NATURAL GAS EXPORTS AND NIGERIA'S FOREIGN RESERVES GROWTH

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ABSTRACT

This research examined the contribution of natural gas exports to Nigeria's foreign reserves in the past two decades using data on Natural Gas export, foreign reserves trends, exchange rate and GDP growth. The study covered 2000 through 2022. Methods of analyses include descriptive statistics, ADF test for stationarity, Error Correction analysis and the Granger causality. The research found that gas export positively impact foreign exchange reserve. The estimated ECT -1 established that 104% of existing dis-equilibrium between the short and long term dynamics were adjusted annually among the series. The study recommends that Nigeria needs to intensify efforts toward developing its gas industry so as to be reckoned with as a major supplier at the international scene, who is capable of meeting the needs of both domestic and international markets, and thus increase its foreign reserve through gas exports.

Keywords: Natural Gas Export, Foreign Reserves, Error Correction Term
JEL Classification Code: Q43, Q48

1. INTRODUCTION

Energy plays a critical role globally, contributing practically to all of the activities that make contemporary life possible, (Kabeyi & Olanrewaju, 2022). Without heat, light, and electricity, which are from various sources such as natural gas, it is impossible to develop or operate industries and towns that supply commodities, employment, and housing, much alone enjoy amenities that make life more pleasant and joyful (Occhlall & Falchetta, 2018). Gas, as an energy source, is important in shaping economic activities of both emerging and industrialized nations across the globe. It is an energy source that is widely employed for industrial production and energy generation owing to its emission of less carbon than other fossil fuels. As a result, it has become a popular environmentally and economically friendly fuel, (Agrawal, and Soni, 2021).

The natural gas, as a resources, is constitutionally owned and controlled by the sovereign state of Nigeria, (Oni & Nwaechefu, 2023). Nigeria's currently known natural gas reserves, which are mostly situated around the Niger Delta region, have established Nigeria as a major gas domain and as a participant in the global energy market, (Nwaoha, & Wood, 2014). The significant natural gas reserves gained recognition during the late 1990s, when the liquefied natural gas (LNG) industry was established (Areremi & Emaviwe, 2023). The country's involvement in international LNG markets has therefore, encouraged relationships with major energy companies. This, in part, explains the evolution of the country's natural gas export business overtime, with the Bonny LNG terminal playing a key role. The plant includes

numerous liquefaction trains, which increases output capacity Contracts with nations like as Japan, Spain, and the United States highlight Nigeria's prominence in the LNG trade (Al-Kuwari, 2023). Nigerian government has therefore, continued to make frantic efforts towards pushing for the transformation of the nation's gas industry, being aware of its potential positive impacts, (Amuda, Hassan & Subramaniam, 2023). The move was targeted towards achieving the country's Gas Master Plan, in the bid to seek additional viable income source for the country while reducing dependence on oil exports (Usman, 2022). LNG exports have helped generate foreign currency revenues, attract investment, and promote economic development. Nigeria's LNG business has grown significantly, cementing its position as a major gas producer in the continent of Africa. In feature, gas is distinguished for its clarity, devoid of smell and nontoxic qualities. While variants exists, natural gas is mostly made up of methane. Liquefied Natural gas passes through intense cooling technique which helps to reduce capacity and space, allowing for efficient and safe transfer through tankers, (Palestini & Sassu, 2021).

In spite of the gains that comes with the development of the gas industry, several challenges have been the bane of the required progress in the country. In one hand, the business is confronted with infrastructural constraints, fluctuating worldwide energy prices and inadequate and non-functional industry-based policies. Efforts at resolving the challenges include continuous infrastructure investments, regulatory changes, and market diversification to strengthen Nigeria's natural gas export business, (Mmesomachukwu & Uchechukwu, 2024). However, recorded progress is still low. In spite of Nigeria being one of the leading natural gas reservoir in Africa, impact of natural gas sales as a proportion of export basket that contributes to Nigeria's foreign reserves growth has been low. This puts to question the country's ability to harness and leverage the resources for national growth and transformation. Crude oil has had and continues to have a good share of the country's income through export earning even in the face of susceptible oil price. Meanwhile, natural gas which promises a strategic alternative to export revenues, still remain sub-optimally explored. This further engendered the challenge to understanding the degree to which natural gas sales could enhance the country's reserve growth. The challenge of inadequate gas export contribution to Nigeria's reserves is compounded by the country's need to balance domestic energy needs with export commitments, as well as the necessity of investing in the gas sector's infrastructure to optimize production and distribution.

This study observed that several past studies subsumed the strength and potential impact of Natural Gas on foreign reserve under crude oil analysis, (Udo, Umoh, & James, 2024). While a lot of schorlarly works examined Natural gas effects on macroeconomic indicators such as Exchange and inflation rates, national output and investments, (Udoudo, Kalu & Oduola, 2024; Ngwu & Ofoegbu, 2024; Udoudo, Oduola, & Kalu, 2023), others were based on utilization of natural gas in relation to how it impacts the domestic economy, (Ani, & Ikiensikimama, 2020; Ubani & Ani, 2017; Odumugbo, 2010). How natural gas exports impact the reserve growth of the country was eluded in all these studies.

This study, against this backdrop, therefore addresses these questions: What are the trends of natural gas exports and Nigeria's foreign reserves growth? What impact does natural gas export have on Nigeria's foreign reserve growth? Is there any causal relationship between foreign reserve growth and gas exports in Nigeria? To this end, the study describes the trends of natural gas exports and growth of foreign reserves in Nigeria during the period under study, it examines effects of gas exports on foreign reserves of Nigeria and also determines the direction of causation between the key variables.

2. LITERATURE REVIEW

2.1 Conceptual Literature

Natural Gas Reserve

Nigeria's gas reserves represents the largest in Africa and among the first ten globally, with over 180 tcf of confirmed gas reserves. Nigeria's unproven reserve is at the approximate value of 600 (tcf). The country has, however, been recognized as a home to huge reserves of gas, (Eneyo, 2022). The country's gas reserves (associated and non-related) were found to have increased to 200.41 tcf from 192.065 tcf in 2015, indicating that additional natural gas reserves were discovered. Following the estimated discovered reserves and the continuous discovery of new reserves the country's gas industry promises to be a potential large global supplier, (Ayinde, 2021). Globally, the OECD nations account for less than 10% of world reserves, while Russia and Qatar, jointly claim over half of it, (Canton, 2021). In spite of the fact that some countries have the resources in abundance, they have not been producing optimally, hence living most required supplies in the hands of countries smaller reserves, (Adelegan, 2018).

Associated and Non-associated Gas

Basically, when gas is discovered along with crude oil they are referred to as associated gas. It's none associated counterpart, independently exist. According to (Onyi & Nwosu, 2020), around 40% of Nigeria's gas is associated gas, which is extracted with oil. The term "associated gas" refers to a material or component that contains other impurities such as oil and water in its natural form under the earth's surface, or its natural reservoir. Associated gas becomes usable only when all other pollutants, like as oil and water, are separated or pushed out at very high temperatures and pressures, yielding a pure natural gas suitable for consumption. It is widely extracted at numerous flow stations in Nigeria's Niger Delta area, where many flow stations have been developed with purification mechanisms to convert the drilled or extracted associated gas into a purified gas suitable for use. It is also known as related gas since it exists with petroleum. It is not drilled separately or directly like the natural gas, but rather comes in association with oil (Páez, 2024). Non-associated gas, often known as "non-associated natural gas" or "free gas," exists independently of oil deposits. It is usually found in reservoirs where hydrocarbons have collected but there aren't many liquid hydrocarbons (Bilkiewicz & Kowalski, 2020). Unlike associated gas, which is sometimes co-produced with oil, non-associated gas deposits are self-contained and principally comprise methane, along with other natural gas components.

Energy Supply and Potential of Gas in Nigeria

A mature economy is distinguished by its constant energy supply. Any country with an epileptic electricity supply risks losing prospective investors. In Nigeria's power industry, energy production has lasted over 40 years, with hydro-generated power and gas-fired systems holding priority (Ayinde, 2021). The reason being that the country has the feed-resources – water body, coal, gas and oil - in abundance and are widely accessible. Nigeria's proven reserve of coal are substantial, and almost inexhaustible, (Gonzalez, Kirsten and Prchlik, 2018). Approximately 95% of Nigerian coal output are utilised domestically, especially for rail transportation and power generation for domestic and industrial purposes. Compared with each other, Nigeria's natural gas energy is more than double its oil, with a relatively longer time availability projected to endure for more than a century as a local fuel and a significant export (Chanchangi *et al*, 2023). Crude oil, which is the next major energy sources boasts of proven reserve of over 30 billion barrels, with major reserves located at the coasts of the Niger Delta (James, 2020).

External Reserve

The reserve, according to the CBN, is made up of foreign assets or currencies such as foreign bank notes and bonds. The external reserve also consists of other financial instruments of the government. They are assets that are in the custody of the nation's monetary authority. Nigeria's foreign reserves have fluctuated over time, mostly due to an overreliance on crude oil profits. The country's foreign reserves were worth around $2.4 billion in 1982. It further rose to over $200 million in 1983 after which it declined. The values subsequently increased, reaching almost $9 billion and $9.5 billion in 1994 and 2000, respectively. It experienced a slower increase till around 2010. The reserve fell drastically during the regimes of President Good Luck Jonathan and did not recover till the end of the last dispensation. In June 2024, Nigeria recorded an upshoot in its foreign exchange reserve with a record value of approximately $35 billion, (CBN, 2024). Nigeria's foreign reserves are critical to the country's economic environment. It act as a financial cushion against external shocks and uncertainty. Hence, the emphasis on the value of these reserves in keeping a stable currency rate and general economic stability.

2.2 Theoretical Literature

The Export-Led Growth Theory

The export-led growth theory portends that a rise in export aids the growth of a nation. It maintains that the development of an economy may be achieved not only by growing the country's factor inputs, but by raising its export base as well, (Stiglitz, 2018). The theory exerts that export serves as an "engine of growth" in a nation. The export-led growth theory hence holds true that exports, particularly natural gas, has the tendency to boost economic development and help to build foreign reserves by increasing foreign currency profits. This is because increased export profits will help a nation develop reserves and stabilize its economy, (Bada, Adetiloye, Olokoyo & Ukporhe, 2022; Mian, 2020).

Trade and Growth

Cross border trade otherwise referred to as international trade saw its initial theoretical foundations in the work of Adam Smith, and was further developed in the works of other Classical economists in the 19th century, (Bhagwati, 1978). Justification for benefits of trade through specialization later became popularized in the body of literature, (Bhagwati, 1978; Krueger, 1978). While most of the models dwelled on the existing connection between national growth and international trade, trade is however noted to be only one of the variables that imbue growth. Upon these trade models, the world economies engage in buying and selling from and to other countries after specializing in their respective areas of competitive advantage as widely promoted among economic researchers, (Tyler, 1981; Balassa, 1985).

The Dutch Disease Theory

The adverse effect experienced by the real sectors of an economy, caused by the discovery of a large pool of natural resources is referred to as the Dutch Disease, (Bature, 2013). A rise in the revenue base of a country as caused by the booming sector causes the real exchange rate to appreciate, leading to the reduction of export demand of such country. The surge in resources and the subsequent rise in its share of a country's export basket which eventually leads to the appreciation of the nominal exchange rate and rise in price level in the country suppresses the competitiveness of non-resource composition of the export basket of the country, (Bature, 2013). The manufacturing and other real sectors where such non-resources exportable goods were produced becomes threatened as they experience a decrease in production because their relatively high sales price readily discourages foreign buyers. Given that the resultant high price level in the country was caused by the resource boom, exporters of tradable goods may

reduce production because of the higher costs of production they are subjected to. This causes the manufacturing sector activities to shrink while exportable commodities in turn contracts.

2.3 Empirical Literature

Adedoyin, Eboh & Solomon (2022) carried out a study on global energy prices as a moderating variable using Dynamic Ordinary Least Squares (DOLS) approach by incorporating data from 1990-2021. The findings revealed that natural gas exports greatly increase foreign reserves; nevertheless, this connection is heavily impacted by global energy prices. High worldwide prices magnify natural gas exports' favourable impact on foreign reserves, but low prices reduce this benefit. The analysis reveals that Nigeria's foreign reserves development is not just reliant on the amount of natural gas exports, but also on favourable worldwide market circumstances.

Bello & Akanbi (2021) investigated the relationship between natural gas exports and foreign reserves. The analysis, covering the period from 1995 to 2020. The findings showed that there is a unidirectional causality from natural gas exports to foreign reserves. This suggests that changes in natural gas exports can predict changes in foreign reserves, reinforcing the idea that natural gas is a key driver of Nigeria's foreign reserve growth.

Nwosa & Oseni (2021) examined the factors influencing Nigeria's foreign reserves. Using a Vector Error Correction Model (VECM) with data from 1995 to 2020, they discovered a substantial positive link between natural gas exports and foreign reserves. The research indicated that natural gas exports are an important driver of foreign reserve accumulation, although their influence is dependent on the global economic situation and Nigeria's production capability.

Ogbuagu & Ewubare (2020) examined the impacts of natural gas exports on Nigeria's economic stability, with a particular emphasis on foreign reserves. Using Vector Error Correction Models (VECM), the research examined data from 1990 to 2018. The research found that natural gas exports had a favourable but statistically negligible influence on foreign reserves in the near term. However, the long-term effect is very good. The analysis blames this to a delay in revenue collection and obstacles in the global natural gas industry.

Ezeabasili, Mojekwu, & Herbert (2020), examined the influence of energy exports on foreign reserves, with a particular emphasis on natural gas. The authors used a Cointegration and Error Correction Model (ECM) on data ranging from 1985 to 2018. The data revealed that, although natural gas exports have a beneficial impact on foreign reserves, the effect is more obvious with time. The research concluded that external variables such as global market instability and local production problems mitigate the effect of natural gas exports on foreign reserves.

Akighir & Kpoghul, (2020), examined the pass-through impact of oil exports through foreign reserves to economic growth in Nigeria by implementing a system of SVAR and granger causality, with annual time series on oil exports, foreign reserves and gross Domestic Product spanning 1970 through 2018. While a pass-through effect was established from oil exports to economic growth via foreign reserves a uni-directional causality from oil export to foreign reserves was also confirmed

Ugochukwu & Nwafor (2019), researched into the influence of natural gas exports on Nigeria's foreign reserves was conducted using a Generalized Method of Moments (GMM) methodology and covered the period 1990-2017. The research showed that natural gas exports had a favourable and statistically significant effect on foreign reserves. The research also suggested that the advantages might be improved by investing in natural gas infrastructure and implementing stronger fiscal policies to reduce income leakages.

Adewuyi & Lawal (2017) examined the short- and long-term implications of natural gas exports on Nigeria's foreign reserves. The authors utilized data from 1981 to 2015, and their results showed that natural gas exports had a considerable long-term beneficial influence on foreign reserves. The report also underlined the need of stronger governance and effective administration of natural gas earnings in order to maximize their impact on foreign reserves.

3 METHODOLOGY

3.1 Theoretical Framework

This study adopts the export-led growth hypothesis where natural gas is included as part of the export items that contributes to economic growth in Nigeria and raise its external reserves through increased foreign exchange earnings. This proposition implies a positive relationship between natural gas exports and Nigeria's foreign reserve growth, as higher export revenues can enhance the country's ability to build reserves

3.2 Model Specification

- ***Regression Model***

In modeling the impact of natural gas export on foreign reserve growth in Nigeria, the below model, which follows the works of Adelegan, (2018), is specified to capture the interaction of natural gas export and the growth foreign reserve in Nigeria.

$$GFRSV = f(NGXP, GDPGR, TOT, EXCHR) \quad eqn.1$$

Explicitly, the econometric form of equation (1) is specified as

$$GFRSV = \beta_0 + \beta_1 NGXP + \beta_2 GDPGR + \beta_3 TOT + B_4 EXCHR + \mu \quad eqn.2$$

The estimated equation is given as

$$GFRSV = \beta 0 + \beta_1 \mathrm{Ln} NGXP + \beta_2 GDPGR + B_3 TOT + B_4 EXCHR + \mu \quad eqn.3$$

Where GFRSV = Foreign Reserve Growth (%); NGXP = Natural Gas Export (million cubic feet); GDPGR = Gross Domestic Product Growth Rate (%); TOT = Terms of Trade (%); EXCHR= Exchange rate (%); β_0, B_1, β_2, β_3, β_4 = Estimated coefficients; μ = Error Term; Ln = Natural logarithm: t = time 2000 -2022 (23 years)

- ***Granger Causality Model***

The causality between the growth rate of Natural gas exports and Foreign Reserve is captured by the model specified below

$$LnGFRSV = \sum xLnGFRSV + \sum x \log NGXP + \mu \quad eqn.4$$

$$LnNGXP = \sum xLnNGXP + \sum x \log GFRSV + \mu \quad eqn.5$$

3.3 Type and Sources of Data

Annual data which covering twenty two years (2000 through 2022), were used in the research work. The research work employs the use of the series; Terms of trade, Foreign Reserve growth in Nigeria, Exchange rate, Growth rate of GDP and Natural gas exports. Information on the variables were gotten through various Annual Reports of the CBN and the NNPC Ltd.

3.4 Estimation Technique

The analysis begins with a descriptive statistics using the results to determine the averages and normality distribution of the series. The study then use trend analysis to evaluate and identify patterns or changes in the data over time. The analysis then continued with the ADF test for Unit root to determine the variables order of integration. The series are integrated at levels I(0)

and I(1). The ECM confirms the presence of a long and short-run interaction among the series. Granger test for causality was also employed to ascertain if there exist causation between key variables that were used. The causality model is rendered in a pair of equation by switching the role of the variables as dependent and independent in each succeeding equation. Diagnostic checks were conducted to validate the results of the study. They are Serial correlation check and the Residual stability Cumulative Sum of square tests.

4. RESULTS AND DISCUSSION OF FINDINGS

4.1 Descriptive Analysis

Features of the estimated series in the research are described below

Table 4.1: Descriptive Statistics

	GFRSV	NGXP	GDPGR	TOT	EXCHR
Mean	13.43174	22602.09	5.148696	147.3919	199.1335
Median	0.930000	24543.00	5.920000	139.1385	153.8616
Std. Dev.	38.66262	9510.434	3.680050	52.94941	100.1207
Jarque-Bera	13.15885	1.111667	1.887065	1.122953	4.411656
Probability	0.001389	0.573594	0.389250	0.570366	0.110159
Observations	23	23	23	23	23

Source: Authors' Computation

The descriptive statistics table reported the mean of Foreign Reserve growth, Natural Gas Export, Gross Domestic Product growth rate, Terms of Trade and rate of exchange as 13.43, 22602.09, 5.15, 147.39 and 199.13, respectively. Probability value of the Jarque-Bera for Natural Gas Export, Terms of Trade, Gross Domestic Product growth rate and Exchange rate are not statistically significant, hence they are normally distributed, but Foreign Reserve growth is not.

4.2 Trend Analysis

The graphs shown below described the trends of adopted variables used in the research work for the period 2000 through 2022.

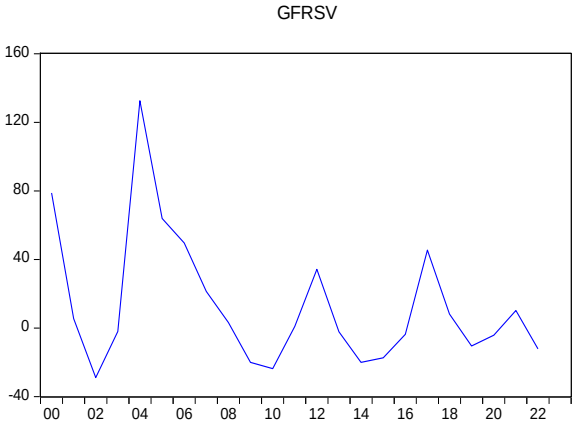

Figure 1

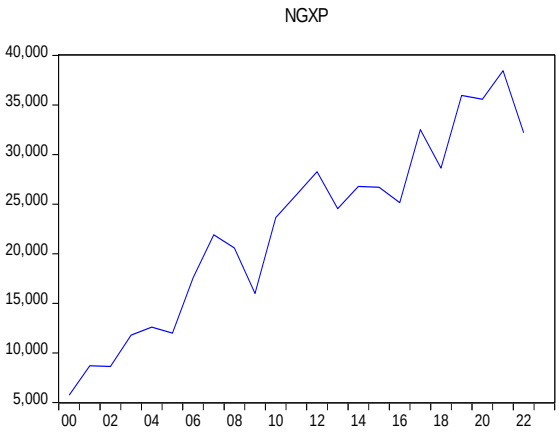

Figure 2

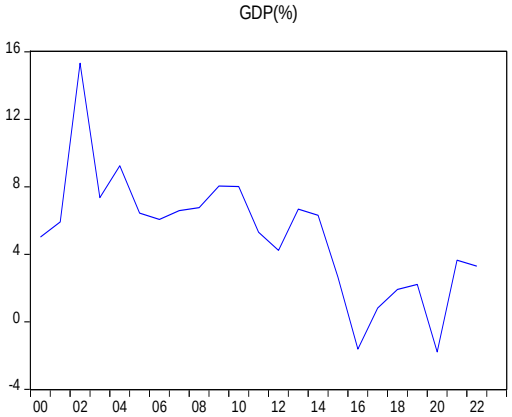

Figure 3

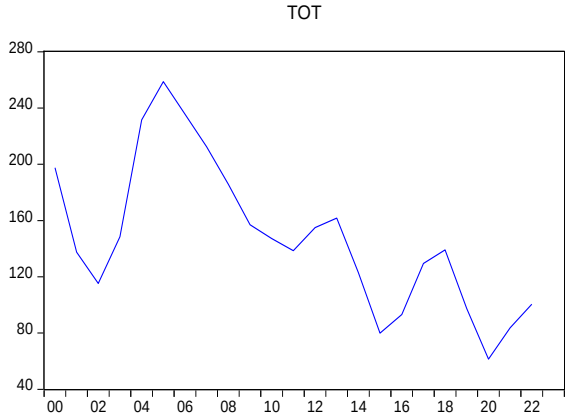

Figure 4

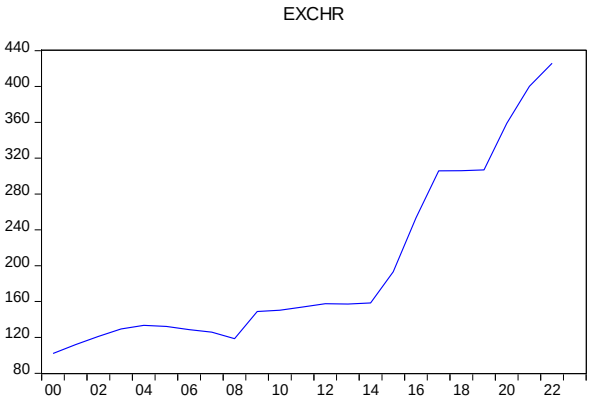

Figure 5

Source: Authors' compilation

As depicted in Figure 1, Nigeria's foreign reserves saw robust growth in the early 2000s. This could partly be attributed to the high global gas prices and increased oil exports, reaching its peak around 2003 and dropped afterwards. This may, however, be adduced to the global financial crisis in 2008 and subsequent energy price volatility, (Udoudo, *et. al*., 2024). Up till the end of the period under study, Nigeria's foreign reserves remained relatively low compared with its value in 2003. Figure 2 shows that Natural Gas Export in the country consistently rose from the beginning of the study period till around 2021 where it stood at above 5000 million cubic meter, after which it experienced slight downturn. The significant growth in its export was largely due to the changing global energy needs in favour of natural gas, (Adelegan, 2018). In Figure 3, economic growth was shown to experience strong increase during the early part of 2000. It slowed down in subsequent years and took a sharp dip around 2015, possibly due to reduced oil prices and lower demand for exports, (Udo, *et. al.*, 2024). The economy, notwithstanding, maintained positive growth rates. It started improving from year 2000 till the end of the study period. Nigeria started out with a decrease in its Terms of Trade at the beginning of the study period. It improved significantly in the early to middle part of 2000. Nigeria's rate of export as captured by its Terms of Trade, however, started declining reaching its lowest point in year 2019. As shown in Figure 5, the naira to dollar exchange rate was weak for almost a decade starting from year 2000, while it slightly appreciated in subsequent years. A closer observation of the trend indicates a turning point in the exchange rate around 2014 whereby it rose sharply and maintained the trend till the end of the period under research.

4.3 Inferential Analysis

- ***Unit Root Test Results***

Results for the confirmation of level of integration of the time series used for the analysis in the study is discussed below

Table 4.2: Unit Root Test Result

Variables	***Level***	***Ist Difference***	***Remark***
GFRSV	-3.447535 (0.0201)	-4.923581 (0.0008)	I_0
LnNGXP	-3.004123 (0.0525)	-6.188961 (0.0000)	I_1
GDPGR	-2.372154 (0.1604)	-5.884868 (0.0001)	I_1
TOT	-0.382395 (0.8947)	-6.001456 (0.0001)	I_1
EXCHR	2.032472 (0.9997)	-2.627095 (0.0350)	I_1

Source: Authors' computation

Table 4.2 above shows the stationarity test results of the series used in the study. The growth rate of Foreign Reserve, (GFRSV) is stationary at level. However, Growth rate of GDP, (GDPGR), Terms of Trade, (TOT), Exchange rate, (EXCHR) and the natural logarithm of Natural Gas Exports, (LnNGXP) are stationary at first difference.

Bound Test

Results of long-run dynamics among tested series are examined and discussed below.

Table 4.3: Bound Test Result

F-Bound	Null Hypothesis: No levels of relationship			
Test Stat.	Value	Sig.	I_0	I_1
			Assymptotic: n =1000	
F –Statistic	7.824696	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Authors' Computation, 2024

In Table 4.3, the bound cointegration test indicates that with F- value of 7.82 being above the upper bound critical value, and significant at 5%, the study establishes the existence of long run relationship among the variables. With co-integration test result pointing to a situation of consistent long run association among the series, appropriate lag is selected in order to fit an Error Correction Model for the study.

Table 4.4: Optimum Lag Selection Result

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	-95.64446	NA	859.7376	9.585187	9.833883	9.639160
1	-92.15229	4.988816*	682.8795*	9.347837*	9.646272*	9.412605*
2	-91.33496	1.089779	701.9327	9.365234	9.713408	9.440797

Source: Authors' Computation, 2024.

In the presented result AIC, SC and other lag length selection criteria suggested the adoption of one lag in estimating the ECM.

- ***Error Correction Analysis***

Given that most of the employed series in the research are integrated of order one and exhibit long run association, the adopted Error Correction analysis tends to address the likely relationship that may exist among them. The results are presented below.

Table 4.5: ECM Result

Variable	***Coefficient***	***Std. Error***	***t – Statistic***	***P –value***
C	7.277733	6.865428	1.060055	0.3071
D(GFRSV(-1))	0.583637	0.190115	3.069913	0.0083
D(LnNGXP(-1))	1.963956	26.44688	0.742604	0.4700
D(GDPGR(-1))	0.672763	1.309938	-5.093954	0.0002
D(TOT(-1))	0.755724	0.219245	3.446941	0.0039
D(EXCHR(-1))	-0.244591	-0.252845	-0.967354	0.3498
ECM(-1)	-1.038452	0.269147	-6.459109	0.0000

R^2	*0.825950*	*Mean dependent var.*	*-0.838095*
Adjusted R^2	*0.751357*	*S.D dependent var*	*41.88586*
S.E of Regression	*20.88601*	*Akaike info. Criterion*	*9.177238*
Sum squared resid	*6107.155*	*Schwarz criterion*	*9.525412*
Log Likelihood	*-89.36100*	*Hannan-Quinn criter.*	*9.252800*
F - statistic	*11.07277*	*Durbin-Watson stat.*	*1.523473*
Prob(F – statistic)	*0.000125*		

Source: Authors' Computation, 2024

From the ECM table, D (GFRSV (-1)) has estimated coefficient of 0.583637 which indicates that Growth of Foreign Reserve in previous year positively affect its current value. The estimate has probability value of 0.0083 which imply a significant effect at 1%. Natural Gas Export in the previous year also positively affect Growth of Foreign Reserve (D(LnNGXP(-1)) = 1.963956). The value of GDPGR in previous year will cause Growth of Foreign Reserve to rise by about 67%, (D(GDPGR(-1)) = 0.672763). The effect of GDP growth on Foreign Reserve growth is significant at 1%. While Terms of Trade in previous year positively and significantly affect Growth of Foreign Reserve, Exchange rate on the other hand has a negative effect. The estimate of the ECM (-1) which is -1.038452 with probability value of 0.0000, indicates that 103.8% of disequilibrium in the short and long run association among the variables would be corrected each year. The Error Correction Term is statistically significant.

The R^2 estimate of 0.825950 showed that about 83% of changes in the dependent variable (GFRSV) is captured by the regressors (LNNGXP, GDPGR, TOT, AND EXCHR). The Durbin Watson stat. of 1.5234 which is in the neighbourhood of 2, indicates that the model does not suffer autocorrelation.

The finding that Natural Gas Export positively affect Growth of Foreign Reserve in Nigeria, as established in this study, corroborates the deduction of the research work conducted by Udoudo, Kalu, & Oduola, (2023) where LNG exports was found to have a favourable influence on the Nigerian economy, through its reserve growth.

4.4 Diagnostic Checks

The statistically significant Breusch–Godfrey autocorrelation test F – stat of 0.009048, suggests the rejection of the null hypothesis for presence of autocorrelation. The study results are therefore optimal and underscore the inference's reliability. The residual CUSUM stability test result also depicts that the residual trend lies within the 5% bound of the chart, thus indicating that there is stability in the model.

4.5 Granger Causality

Granger test for causality is used to determine the direction of causality between Natural Gas Exports and Foreign Reserve growth. The validity of the analysis is not diminished by the fact that the adopted series are not of the same level of stationary. The results are presented as shown below

Table 4.8: Granger Causality Result

Null hypothesis	*Obs*	*F-statistic*	*P-value*
LnNGXP does not Granger Cause GFRSV	22	0.37863	0.0456
GFRSV does not Granger Cause LnNGXP		0.74700	0.3982

Source: Authors' Computation, 2024

In the reported granger causality result, the first null hypothesis has F-stat of 0.37863 and a probability of 0.0456. The null hypothesis is rejected, hence Natural Gas Export uni-directionally granger cause the Growth of Foreign Reserve during the study period. This is in line with the findings in the research conducted by Akighir & Kpoghul, (2020).

However, the P-value for the other F-stat is not significant, indicating that there is no causality. Therefore there exist a uni-directional causation between Natural Gas Export and Foreign Reserve growth in Nigeria.

5. CONCLUSION & POLICY RECOMMENDATIONS

The study focused on analysing the impact of Natural Gas exports on Nigeria's Foreign reserve using annual time series for twenty two years, (2000-2022). It was found that gas export has

positive effect on foreign exchange reserve, exhibiting both long and short run dynamics. The estimated ECT -1 established that 104% of existing dis-equilibrium between the short and long term dynamics were adjusted annually among the series. Natural Gas Export was also found to granger cause the Growth of Foreign Reserve during the study period. Nigeria needs to intensify efforts toward developing its gas industry so as to be reckoned with as a major supplier at the international scene, who is capable of meeting the needs of both domestic and international markets, and thus increase its foreign reserve through gas exports.

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