a result of the high level of inflation that existed at the time. Hamid et al. (2019) explain that profitability has had no impact on yields as profitability indicates that the company is secure, and risk is low. Finally, the test results for bond ratings were negative and not significant as bond ratings would have remained stable over the period of the study. In addition, a study by Gubareva (2020) concluded that the spread between the bid and offer price levels of high yield bonds is between the range of 55-60% higher than the bid/ask spread of investment grade bonds.

ii. Africa

Christensen (2004) analysed the domestic debt market in Sub-Saharan African countries. The findings indicated that domestic debt markets in Africa are not broad, but they consist of small debt markets. Fredericks (2014) conducted a study on the factors that impact the bond market size, the findings indicate that exports and fiscal policy do not effect on the size of the bond market whilst, an improving exchange rate, rising interest rates and GDP per capita had a positive impact on the size of the bond market. Samouni et al (2017) supported this view adding that the size of the economy, measured by the per capita GDP, has a huge positive impact on the development of a local sovereign bond market. Relevant to the aforementioned studies, Kapingura and Makhetha (2014) assessed the relationship between the bond market

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development and economic development in Africa with more focus on South Africa over a period from 1995-2012. The findings revealed that there is a positive correlation that exists between economic growth and the bond market development. Mandigma (2021) documented a long run association between exchange rate and foreign direct investment (FDI) in South Asian while Lee and Fernando (2021) confirmed FDI- and export-induced economic growth in Indonesia.

In addition, Musah, Acquah and Adjei (2019) examined the effect of the bond market factors on the development of the bond markets in Ghana. The study used a vector correction model to analyse data and in order to test for stationarity of the variables the study used Augmented Rickey fuller test and Johansen cointegration test. The results of the paper revealed that bank size, money supply, external debt, and the size of the economy affect the development of the corporate bond market in Ghana. The study also found that in turn the level of economic development, budget deficit and the bank's size significantly have an effect on the government bond market in Ghana.

Mu, Phelps and Stotsky (2013) studied the nature of the bond market in Africa and maintained that although the bond market in Africa is growing very fast, the market is still underdeveloped. Using the econometric models such as pooled ordinary least squares, random and fixed effects models, they found out that the bond market has a positive relationship with improved institutions, interest rate risk and it has an inverse relationship with the government budget shortfalls, decreasing interest rates and exchange rates. The same study also found out that the underdevelopment in African markets is due to failure of the local currency bond market's improvements. The research conducted by Friday (2020) about the macroeconomic determinants of bond market development, had similar findings; the exchange rate, interest rate, inflation, and the development of the banking sector have a negative effect on the bond market in Nigeria.

iii. South Africa

Raider et al (2016) studied 106 corporate vanilla bonds in South Africa and one of their key findings was that bond performance is significantly influenced by the level of volatility exhibited and for these investors requires compensation in the form of higher returns. In addition to volatility, the study also found that interest rates and the slope of the yield curve also impact yield spreads. However, Ngabirano (2016) assessed the impact of size of firm; bond rating; interest rates, inflation, exchange rates, stock index and domestic borrowing on yields. Using a sample of 18 corporate issues, the study found that although these factors collectively had an impact on bond performance, each factor on its own had an insignificant impact on bond performance. This is important as it highlights that bond yields are impacted by multiple factors.

Contrary to Ngabirano (2016), Zhou (2020) found the main determinant of the long-term bond yield to be the short-term interest rates. Zhou (2020) states that in the short-run, economic growth and the bond yield have a positive relationship, however, this relationship changes and becomes negative in the long run. The results from this study also found that inflation, exchange rates, and bank financing are negatively correlated with bond yields. Similar to Ngabirano (2016) conclusions, a recent study by Slusarczyk, Meyer and Neething (2020) states that when the exchange rate depreciates, accompanied with simultaneous increases in inflation and rising debt levels it is more likely to cause a rise in bond yields which will in turn lead to a rise in debt repayments. These findings were also consistent with the comprehensive study of the macroeconomic determinants of bonds across 28 African Countries, by Ahwireng-Obeng and Ahwireng-Obeng (2020), which showed that an increase in inflation, central government debt, GDP at PPP, GDP per capita, and fiscal balance have a negative impact on sovereign

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bond, bond index return, and deteriorating bond yields. The analysis indicated that an increase in external debt, exports, domestic debt, and exchange rate have a positive impact on sovereign bond, bond index returns and improving bond yields.

Muzindutsi and Obalade (2020) conducted a study on the South African Bond market and found that changes in political, economic, and financial risk have a positive effect on bond return and bond yield spread in bear markets, whilst they have little or no effect on bond return and bond yield spread in bull markets. Nonetheless, Nhlapo and Muzindutsi (2020) findings contradicted the aforementioned conclusions by Muzindutsi and Obalade (2020) and revealed that as economic risk increases in the short run, bond yield decreases in tandem-suggesting that there is a negative relationship, as opposed to a positive one between economic risk and bond yield. Nhlapo and Muzindutsi (2020) also concluded financial markets are negatively affected by increases in country risk shocks. One of the reasons for the differences in the findings of Muzindutsi and Obalade (2020) and Nhlapo and Muzindutsi (2020) is that they used different estimation techniques. Both bond markets and equity markets are affected by these risks.

The research gaps exist on the study of the determinants of the bond market, particularly in SA. For example Friday (2020), Kapingura and Makhetha (2013), Ahwireng-Obeng and Ahwireng-Obeng (2020), Aman, Isa and Naim (2020) are recent studies involving the macroeconomic determinants of the SA bond performance. However, none of these articles account for regime changes. This indicates a need for research to be done to examine the determinants under changing regimes to bridge the gap. Moreover, studies like Roubaud and Arouri (2018) that use the regime switching model or framework are mostly focused on stock markets or based on other countries. There are very few studies which use the regime switching model in the context of South Africa. For those studies that are South African based, they do not study the macroeconomic determinants of the SA bond market. For example, Muzindutsi and Obalade (2020) only focus on the effects of country risk shocks on the South African Bond Market under changing regimes. The proposed study therefore addresses the above gaps in the existing literature by examining the macroeconomic determinants of the South African bond market performance under different regimes.

3. DATA AND METHODOLOGY

This section discusses the data used and the method adopted in this study. Choosing the correct methodology is essential to obtain accurate results. This particular study is quantitative in nature and involves the analysis of the South African bond market and the effects of certain macroeconomic variables on this bond market under different regimes. The data used in this study is time-series data and the variables are studied over a long period of time. This section consists of three subsections namely, sample period and justification which will discuss the variables that is analysed in this study, empirical model which discusses the model that is adopted and used, and lastly the estimation technique which entails the statistical methods that will be used for estimation.

3.1. Sample period and Justification

The data used in this study focuses on time series data with a monthly frequency over the period 1997-2020 for the corporate bond index, 2003-2019 for the government bond index and lastly, 1999-2020 for the all-bond index. The difference in the study periods is due to data availability. The sample covers three identifiable time periods, namely, the post-apartheid period (Muzindutsi and Obalade, 2020), the global financial crisis, and the recent events affecting the bonds market such as Covid-19. The financial crisis and the Covid-19 pandemic effects on the data can be accounted for by using the regime switching model. The study is based on the SA Bond market and was conducted based on the macroeconomic determinants on the SA bond

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market. The data used in this study: 10 Year Government Bond Yields, All Bond Index (ALBI), Corporate Bond Yields, Consumer Price Index, Exchange Rate and Inflation Rates are sourced from Investing.com, IRESS, ABSA SA, Stats SA, Infront, and Stats SA respectively

3.1.1. Dependent variables

There will be three dependent variables in this study: the government bond, corporate bond, and the all- bond index performance. This will help deduce how each of the bonds are affected and how they each react to the changes in regimes. The All-bond Index will help with clarifying how these different types of bonds collectively react to regime changes. All these dependent variables will be specific to the South African bond market. The government bond will be measured as the logarithm of all outstanding government bonds which will be expressed as a percentage of GDP. Corporate bonds will be measured in a similar manner; the logarithm of all outstanding corporate bonds which will be expressed as a percentage of GDP (Ahwireng-Obeng and Ahwireng-Obeng, 2020). Lastly, the All-Bond Index performance which is a measure of the joint market capitalization of both government and corporate bonds which will serve as a measure of performance for the aggregate bond market (Nkwede, 2020).

3.1.2. Independent variables

Following literature on this topic (Ahwireng-Obeng and Ahwireng-Obeng, 2020, Essers, Blommestein, Cassimon and Flores, 2016, Eichengreen and Luengnaruemitchai, 2004, Smaoui, Grandes and Akindele,2017 and Meyer, 2019), the independent variables include:

i. Interest rate

The official interest rate in South Africa, the repo rate, is set by the Monetary Policy Committee (MPC) of the SARB (tradingeconomics, 2021). Theoretically, bond performance is influenced by interest rates in that, when interest rates increase, causing a decline in the price of bonds, in turn causing a rise in the bond yields-since there exists an inverse relationship between bond prices and yields (Kenny, 2021). However, when interest rates surpass bond yield rates, there will be a decline in the demand for bonds, vice versa. Therefore, interest rates are hypothesized to have an inverse relationship with bond performance (Meyer, 2019).

ii. Exchange rate

South Africa uses a free-floating/flexible exchange rate regime-which means that the ZAR/USD exchange rate is determined by the market demand and supply forces (Rahman and Ghosh, 2011 and Miyajima,2020). Investors' decision to either invest or hold their funds is encouraged by the uncertainty of the exchange rate movements, which is highly dependent on investors' expectations (Meyer, 2020). Consequently, the exchange rate is hypothesized to either have a negative or positive impact on the bond yield (Meyer,2020).

iii. Fiscal balance

This is measured by taking the total of all government revenues and subtracting the expenditures made by the South African government (South African market insights, 2020). The significance of the fiscal balance to the bond market is largely influenced by prudent fiscal policy. Larger government bond markets are by virtue of larger fiscal deficits, considering an enhancement in the fiscal balance reduces the need for government bond financing (Smaoui et al., 2017). On the grounds that the improvement would signal additional available funds and therefore, there would not be any incentive in seeking more funds by ways of bond issuance. Bond market is inversely related to the fiscal balance (Smaoui et al., 2017). According to Ahwireng-Obeng and Ahwireng-Obeng (2020), for economies with low inflation rates, a positive relationship is expected between larger fiscal deficits and larger government bond

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markets. Fiscal balance is hypothesized to have a negative impact on the bond market. Fiscal balance data was obtained from Statistics South Africa and National treasury website

iv. GDP

According to literature (Eichengreen and Luengnaruemitchai, 2004, and Ahwireng-Obeng and Ahwireng-Obeng, 2020), GDP at PPP is used as a proxy for the economy size. Investors may view risks in larger economies to be lower than those in smaller ones (Eichengreen and Luengnaruemitchai, 2004, Smaoui et al.,2017, Ahwireng-Obeng and Ahwireng-Obeng, 2020. Some of the reasons for this are that larger economies are able to reach the scale efficiencies necessary to attain deep and liquid markets, additionally, funds raised from larger economies are enough to draw interest from foreign investors and multinational companies (Eichengreen and Luengnaruemitchai, 2004, and Ahwireng-Obeng and Ahwireng-Obeng, 2020). Smaller economies on the other hand offer less diversification benefits for investors when compared to larger ones. Therefore, lending risks and costs may be higher in smaller economies thus hindering governments from obtaining finance through bonds. Whereas, in larger economies it is more likely that financing may be obtained through bonds since additional financing may be required in addition to banks (Ahwireng-Obeng and Ahwireng-Obeng, 2020). Economic size is especially vital for the bond market since additional financing over and above the banking system may be required in larger economies, consequently, bonds are issued to meet the additional demand for financing. GDP at PPP is therefore hypothesised to have a positive relationship with bond market performance.

v. Inflation rate

In South Africa, the inflation rate is measured by the consumer price index (CPI) which represents the cost of living for an average consumer (StatsSA, 2020). The CPI is computed by calculating the total cost of an average consumer's fixed basket of goods and services over 12 months (Shahriya, Jeyhun and Fariz, 2019). Inflation is hypothesised to either have a negative or positive impact on the bond yield depending on the number of investors that are motivated to invest when inflation is rising. Fewer investors may be motivated to invest in bonds given the likelihood that the bond's yield may not be able to keep up with the rising cost of inflation. On the other hand, more investors may be motivated to invest given the increased interest payments after the adjustment to rising inflation (Meyer, 2020).

vi. GDP per capita

GDP per capita represents the degree of economic development, since it considers facets of underdevelopment which are not considered by other explanatory variables (Ahwireng-Obeng and Ahwireng-Obeng, 2020, and Mu et al., 2013). As seen in the study done by Smaoui, Grandes and Akindele (2017) indicated that GDP per capita was a significant factor in determining bond market performance. The expected relationship between bond market indices and GDP per capita is a positive relationship as GDP per capita increases the bond market indices increase.

vii. Exports

Exports show the relationship of a country with the rest of the world. More precisely, it is used as a proxy for trade openness and is expressed as a percentage of GDP (Eichengreen and Luengnaruemitchai, 2004, and Ahwireng-Obeng and Ahwireng-Obeng, 2020). If a country trades with other countries it gets exposed to market discipline and thereby increases the attention of domestic investors to bonds (Ahwireng-Obeng and Ahwireng-Obeng, 2020). For instance, if there are capital controls in place, this can drive corporations and governments to explore funding from local markets, more precisely, domestic bond markets than external sources (Ahwireng-Obeng and Ahwireng-Obeng, 2020, and Mu et al., 2013). Data from IMF

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Database and South African Treasury Document. Strong exports generally mean a strong currency, which is favourable to bonds. Typically, those countries that export more than they import would have a strong trade account and this would assist their currency, which is favourable to bonds. The expected relationship between bond market indices and exports is a positive relationship; as exports increases the bond market indices increase.

viii. Domestic debt

This is used as a proxy for the size of the banking sector and represents the domestic debt given to the private sector and is expressed as a percentage of GDP (Ahwireng-Obeng and Ahwireng-Obeng, 2020, and Mu et al, 2013). It is often argued in literature that bonds and banks compete with each other for investors, therefore, this means that if the size of the banking sector is large it discourages the use of bond financing since it drives greater bank lending (Ahwireng-Obeng and Ahwireng-Obeng, 2020). The expected relationship between domestic debt and bond market indices is a negative relationship whereby, as the domestic debt increases the bond market indices will fall.

ix. Central government debt

Following Ahwireng-Obeng and Ahwireng-Obeng (2020), the central government debt all-inclusive stock of direct government fixed term contractual duties due to distinct parties at a specific time. A rise in central government debt increases aggregate demand thereby increasing both nominal and real interest rates. This, therefore, provides higher returns for investors. However, risk averse investors may shy away from bonds when interest rates are volatile or too high Ahwireng-Obeng and Ahwireng-Obeng, 2020). Data was taken from the South African Reserve bank. The expected relationship between central government debt and bond market indices is an indirect proportion relationship whereby, as central government debt increases the bond market indices will be expected to fall.

3.2. Empirical Model

This section introduces the Markov regression models that will be used in the study to show the shifts or movements in the bond's market and the impact of the changes in the macroeconomic variables. The MSM was used based on its suitability to investigate the effects of the macroeconomic variables on the bond market. The study has three dependent variables namely All bond index, corporate bonds, and government bonds while the independent variables are the macroeconomic variables.

The models used in the study are as follows:

$$Gov.Bond\ Index = \alpha_{S_t} + \beta_{S_t} INFL_t + \beta_{S_t} DD_t + \beta_{S_t} ED_t + \beta_{S_t} FB_t + \beta_{S_t} INT_t + \beta_{S_t} CD_t + \beta_{S_t} ER_t + \beta_{8_{S_t}} GDP_t + \varepsilon_{S_t t} \quad (1)$$

$$Corp.Bond\ Index = \alpha_{S_t} + \beta_{S_t} INFL_t + \beta_{S_t} DD_t + \beta_{S_t} ED_t + \beta_{S_t} FB_t + \beta_{S_t} INT_t + \beta_{S_t} CD_t + \beta_{S_t} ER_t + \beta_{8_{S_t}} GDP_t + \varepsilon_{S_t t} \quad (2)$$

$$ALBI = \alpha_{S_t} + \beta_{S_t} INFL_t + \beta_{S_t} DD_t + \beta_{S_t} ED_t + \beta_{S_t} FB_t + \beta_{S_t} INT_t + \beta_{S_t} CD_t + \beta_{S_t} ER_t + \beta_{8_{S_t}} GDP_t ** + \varepsilon_{S_t t} \quad (3)$$

INF_1 represents the inflation, DD_1 represents the domestic debt, ED represents the external debt, FB_1 represents the change in fiscal policy, ER_1 represents changes in exchange rate, GDP_1** represents gross national income at PPP, CD1 represents the change in central government debt while INT_1 represents the change in interest rate. ALBI, Corp and Gov represent the dependent variables which are all bond index, corporate bonds, and government bonds respectively. S_t

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represents the regime or state while the state-dependent $\boldsymbol{\beta}_{i_{S_t}}$ are state dependent coefficients, and $\boldsymbol{\varepsilon}_{S_t}$ is the switching- or state-dependent error term.

4. ANALYSIS AND INTERPRETATION

The MSM results for the corporate bond index are presented in the first column of Table 1A. Under the high volatility(bear) regime, the interest rate is insignificant, suggesting that it is not an important macroeconomic determinant of the bond market under this regime. The fiscal balance is significant at the 5% level. Exports, domestic debt, GDP per capita, exchange rate, government debt and inflation are significant at all levels, in determining corporate bond index. Exports, inflation, fiscal balance, and domestic debt have a positive impact on the corporate bond index while the exchange rate, government debt and GDP per capita have a negative impact on the corporate bond index.

In the bull regime, the fiscal balance is insignificant while the interest rate is significant at the 5% level. Exchange rate, domestic debt, government debt, GDP per capita and inflation are significant at all levels, which indicates that any changes in the aforementioned independent variables will surely affect the CBI. The fiscal balance only impacts the index in the high volatility regime. Exports changed from having a positive impact in the high volatility regime to being negative in the low volatility regime. Similarly, the impact of the government debt changed from being negative in the bear regime to being positive in the bull regime. Inflation and the domestic debt both have a positive effect on the index in both regimes, with a higher impact in the low volatility regime. GDP per capita and the exchange rate both negatively impact the corporate bond index, their effects are higher in the high volatility (bear) regime than in the low volatility regime. An increase in GDP per capita, exports, exchange or exchange rate will reduce the CPI in the bear regime.

MSM results for the government bond index are presented in the second column of Table 1. Eviews could only generate results with GDP as a non-switching regressor and three variables (exchange rate, inflation, and government debt) excluded. Per capita GDP has a positive and significant influence on the government bond index. In the low volatility regime, fiscal balance and domestic debt are insignificant while exports and interest rates are significant, having negative and positive effects, respectively, on the government bond Index. Thus, the volatility of the government bond index in the bull regime is attributable to interest rates and the level of exports. All the explanatory variables do not pose significant impact on GBI in bear regime.

Column 3 of Table 1 above shows the MSM results for the third dependent variable, All-bond index. GDP per capita, fiscal balance, and exports are all insignificant in the high volatility (bear) regime. Government debt and domestic debt are found to have a significant and positive impact on the ALBI. Similarly, inflation was also found to have a positive and significant relationship with the Index. As expected, the relationship between the all-bond index and the interest rate was found to be negative and significant, and this is in line with the theorems developed by Malkiel (1962).

In the low volatility (bull) regime, fiscal balance and GDP per capita remain insignificant but export has a significant positive impact on ALBI. The exchange rate, exports, and interest rate have a negative and significant relationship with the index. The interest rate has the hypothesized sign. The inflation rate, government debt, and the domestic debt are significant and positive in the low volatility regime; however, domestic debt does not have the expected sign.

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Table 1: MSM results for CBI, GBI and ALBI

	CBI		GBI		ABI	
Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Regime 1 (bear)			**Regime 1 (bull)**		**Regime 1 (bear)**	
C	-18.68393	0.2007	1086.953	0.0001	-168.1481	0.0000
CPI	1.727238	0.0000	-	-	7.896964	0.0000
EXCH	-3.108478	0.0000	-	-	-4.305842	0.0001
EXPO	4.363657	0.0000	-46.32495	0.0000	-0.723164	0.1646
FISCAL	0.184211	0.0001	0.049421	0.8861	0.031971	0.6413
GDEBT	-0.837305	0.0000	9.488011	0.5069	0.847175	0.0458
GDP	-13.95832	0.0000	-	-	-3.317869	0.3224
RATE	0.545441	0.1400	78.12166	0.0000	-4.380817	0.0002
LDOMDEBT	6.203357	0.0000	-	-	17.71151	0.0000
Regime 2 (bull)			**Regime 2 (bear)**		**Regime 2 (bull)**	
C	79.71504	0.0000	-54.16135	0.0542	-117.2470	0.0000
CPI	1.189110	0.0000	-	-	7.903266	0.0000
EXCH	-1.283729	0.0000	-	-	-5.391013	0.0000
EXPO	-0.789235	0.0000	0.312170	0.9376	-2.647194	0.0000
FISCAL	0.008487	0.6182	0.063685	0.6075	0.110130	0.1393
GDEBT	0.327014	0.0000	0.323975	0.9654	0.530043	0.0006
GDP	-5.644078	0.0000	-	-	-2.705876	0.0995
RATE	-0.196724	0.0270	-7.126495	0.2820	-3.967145	0.0000
LDOMDEBT	3.450754	0.0000	-	-	16.79792	0.0000

Source: Authors' estimation (2021)

Fiscal balance and GDP per capita are not significant in both regimes. Although the interest rate is significant and negative in both regimes, it is, however, more negative in the low volatility regime. Domestic debt has a much higher impact on the low volatility regime. Lastly, the exchange rate is significant and negative in both regimes, more negative in bull regime. Therefore, the volatility of the ALBI in the bear regime can be attributable to the domestic debt, interest rate and inflation, government debt, exchange rate. Whereas, in the bull regime, the volatility is explained by changes in inflation, domestic debt, exchange rate and interest rate and government debt.

Table 2: Constant transition Probabilities and expected duration for CBI, GBI and ALBI

	CBI		**GBI**		**ALBI**	
Constant transition probability	**Regime 1 Bear**	**Regime 2 Bull**	**Regime 1 Bull**	**Regime 2 bear**	**Regime 1 Bear**	**Regime 2 Bull**
Regime1	0.936931	0.063069	0.982053	0.017947	0.935147	0.064853
Regime2	0.018170	0.981830	0.013833	0.986167	0.067401	0.932599
expected durations	**Regime 1**	**Regime 2**	**Regime 1**	**Regime 2**	**Regime 1**	**Regime 2**
	15.85563	55.03556	55.72081	72.29262	15.41952	14.83650

Source: Authors' estimation (2021)

Based on the results in Table 2, the probability of the CBI of being in a high volatility regime and continue to be in that regime the following month is approximately 93.7%, while the probability of the CBI being in a high volatility regime in the current month but switch to the low volatility regime in the following month is approximately 6.3%. If the index is currently

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in a low volatility regime, its probability to remain there and not switch in the next month is 98.2%, while the probability of the CBI switching to the high volatility regime in the next period is 1.8%. The high volatility regime is expected to last for approximately 15 months, while the low volatility regime is expected to last for approximately 55 months. This finding is consistent with Chkili and Nguyen (2014), as they concluded that, in the BRICS countries' stock markets, the low volatility regime tends to persist for longer periods than the high volatility regime.

Table 2 shows that if the government-bond index is currently in the low volatility(bull) regime, there is a 98,2% chance that it will not switch, and it will continue to be in the low volatility regime in the following quarter, and approximately 1.8% chance that it will switch to the high volatility regime in the next month. If, however, the government bond index is currently in the high volatility (bear) regime, there is a 99% chance that it will not switch from the high volatility (bear) regime but remain there in the following month. The probability that it will switch from high volatility regime to the low volatility regime, in the following month, is approximately 1%. Although the differences are not as much, this is a similar finding with that of Chkili and Nguyen (2014), who found that the probability of being in the low volatility regime and staying in that regime, was lower than that of being in the high volatility regime. CBI is expected to be in the low volatility regime for approximately 55 months, and high volatility regime for approximately 72 months.

Table 2 further shows that if the ALBI is currently in the high volatility regime, there is a 93,5% chance that it will not switch, in the following quarter, and approximately 6,5% chance that it will switch to the low volatility regime in the next quarter. If, however, the all-bond index is currently in the low volatility regime, there is a 93,3% chance that it will not switch, that is, in the following month, it will still be in the low volatility regime. The probability that it will switch to the high volatility regime, in the following month, is approximately 6.7%. The high volatility regime is expected to last for approximately 15 months, while the low volatility regime is expected to last for approximately 14 months.

This study incorporates Huber-White estimator to deal with autocorrelation in the three MSM models results. The data do not follow normal distribution in all of the three models. However, by reason of their volatility clustering and condition non-normality, in many cases, the economic and financial data have leptokurtosis which contributes to the data being fat-tailed and skewed, and not following a normal distribution (Coleman and Mansour,2005). The problem, however, does not invalidate regression results, (Tabachick and Fidell, 1989).

5. CONCLUSION

This study investigated how the South African Bond Market is influenced by the selected macroeconomic variables in different market regimes. The study employed the Two-Stage Markov model (MSMs) with three dependent variables, namely the Corporate Bond Index (CBI), the Government Bond Index (GBI), and the All-Bond Index (ALBI). This study found that the corporate bond index is impacted by the exchange rate, a similar finding to that of Mu. et al (2013) and Bhattacharyya (2013). Similar to Milaljek, Scatigna and Villar (2002) the corporate bond index and the all-bond index are significantly affected by changes in fiscal balances and inflation levels. Contrary to Chikili and Nguyen (2014) who concluded that stock returns are not significantly affected by the exchange rate movements in both regimes, this study provides evidence that the bond market is significantly affected by the changes in exchange rates. Interest rate is found to be the key macroeconomic variable in the bond market, which contradicts the findings of Poghosyn (2014) and Perraudin and Taylor (2003).

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In the low volatility regime, the interest rate is found to have mixed results, it affects the CBI and ALBI inversely, but has unexpected sign in relation to GBI. In theory, the interest rate is expected to be inversely related with the bond market performance. Interest rate has the expected sign on the ALBI in bull regime, and CBI in both regimes, which is line with the theory and several literature studies (Meyer, 2019) and Malkiel theorems. Consistent with Meyer (2020), the inflation rate has been found to be positively impacting the ALBI and CBI in both regimes. This contradicts Friday (2020) who found that a higher inflation hinders the development of the bond market. In terms of the government index.

The export affects the three indices negatively in the low volatility regime which contradicts Ahwireng-obeng and Ahwireng obeng (2020) who suggest that an increase in exports will positively affect the bond index. The CBI has expected positive sign vis-à-vis exports in the bear regime, however the coefficient is not significant in relation to GBI and ALBI. Based on the results of this study, domestic debt has a positive effect with the CBI and ALBI in both regimes which is what was expected, the more domestic debt increases so does the bond index. The GDP did not show any effect on the government bond index in both regimes which contradicts with the expected positive effect of GDP as found in Ahwireng-obeng and Ahwireng-obeng (2020) and Smaoui,Grandes and Akindele (2017).

While Chilki and Nguyen (2014) found that the low volatility regime persists longer than the higher volatility regime this study found mixed results. GBI and ABI, both to undergo longer bearish regimes, whereas the CBI stay longer in bull regimes. Additionally, this study finds that the effects that the macroeconomic have on the different indices change depending on the regime. The differences in the results of the three indices could be attributable to the difference in sample size, number of variables included in the estimation, their level of risk which was not accounted for in this study, liquidity, and also their credit rating as it contributes to the level of volatility that each type of bond has-since it shows the level of risk as perceived by investors which then affects their sentiments towards the bond.

The different types of bonds in the South African Bond Market are not influenced by the same macroeconomic variables. The corporate bond index is the only index affected by all the macroeconomic variables in this study, while the government bond index is only affected by exports and interest rates. The all-bond index, on the other hand, is not affected by the changes in government debt and exports. The interest rate is a key macroeconomic variable affecting all the indices, which suggests that interest rate is a key macroeconomic determinant of the South African Bond Market. The SA bonds react differently under each regime and the variables that may affect them in the low volatility regimes are not the same as those that may influence their performance in the high volatility regime. The findings of this study are important for all stakeholders and policymakers, it is recommended that they take into consideration the regime changes when developing policies as that will impact the bond market performance. This study contributes to literature by accounting for regime changes. The influence that these macroeconomic variables have on the South African Bond Market is not predetermined, it is highly dependent on the market and regime. Future research should consider the bond market performance during the global Covid-19 pandemic.

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