Original Research Article

An Empirical Study on Macroeconomic Determinants of Ghana's Bond Market Performance

ABSTRACT

Aims: Ghana's economy has recently faced challenges, including power fluctuations ("dumsor"), financial system clean-up, and the COVID-19 pandemic. These events have severely impacted both the real and the finance sectors of the economy. Hence, this study examined the effects of key macroeconomic factors on Ghana's bond market.
Study design: The study employed a quantitative methodology utilizing secondary data from 1990-2022.
Methodology: The analytical techniques involved both descriptive and inferential statistics. The Johansen cointegration methodology and the vector error correction model (VECM) explored the long-run and short-run relationships.
Results: The results showed that Ghana's bond market responds positively to interest rates, GDP growth, and inflation. Banks' credit to the private sector was also significant. In the short run, only the exchange rate matters, with a positive correlation to bond yield. However, it has a negative impact in the long run.
Conclusion: The key macroeconomic variables that significantly impact bond market performance are the exchange rate, GDP growth rate, and interest rate. However, bond performance is positively impacted by the growth rate in GDP and interest rates and negatively affected by the exchange rate over the long run; only exchange rates have a short-run effect and are positive.

Keywords: Bond, bond market, preferred habitat, liquidity premium theory, exchange rate, interest rate.

1. INTRODUCTION

The financial system comprises institutions such as banks, savings and loan institutions, credit unions, pension funds, and financial markets, in addition to their regulatory and supervisory authorities. Financial markets facilitate the exchange of financial assets such as treasury bills, bonds, and stocks. They promote the flow of funds and thus allow financing and investment by households, firms, and the government (Madura, 2021). A robust financial market is vital in driving economic growth. Similarly, a healthy economy depends on a well-functioning financial market (Avom et al., 2020). It implies that the macroeconomy and financial markets have a mutually beneficial relationship.

Nonetheless, the banking system dominates the financial industry in Africa. According to Aryeetey (2003), the stock and bond markets are relatively new and typically underdeveloped. The reason is that African nations' financial sector reform

initiatives around the 1980s and 1990s facilitated capital markets' growth, particularly stock exchanges like the Ghana Stock Exchange (GSE), regarded as essential means of obtaining capital for long-term investments (Kenny & Moss, 1998; Madura, 2021). According to Ezeoha et al. (2009), overstating long-term capital's role in a nation's economic progress is impossible. The bond market contributes significantly to the expansion and development of national economies, particularly in emerging and developed markets (Ezeoha et al., 2009). More money is required as economies expand to keep up with fast expansion and maintain growth. The bond market provides long-term funds that businesses and governments can use to finance their long-term projects. For developing economies, particularly sub-Saharan African countries, which have historically relied significantly on short-term funding from the banking industry, the efficient operation of the bond market is essential (Owusu-Ankamah & Sakyi, 2021).

Bond market growth provides significant advantages to a nation's financial system and economy, positively impacting economic growth (Pratiwi & Matrodji, 2021). A bond constitutes a financial contract in which a borrower (issuer) promises to repay a lender the amount borrowed together with interest within an agreed-upon predetermined date (Fanta, 2017). The issuer must pay the borrowed amount (principal) and interest to the investor within a specified timeframe (Ferreira et al., 2020). Debt securities, including domestic and international bonds, are issued and sold on the bond market. Government, municipal, and corporate bonds comprise most domestic bond markets. These securities make it easier for investors to transfer money to issuers for various purposes, including ongoing operations, business expansions, and government projects (Owusu-Ankamah & Sakyi, 2021).

Popov (2018) defines macroeconomics as the study of the behaviour and structure of the economy. According to Dhony et al. (2019), macroeconomic variables significantly affect the economy locally or globally, influencing all parties involved, including business owners, clients, the government, firms, and other service providers (Dhony et al., 2019). Macroeconomic factors affecting a nation's overall economy include Gross Domestic Product (GDP) and its growth rate, interest, inflation, exchange rates, fiscal and debt balances, and unemployment rates (Elly & Oriwo, 2013; Sprcic & Wilson, 2017). This study examines how these variables influence the bond market in the short and long run. This academic curiosity was instigated to understand better how the bond market responds to changes in macroeconomic conditions. In Ghana, this area of research has yet to receive much attention. Most studies have concentrated on how macroeconomic factors affect the stock market (Adam & Tweneboah, 2008; Akosah, 2016; Asravor et al., 2021), with limited studies focusing on specific markets such as the bond market.

Our search found one study by Moro and Opoku (2022). They concentrated on how macroeconomic factors affect government bonds without considering corporate bonds. The entire bond market consists of treasury bonds and corporate bonds. Moro and Opoku's study focused on one side of the market. Given this limitation, they recommended that further studies "delve into the relationship between macroeconomic variables and bond prices of corporate bonds" (Moro & Opoku, 2022, p. 580). This study, however, fills this gap by considering both government and corporate bonds traded on Ghana's Fixed Income Market (GFIM) of the GSE using the average yearly bond yields as the endogenous variable. Using the average yearly bond yield as a measure of bond market performance, according to Nkwede (2020), "captures the overall market size and depth" (p. 185). The study seeks to establish how these macroeconomic conditions impact Ghana's bond market in the short and the long run.

The key macroeconomic indicators that impact bond market performance, as revealed in the literature review, include interest rates, inflation rate exchange rates, and GDP (Siahaan & Panahatan, 2019; Permanasari & Kurniasih, 2021; Kurniasih & Restika, 2021; Nkwede, 2020; Koroleva & Kopeykin, 2022; Moro et al., 2022). In most studies, the interest rate negatively impacts the bond market (Barr & Campbell, 2016; Nkwede, 2020; Moro et al., 2022). Inflation affects the bond market in various ways. In some studies, inflation negatively affects the bond market (Paisarn, 2012; Nkwede, 2020; Moro et al., 2022) but has a positive effect (Kurniasih & Restika, 2021; Koroleva & Kopeykin, 2022), with studies such as Permanasari and Kurniasih (2021) showing no effect. Regarding the exchange rate, reviews have revealed adverse effects (Nkwede, 2020) and mixed results over the short and long term (Syarif et al., 2021; Moro et al., 2022). Concerning the impact of GDP on the bond market, the literature shows that GDP could have a positive effect (Koroleva & Kopeykin, 2022; Moro et al., 2022), an adverse effect (Huang et al., 2019), or no effect (Pratiwi & Mustafa, 2021).

In empirical studies, the bond market's performance has been measured using various indicators. Moro et al. (2022) employed the government bond price as a proxy for bond market performance when evaluating the determinants of Ghana's domestic bond market. Syarif et al. (2021) also employed the government bond yield to measure bond performance in a study to ascertain the exchange rate and bond yield nexus in Indonesia. Using a dataset of 22 Organization for Economic Cooperation and Development (OECD) countries for ten years, Koroleva and Kopeykin (2022) used the government yield as the endogenous variable. In Nigeria, Nkwede et al. (2016) used corporate bond market capitalization as a proxy for developing the corporate market, while in another study, Nkwede (2020) employed bond market capitalization as a share of GDP. Another survey by Nneka et al. (2022) also used total bond market capitalization

as a proxy for the bond market's development. Exploring bond market determinants using 26 developing and emerging countries, Alsadoun (2022) employed three dependent variables:

- total bonds as a percentage of GDP
- government issued domestic bonds as a percentage of GDP
- private sector bonds as a share of GDP

To date, various researchers have employed multiple measures to measure bond market performance: bond price, bond yield, and bond market capitalization (Alsadoun, 2022).

2. MATERIAL AND METHODS

2.1 Research Design.

A longitudinal quantitative research approach was used to investigate the dynamic interaction between macroeconomic determinants and the performance of the bond market in Ghana. The research explored secondary data covering the period from 1990 to 2022 collected from the annual reports of the Ghana Stock Exchange (GSE), World Development Indicators (WDI), and the Bank of Ghana (BoG). Data on interest rates (ITR), inflation (IFR), the growth rate in GDP (GGR), exchange rates (EXR), the banking sector credit to the private sector (BCP), Gross savings (GSV) and bond yields (BDY) were collected. Bond market performance is the dependent variable, whereas the EXR, GGR, ITR, IFR, BCP and GSV are the independent variables. Table 1 presents the details of these variables in terms of their measurement, type, and data source.

Table 1: Study variables

Variable	How it is measured	Variable Type	Source
Bond Market Performance (BDY)	Average Yearly Bond Yield	Dependent variable	Ghana Stock Exchange (Ghana Fixed Income Market)
Interest Rate (ITR)	Average yearly lending rate	Independent variables	Bank of Ghana
Inflation Rate (IFR)	Average yearly inflation rate		World Development Indicators (WDI)
GDP Growth Rate (GGR)	Annual GDP growth rate		
Exchange Rate (EXR)	Average US/GHC exchange rate		
Banks' Credit to Private Sector (BCP)	Domestic credit to the Private Sector as a percentage of GDP	Control variables	
Gross Savings (GSV)	Gross savings as a percentage of GDP		

2.2 Model Specification

Based on Moro and Opoku's (2022) model specification approach, the researchers specified the following econometric model for studying the macroeconomic effects on the bond market, with the variables expressed in semi-log form in the following Lin-log model:

$$BDY_t = \alpha + \beta_1 GGR_t + \beta_2 ITR_t + \beta_3 lnEXR_t + \beta_4 IFR_t + \beta_5 BCP_t + \beta_6 GSV_t + \mu_t \ldots\ldots\ldots\ldots (1)$$

where BDY_t denotes the annual bond yield; GGR_t denotes the growth rate in GDP; ITR_t represents the interest rate; EXR_t represents the exchange rate in period t; BCP_t is banks' credit for the private sector in period t; and GSV_t is the gross savings at time t. Furthermore, α is the intercept, $\beta_1 - \beta_6$ represent the slope coefficient, μ_t is the stochastic disturbance term, and t epitomises the time spanning from 1990 to 2022.

2.3 Estimation Approach

The initial task is to examine the stationarity of the series to avoid spurious regression. The researchers assessed this using the augmented Dicky Fuller (ADF) test at both levels and the variables' first differences. A unit root indicates that the variables are nonstationary. The null hypothesis states that the series contains a unit root (H_0: ρ = 0), whereas the alternative hypothesis assumes no unit root in the series (H_1: ρ ≠ 0). When the tau value exceeds the critical value of the ADF statistic, H_0 is rejected in favour of H_1 (Darko, 2016; Syarif et al., 2021). A rejection of the null hypothesis signifies the series' absence of a unit root.

The subsequent phase involved investigating the presence of cointegration. The examination for cointegration assesses the enduring equilibrium associations among the variables (Al-tarawneh et al., 2020). This was accomplished through the utilization of the Johansen cointegration methodology. The approach employs the maximum likelihood technique to ascertain the presence of cointegrating vectors in nonstationary time series when variables are integrated at the same or different levels (Johansen, 1988; Johansen & Juselius, 1990). However, the same order is most desirable (Nkoro & Uko, 2016; Yussuf, 2022). The Johansen technique has several advantages over similar techniques; hence, the Johansen technique is preferred. According to Nkoro and Uko (2016, p. 254), the cointegration test by Engle and Granger (1987) makes no distinction when more than one cointegrating vector exists. Because the test relies on a "super convergence result," the estimated OLS differs from the "arbitrary normalization implicit in selecting the left-hand side variables for the regression equation," which can alter the test results. When there are multiple cointegrating relationships, the Johansen cointegration technique can be applied, unlike the autoregressive distributed lag (ARDL) approach. It allows testing for

cointegrating vectors besides yielding maximum likelihood estimators of unconstrained cointegrating vectors. Furthermore, it does not rely on arbitrary normalization or no pretesting of unit roots (Nkoro & Uko, 2016).

For the cointegration test, H_0: $\beta_1 = \beta_2 = \ldots = \beta_n = 0$, is the null hypothesis while H_1: $\beta_1 \neq \beta_2 \neq \ldots \neq \beta_n \neq 0$, is the alternative hypothesis. According to the decision rule, the null hypothesis is rejected when the trace statistics or the maximum eigenvalue is less than the 5% critical value. This finding concludes that cointegration exists among the series (Nkoro & Uko, 2016). If cointegration among the independent and dependent variables is discovered, then the long-run and short-run coefficients of the model are estimated by estimating the vector error correction model (VECM) (Al-tarawneh et al., 2020).

It specifies the VECM as follows:

$$\Delta BDY_t = \alpha + \beta_1 BDY_{t-1} + \beta_2 GGR_{t-1} + \beta_3 ITR_{t-1} + \beta_4 lnEXR_{t-1} + \beta_5 IFR_{t-1} + \beta_6 BCP_{t-1} + \beta_7 GSV_{t-1} + \sum_{i=1}^{P} \delta_1 \Delta BDY_{t-i} + \sum_{i=0}^{P} \delta_1 \Delta GGR_{t-i} + \sum_{i=0}^{P} \delta_2 \Delta ITR_{t-i} + \sum_{i=0}^{P} \delta_3 \Delta lnEXR_{t-i} + \sum_{i=0}^{P} \delta_4 \Delta IFR_{t-i} + \sum_{i=0}^{P} \delta_5 \Delta BCP_{t-i} + \sum_{i=0}^{P} \delta_6 \Delta GSV_{t-i} + \mu_t \quad \ldots\ldots (2)$$

where Δ is an operator denoting the first difference, p is the lag order determined from the Akaike information criterion (AIC), α is the drift, δi are short-run parameters, and βi are the long-run multipliers. The remaining variables are as defined previously. In this case, the equilibrium model over the long run can be represented as:

$$BDY_t = \alpha + \sum_{i=1}^{P} \beta_1 BDY_{t-i} + \sum_{i=0}^{P} \beta_1 GGR_{t-i} + \sum_{i=0}^{P} \beta_2 ITR_{t-i} + \sum_{i=0}^{P} \beta_3 lnEXR_{t-i} + \sum_{i=0}^{P} \beta_4 IFR_{t-i} + \sum_{i=0}^{P} \beta_5 BCP_{t-i} + \sum_{i=0}^{P} \beta_6 GSV_{t-i} + \mu_t \ldots\ldots\ldots\ldots (3)$$

The short-run model also becomes:

$$\Delta BDY_t = \alpha + \sum_{i=1}^{P} \delta_1 \Delta lnBDY_{t-i} + \sum_{i=0}^{P} \delta_1 \Delta GGR_{t-i} + \sum_{i=0}^{P} \delta_2 \Delta ITR_{t-i} + \sum_{i=0}^{P} \delta_3 \Delta lnEXR_{t-i} + \sum_{i=0}^{P} \delta_4 \Delta IFR_{t-i} + \sum_{i=0}^{P} \delta_5 \Delta BCP_{t-i} + \sum_{i=0}^{P} \delta_6 \Delta GSV_{t-i} + \varphi ECM_{t-1} + \mu_t \ldots\ldots (4)$$

where ECM_{t-1} represents the lagged error correction term and its coefficient, and φ is the speed of adjustment to equilibrium. The sign of φ is expected to be negative and statistically significant.

2.4 Post Estimation Tests

The post-estimation tests include the Lagrange multiplier (LM) to determine the existence or otherwise of autocorrelation, normality testing using the Jarque-Bera approach, and the eigenvalue stability condition to determine the model's stability. These tests help determine the goodness of fit of the vector error correction model (VECM).

3. RESULTS AND DISCUSSION

3.1 RESULTS

In this section, the researchers present the results of both the descriptive and the inferential analyses. It specifically comprises descriptive statistics, correlation analysis, pre-estimation tests, cointegration, error correction models, and postestimation diagnostic tests.

Table 2: Descriptive Statistics

Variable	Bond Yield (BY)	Inflation Rate (IFR)	Interest Rate (ITR)	Exchange Rate (ER)	GDP Growth (GGR)	Gross Savings (GSV)
Mean	15.180	21.083	31.378	1.860	5.242	14.822
Standard deviation	5.014	13.642	6.878	2.124	2.487	5.688
Maximum	22.720	59.462	46.720	8.272	14.047	22.872
Minimum	6.450	7.144	20.610	0.033	0.514	3.882
Skewness	-0.141	1.211	0.508	1.339	1.386	-0.615
Kurtosis	1.744	3.518	2.125	3.930	6.120	2.087
Observations	33	33	33	33	33	33

Source: Authors' Computation, 2024

Table 2 shows that the average bond yield in the market over the period under consideration was 15.18%, with the lowest yield being 6.45% and the highest yield being 22.72%. The average inflation rate was 21.08%, reaching a minimum of 7.14% and an overall high value of 59.46%. The interest rate averaged 31.38%, with the highest reaching 46.72% and the lowest reaching 20.61%. This is a testament to Ghana's high interest (lending) rate regime. For the exchange rate, the minimum rate was GHC0.033 to the dollar, with a maximum of GHC8.27 and an average of GHC1.86. The growth performance was remarkable over the period, averaging 5.24%, with the highest growth being 14.05% and a low growth of 0.51%. The standard deviation shows a more significant variability in some variables, particularly the inflation and interest rates. The mean national savings rate is 14.82% of GDP, ranging from 3.88% to 22.87%.

Skewness statistics describe the degree of asymmetry in the distribution of a series relative to its means. Table 2 indicates that the growth rates in GDP, interest rates, exchange rates, and inflation exhibit a positive skew. This suggests the variables have a long tail on the right side suggesting a positively skewed distribution. The bond yield and savings exhibit a negative skew, suggesting that a long tail on the left side characterizes their distribution. Kurtosis quantifies the degree of deviation from a standard distribution curve, indicating whether it is flatter or more peaked. The normal distributions are mesokurtic, platykurtic, and leptokurtic when the kurtosis is 3, less than 3, and greater than 3, respectively. According to Table 2, the bond yield, interest rate, and savings are platykurtic, whereas the inflation, exchange rate, and GDP growth rate are leptokurtic.

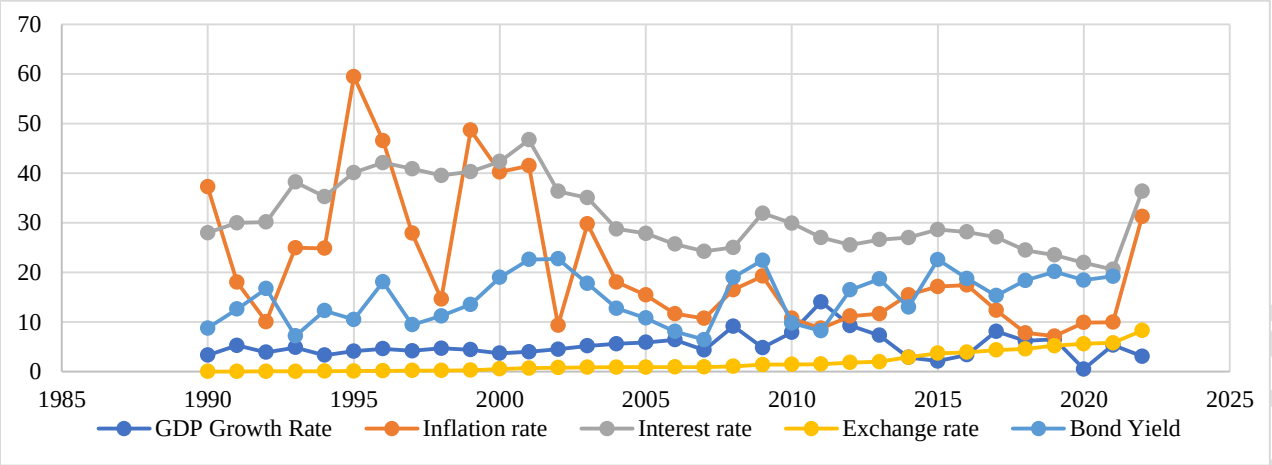

Figure 1: Trend analysis of the study variables from 1990 to 2022
Source: Authors' Computation, 2024

Figure 1 presents the trend analyses of the study variables. The exchange rate generally trends upwards. This is explained by the Ghana Cedi's continuous depreciation to the US dollar. Similarly, interest rates continued to trend up until 2001, when they reached their highest value of 46.72%. Beyond that time, it has consistently declined, although comparatively, it is very high. The rate of inflation shows considerable volatility over the period. A downward trend was observed after reaching its highest point of 59.46% in 1995. It should be mentioned that before 2003, the rate at which prices rose was extremely high, at over 30%. However, it moderated after the year 2003, with rates hovering around less than 20%.

The growth performance was quite impressive during this period. In 2011, when it reached its peak of 14.05%, it started trending downward until it reached its lowest point in 2015. Between 2012 and 2015, Ghana experienced serious power crises that negatively affected its productive sector and capacity. Hence, the poor growth performance. As the situation was brought under control and things began to improve, in 2019, the COVID-19 pandemic struck. With its attendant layoffs, lockdown, and a general halt in economic activities, the economy suffered a setback, bringing growth to its record low of 0.51%. The bond yield also presents an exciting trend. This shows that the yield is subject to some volatility. It reached the worst performance of 6.45% in 2007; perhaps the market responded to uncertainties surrounding the 2008 general elections. Beyond that, the bond yield steadily increased.

It needs to be emphasised that the bond yield and interest rates gap was initially wider, but it became closer with time. This means that initially, raising money from the bond market costs bond issuers less than borrowing from financial institutions. With time, this spread has approached to the extent that it was almost at par in 2021. The time series graph in Figure 2 shows some comovement among the variables.

Table 3: Matrix of correlations

Variables	BDY	GGR	IFR	ITR	EXR	BCP	GSV
BDY	1.000						
GGR	-0.211	1.000					
IFR	-0.037	-0.342	1.000				
ITR	0.029	-0.285	0.761	1.000			
EXR	0.451	-0.095	-0.349	-0.469	1.000		
BCP	0.315	0.320	-0.427	-0.392	0.407	1.000	
GSV	0.362	-0.541	0.144	0.164	0.313	-0.038	1.000

Source: Authors' Computation, 2024

Table 3 shows that two explanatory variables are highly correlated and can cause multicollinearity. For instance, the interest rate (ITR) and inflation rate (IFR) are strongly correlated (correlation coefficient = 0.761). Due to the strong correlation between the two variables, the IFR was removed from the remaining analyses to avoid any potential multicollinearity problems.

Table 4: Unit Root Test (level variables)

Variables	t-stats	Critical values			P value	Order of Integration
		1%	5%	10%		
BDY	-6.6950*	-2.4310	-1.6870	-1.3050	0.0000	I(0)
GGR	-2.705***	-3.709	-2.983	-2.623	0.0732	I(0)
ITR	-1.653	-3.709	-2.983	-2.623	0.4556	-
lnEXR	-1.925	-3.709	-2.983	-2.623	0.3204	-
BCP	-1.856	-3.702	-2.980	-2.622	0.3531	-
GSV	-2.717***	-3.702	-2.980	-2.622	0.0711	I(0)

*Significant at 1%; **significant at 5% and ***significant at 10%.
Source: Authors' Computation, 2024

The ADF test was utilised to ascertain the existence of unit roots in the series. At the levels with one lag, bond yield and GDP growth were the only stationary variables at 5% and 10%, respectively. With a zero lag, gross savings also became significant at 10%. The implication is that the H_0 cannot be rejected for interest rates, exchange rates, and banks' credit to the private sector, indicating that those variables are nonstationary at the levels.

Table 5: Unit Root Test (First difference variables)

Variables	t-stats	Critical values			P value	Order of Integration
		1%	5%	10%		
BDY	-6.631*	-3.709	-2.983	-2.623	0.0000	I(1)
GGR	-4.459*	-3.716	-2.986	-2.624	0.0002	I(1)
ITR	-2.743***	-3.716	-2.986	-2.624	0.0669	I(1)
lnEXR	-3.413**	-3.716	-2.986	-2.624	0.0105	I(1)
BCP	-8.281*	-3.709	-2.983	-2.623	0.0000	I(1)
GSV	-6.859*	-3.709	-2.983	-2.623	0.0000	I(1)

*Significant at 1%; **significant at 5% and ***significant at 10%.
Source: Authors' Computation, 2024

After taking the first difference of all the variables with the same lag, all variables are now stationary. As shown in Table 5, since the t-statistics for all six variables are more than the critical values of the ADF statistics at different significance levels (i.e. 1%, 5%, and 10%), the null hypothesis that the series contains unit roots is rejected. Based on this result, we conclude that the series are integrated of order one, i.e. I(1).

Table 6: Optimal Lag Length

lag	LR	df	p	FPE	AIC	HQIC	SBIC
0				410843	29.9531	30.0417	30.236
1	217.35	36	0.000	2898.59	24.9409	25.5611	26.9212*
2	82.679	36	0.000	2854.36	24.5727	25.7245	28.2502
3	136.1*	36	0.000	977.266	22.3624*	24.0457*	27.7373

*Indicates significance; selection-order criteria; sample: 1994-2022.
Source: Authors' Computation, 2024

The ideal lag length is four, as shown in Table 6. The AIC, HQIC, and LR criteria selected three lags, whereas the SBIC criterion selected one lag. Since AIC has the least meaningful value, it becomes the preferred choice. Therefore, the preferred number of lags is three. In Table 5, the series are integrated of order one. The subsequent task is to analyse the equilibrium relationships among the variables in the long run. The appropriate test based on the above orders of integration is the Johansen cointegration, which Johansen (1988) and Johansen and Juselius (1990) introduced, as cited in Nkoro and Uko (2016). Table 7 presents the results.

Table 7: Johansen Cointegration Test

Max. rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	78	-321.26226	.	199.6983	94.15
1	89	-289.94211	0.87607	137.0580	68.52
2	98	-265.44388	0.80470	88.0615	47.21
3	105	-242.58813	0.78210	42.3500	29.68
4	110	-230.62005	0.54971	18.4139	15.41
5	113	-221.4414	0.45769	0.0566*	3.76
6	114	-221.41312	0.00188		

Source: Authors' Computation, 2024

Table 7 demonstrates the outcomes of the Johansen test for cointegration. The trace statistics for the first four ranks exceed the 5% critical values. However, the trace statistic for the fifth (5th) rank, 0.0566, falls below the critical value of 3.74. Consequently, the null hypothesis is rejected, indicating that no cointegration is warranted. The insight drawn from this outcome is the existence of cointegration, showcasing a long-run equilibrium relationship amidst the bond market performance and the predictors: GDP growth, exchange rate, interest rate, banks' credit to the private sector, and

savings. This also implies that despite short-term shocks potentially impacting individual series movements, they eventually converge over time in the long run.

Table 8: Johansen normalization restriction imposed (long-run)

beta	Coefficient	Std. err.	z	P>|z|	[95% Conf	Interval]
_ce1						
BDY	1	.	.	.	.	.
GGR	.6235936*	.373121	1.67	0.095	-.10771	1.354897
ITR	.2470162**	.113323	2.18	0.029	.0249071	.4691252
lnEXR	-3.260834***	.9274778	-3.52	0.000	-5.078657	-1.44301
BCP	.698046**	.2876058	2.43	0.015	.1343489	1.261743
GSV	.052781	.1641496	0.32	0.748	-.2689463	.3745082
Constant	-33.53116	.	.	.	.	.

*** p<.01, ** p<.05, * p<.1*

Source: Authors' Computation, 2024

The findings in Table 8 reveal that economic growth, interest rates, and banking sector credit exert a statistically significant long-term positive impact on bond market performance in Ghana performance in Ghana. This signifies that a 1% rise in the real GDP growth rate causes a 0.62% increase in bond yield. Likewise, a 1% increase in the interest rates and banking sector credit leads to a 0.25% and 0.70% gain in bond market yield, respectively. Conversely, the exchange rate negatively influences the bond market performance over the long term.

Table 9: Estimation results using the vector error-correction model (short-run)

	Coef.	St. Err.	t value	p value	[95% Conf	Interval]
ECM (-1)	-.776***	.226	-3.43	.001	-1.219	-.333
∆BDY	.151	.188	0.80	.422	-.218	.52
∆GGR	.491	.381	1.29	.197	-.256	1.239
∆ITR	.028	.293	0.09	.924	-.546	.602
∆lnEXR	15.737**	7.808	2.02	.044	.433	31.041
∆BCP	.098	.564	0.17	.862	-1.008	1.204
∆GSV	-.15	.239	-0.63	.531	-.618	.319
Constant	-.367	1.544	-0.24	.812	-3.394	2.66

Mean dependent var	-0.057	SD dependent var	1.428
Number of obs.	31.000	Akaike crit. (AIC)	25.60125
R-squared	0.4321	Log likelihood	-343.8194
Chi^2	17.49831	P>chi^2	0.0253

*** p<.01, ** p<.05, * p<.1*

Source: Authors' Computation, 2024

Therefore, it may be inferred that in the long run, the pivotal macroeconomic variables significantly influencing the bond market are the real GDP growth rate, interest rates, and exchange rates. Furthermore, the importance of banking sector credit is equally underscored.

Table 9 also outlines the short-term outcomes. The exchange rate exhibits a positive statistically significant impact on bond market yield in the short run. Specifically, a Cedi-induced rise boosts the bond yield by GHC15.74. Consequently, in

the short term, only exchange rates wield a causal effect on Ghana's bond market performance. It is crucial to note that while exchange rates favourably influence bond market yield in the short run, the direction shifts over the long term to negative. This implies that the currency exchange benefits foreigners during the investment period. Nonetheless, upon maturity of the investment, converting returns into foreign currency exposes them to currency risk, hence the adverse long-term impact.

The estimated coefficient for the error correction (ECM(-1)) or adjustment (ADJ) term is -0.776, exhibiting both statistical significance and a negative sign, aligning with expectations. This outcome further validates a long-term causality flowing from the explanatory variables considered to the response variable. Significance is observed for the adjustment or error correction term at the 1% level, indicating that past year's deviations or errors are rectified within the current year at a rate of 77.6%. Consequently, if disparities between long-term and short-term equilibria exist, approximately 77.6% of these inconsistencies will be rectified. Furthermore, the coefficient of determination (R^2) value is 0.4321, indicating that the explanatory variables explain around 43% of the variation in bond yield. The chi-squared test's significance further reinforces the model's explanatory capability. Following the regression examination, several diagnostic evaluations were conducted, the outcomes of which are described below.

Table 10: Diagnostic tests

eigenvalue		modulus
Test	lag	value	p value
Lagrange-multiplier test	1	32.206	0.650
	2	34.025	0.563
Jarque-Bera test		1.495	0.473
1		1
1		1
1		1
0.474	+ .4485199i	0.652
0.474	- .4485199i	0.652
-0.440	+ .3737247i	0.577
-0.440	- .3737247i	0.577
-0.499		0.499
-0.325		0.326
-0.103		0.103

Source: Authors' Computation, 2024

The outcomes of the post-estimation diagnostic tests for the model are presented in Table 10. These assessments encompass the autocorrelation test using the Lagrange multiplier (LM), normality testing using the Jarque-Bera's test, as well as eigenvalue stability conditions for VEC estimates. The probabilities (0.650 and 0.563) for lag orders 1 and 2 of the

Lagrange multiplier test indicate support for the null hypothesis of no autocorrelation. This result signifies no autocorrelation or serial correlation in the residuals. Correspondingly, Jarque–Bera's test fails to reject the H_0, suggesting that the disturbances in the bond yield model adhere to a normal distribution. Finally, the eigenvalue stability condition enables us to verify the correct specification of the cointegrating equations. Given K response variables as well as the 'r' number of cointegrating equations in a VECM, the companion matrix will possess the 'K-r' unit of eigenvalues. The VECM specification entails 5-unit moduli, implying stability since the remaining *r* eigenvalues' moduli are strictly below one. The stability assessment did not reveal any model misspecification, as none of the remaining eigenvalues indicate proximity to unity.

3.2. DISCUSSION

The study's outcomes revealed that the exchange rate significantly impacted the bond market's performance in the short term. This indicates that none of the other crucial macroeconomic determinants, such as the growth rate in GDP, interest rates, or the other two control variables, influence the bond market's performance in the short term. In the long term, however, while variations in economic growth, interest rates, and banks' credit to the private sector positively affect Ghana's bond market, the exchange rate negatively influences the market. This indicates that bond yield increases with enhancements in the growth rate in GDP, interest rates, and banks' credit to the private sector and declines when exchange rates improve. The positive correlation between interest rate and bond yield, although not significant in the short term, suggests that the yield curve inclines upwards, implying that long-term rates are higher than short-term rates. This discovery is consistent with the preferred habitat (liquidity premium) theory's proposition (Mishkin, 2019; Hongmei, 2021).

Moreover, the findings demonstrate that the exchange rate is the sole macroeconomic determinant impacting Ghana's bond market in the short and long term but with varying effects. This discovery is in line with Syarif et al. (2021), who determined the relationship between the exchange rate and bond yield in Indonesia and revealed that it was positive for the initial three months but later turned negative. However, no relationship was observed in the long run. Francová (2017) also found that bond prices and their return are positively associated with the exchange rate.

Conversely, Varirahartia and Marsoem (2022) did not identify any impact on the yield by the exchange rate when utilizing Indonesian treasury bonds. Nkwede (2020) discovered that exchange and inflation rates detrimentally influence the bond market in Nigeria. In stark contrast to this study's findings regarding the GDP growth rate and exchange rate, Moro et al. (2022) ascertained that the latter had a notably negative impact in the short term. However, in the long term, a significant positive effect was evident. Concerning GDP, they observed a substantial positive influence in the short run but in the long

run the effect on the price of treasury bonds was positive and insignificant. Huang et al. (2019) identified a negative correlation, while Pratiwi and Mustafa (2021) observed no impact. Through evidence from 22 OECD countries, Koroleva and Kopeykin (2022) unveiled that per capita GDP and inflation influenced treasury bond yields positively in the short term. They also determined that inflation adversely affected treasury bond prices in the short and long term. In this study, inflation was dropped at the initial stages of the analyses due to collinearity issues.

Interest rate fluctuations affected the bond market positively in the long run. Similarly, Ogilo (2014) revealed that interest rates positively affected Kenya's bond market, whereas in the United Kingdom, Barr and Campbell (2016) determined that the relationship between short-term interest rates and bond market's performance was inverse with no long-term causation. The discussion above suggests that the exchange rate, GDP growth rate, interest rates, and inflation are critical macroeconomic factors impacting the bond market. However, this impact varies across studies and time. This result has important implications because Ghana's bond market responds to the behaviour of the economic environment. For this reason, policy makers, especially monetary authorities, should work to stabilise the exchange rate due to its detrimental effect on the economy. The study concentrated on analysing how macroeconomic factors impact the bond market. One area that another study can also explore is the role of institutions in the bond market performance and macroeconomic conditions' nexus.

4. CONCLUSION

The study assessed the short-and long-term effect of several key macroeconomic factors on Ghana's bond market using annual time-series data spanning from 1990 to 2022. Empirical research has shown a correlation between macroeconomic variables and the performance of Ghana's bonds in the long term. The key macroeconomic variables that significantly impact bond market performance are the exchange rate, GDP growth rate, and interest rate. However, bond performance is positively impacted by the growth rate in GDP and interest rates and negatively affected by the exchange rate over the long run; only exchange rates have a short-run effect and are positive. Therefore, these macroeconomic conditions significantly impact Ghana's long-term bond market performance. However, in the short run, only exchange rates matter.

The following recommendations are deduced based on the findings of the study.

1. Policymakers (the Ministry of Finance, the Bank of Ghana, and other allied Ministries) urgently need to implement strategies to stabilize the Ghana Cedi-Dollar exchange rate. In the short to medium term, these strategies could

include intense public education to reorient Ghanaians against external orientation and the benefits of domestication.

2. Efforts must also be made to intensify the One District One Factory (1D1F) policy through the import substitution industrialisation strategy in the medium to long term. This will go a long way toward achieving sustained economic growth, reducing imports, and strengthening domestic currency.
3. Although inflation was not explicitly analysed in this study, its impact must be considered, primarily through the interest rate channel. The study suggests rigorous monetary policy and the effective management of variables influencing changes in the inflation rate to improve bond market performance.

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