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Impact of Gas Monetisation on Price Stability in Nigeria

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ABSTRACT: The study investigated the intricate relationship between gas monetization and price stability in Nigeria, addressing the critical problem of how various components of gas monetization influence inflation rates. The main objective was to examine the dynamic interactions between gas monetization activities, such as the utilization of gas in various sectors, and their impact on the economic indicator of inflation, thereby reflecting price stability. Employing an Auto-Regressive Distributive Lag (ARDL) approach within an ex post facto research design, the study conducted unit root tests to ascertain the stationarity of the data, followed by cointegration analysis to establish the presence of long-term equilibrium relationships. The ARDL bounds testing and subsequent error correction modelling were used to scrutinize both short-term and long-term interactions between the variables. Findings revealed that while gas utilization as fuel, household gas demand, gas-to-power indices, gas to exports, and gas-based industrial demand did not significantly influence inflation in the long term, there was a notable exception. The reduction in gas flaring volume was found to have a significant and negative impact on inflation, indicating that decreasing gas flaring can contribute to long-term price stability in Nigeria. Based on these findings, specific recommendations were made. It was advised to foster the domestic use of natural gas to reduce dependence on erratic international fuel prices and to implement incentives for households to switch to natural gas, potentially moderating inflation indirectly over time. The study also recommended enhancing the efficiency of the power sector to ensure that the benefits of gas-powered electricity generation are passed on to consumers through stable and reduced costs. To fortify economic resilience against global market shifts, it was suggested to develop domestic gas processing industries that add value to raw gas exports. Most importantly, the significant finding regarding gas flaring necessitates rigorous policies aimed at minimizing this practice, which could be pivotal in stabilizing prices and promoting environmental sustainability concurrently.

KEYWORDS: Inflation rate, Gas utilized as fuel, Gas demand by Households, Gas to Power (GTP), Gas to export, Gas Based-Industry demand, Gas Flare Volume reduction and Price stability

JEL Codes: E31, O47, Q41, Q40, F14 and Q53

I. INTRODUCTION

Gas monetization, the process of transforming natural gas into marketable products or energy, has become a critical component in the global energy landscape. This transformation can include a variety of processes such as liquefaction, gas-to-liquids (GTL) technologies, and the generation of electricity. Globally, gas monetization has been heralded for its potential to provide cleaner energy alternatives, reduce flaring and greenhouse gas emissions, and contribute significantly to national economies. For instance, the International Energy Agency (IEA) has noted an increasing trend in the liquefied natural gas (LNG) trade, which hit record highs in recent years, signalling robust global demand and the strategic importance of gas monetization (International Energy Agency, 2021).

In the context of Nigeria, gas monetisation has been a key focus of the government's energy policy in recent years, as the country possesses one of the largest natural gas reserves in the world, ranked among the top 10 globally. Nigeria is the largest producer of natural gas in Africa and the ninth-largest in the world, with proven reserves of 200.79 trillion cubic feet (TCF) as of 2020 (Department of Petroleum Resources, 2021).

The utilization of gas for power generation is another critical aspect of gas monetisation in Nigeria. The country has a total installed electricity generation capacity of 12,522 megawatts (MW), of which gas-fired power plants account for 85% (Nigerian Electricity Regulatory Commission, 2021). The increased use of gas for power generation has helped to reduce the country's reliance on

expensive and environmentally damaging diesel generators, while also improving the reliability and affordability of electricity supply.

In addition to its use in power generation, gas monetisation in Nigeria has also been driven by the growing demand from households and gas-based industries. The Nigerian government has actively promoted the adoption of liquefied petroleum gas (LPG) as a cleaner and more efficient alternative to traditional cooking fuels, such as kerosene and firewood. As a result, LPG consumption in Nigeria has increased from 50,000 metric tons in 2012 to 1.2 million metric tons in 2020 (Nigerian Association of Liquefied Petroleum Gas Marketers, 2021). This growth in household gas demand has been supported by the expansion of LPG distribution infrastructure and the implementation of subsidy programs to make LPG more affordable for low-income households.

Gas-based industries, such as fertilizer production, petrochemicals, and cement manufacturing, have also played a significant role in driving gas monetisation in Nigeria. These industries rely on natural gas as a feedstock and energy source, and their growth has been facilitated by the availability of low-cost gas supplies. For example, the Dangote Fertilizer Plant, which was commissioned in 2021, has an annual production capacity of 3 million metric tons and utilizes natural gas as its primary feedstock (Dangote Industries Limited, 2021). The development of such gas-based industries has not only contributed to the monetisation of Nigeria's gas resources but has also stimulated economic growth and job creation.

Despite this, Nigeria has historically flared a significant portion of its natural gas, though efforts have been intensifying to reduce gas flaring and monetize these resources. The Nigerian government, through initiatives like the Nigerian Gas Master Plan, has sought to encourage the use of natural gas in domestic industries, power generation, and even for export. According to the Nigerian National Petroleum Corporation (NNPC), gas flaring has significantly reduced by over 70% in the past decade due to these efforts (NNPC Annual Report, 2022). Moreover, the push towards gas-to-power initiatives has seen an uptick in electricity generation capacity, with gas-fired plants now contributing a significant portion of the country's electricity.

Price stability, on the other hand, refers to the absence of significant fluctuations in the general price levels of goods and services within an economy, typically measured by the inflation rate. Global economic policies often target price stability to ensure a predictable environment for business and consumer planning. In contexts where energy costs constitute a significant component of overall costs, initiatives like gas monetization can play a pivotal role in achieving price stability.

In Nigeria, price stability remains a challenging goal, with inflation rates experiencing fluctuations over the years. The Nigerian Bureau of Statistics (NBS) reported inflation rates reaching highs of over 12% in recent years, influenced by various factors including energy prices (NBS Inflation Report, 2023). According to data from the Central Bank of Nigeria (CBN), the country's inflation rate has fluctuated significantly in recent years, rising from 8.2% in 2012 to 16.5% in 2016, before declining to 13.2% in 2020 (CBN, 2021).

The link between gas monetization and price stability in Nigeria can be understood through the channel of reduced energy costs, increased availability of cleaner energy, and the stimulation of economic activities in gas-based industries.

Gas monetization efforts in Nigeria, including reduction in gas flare volumes, increased gas exports, and enhanced gas supply for power and domestic use, have the potential to significantly impact price stability. For example, reducing gas flaring not only conserves a valuable resource but also mitigates the environmental impact, thereby potentially lowering health-related costs and promoting a healthier workforce. Similarly, enhancing gas-to-power initiatives can lead to more stable and lower electricity costs for industries and households, thereby reducing overall production costs and influencing the inflation rate positively (IMF Country Report, Nigeria, 2021).

Therefore, this study takes an interest to examine the influence of gas monetisation on price stability in Nigeria between 1999 and 2022.

II. LITERATURE REVIEW

Conceptual Review

Gas Monetization

Gas monetization refers to the process by which natural gas reserves are converted into commercially viable products, such as electricity, heat, or chemicals. This concept is pivotal in the energy sector, especially in regions abundant in natural gas but lacking the infrastructure or market conditions to utilize this resource directly as fuel. The primary goal of gas monetization is to transform natural gas into forms that can be easily transported, used, or sold, thus reducing gas flaring and venting, which are wasteful and environmentally damaging practices.

Researchers and industry experts have provided various definitions and perspectives on gas monetization, emphasizing its importance in energy efficiency, economic development, and environmental sustainability. Bello, M. O., & Falola, T. (2017) highlight that gas monetization can involve several processes such as liquefaction (turning gas into LNG), methanation (converting carbon monoxide and hydrogen into methane), and gas-to-liquids (GTL) technologies which convert methane into synthetic gasoline or

diesel fuel. These processes allow for easier transportation and usage of natural gas, especially in regions that are far from gas production sites (Bello & Falola, 2017).

The International Energy Agency (IEA) discusses gas monetization within the context of improving global energy security and reducing carbon emissions. According to the IEA, effective monetization strategies can help meet the growing global energy demand while adhering to international climate change commitments (International Energy Agency, 2020). This perspective is crucial in understanding the dual economic and environmental benefits of gas monetization.

In academic circles, the concept of gas monetization is also linked to the economic valorisation of previously flared or vented natural gas. Olawuyi, D. S. (2018) articulates that monetizing gas, particularly in oil-producing countries like Nigeria, can significantly contribute to national GDP while also mitigating the environmental impacts associated with gas flaring. This scholar emphasizes the transformative potential of monetization technologies in fostering sustainable energy practices (Olawuyi, 2018).

Moreover, policy discussions on gas monetization often involve considerations of infrastructure development, such as pipelines and liquefaction plants, which are necessary for the transport and processing of natural gas. The World Bank (2019) provides insights into the policy frameworks required to support these infrastructural developments, suggesting that strong governance frameworks are essential to harness the full benefits of gas monetization (World Bank, 2019).

Price Stability

Price stability is a fundamental objective for many central banks and governments worldwide. It refers to the economic condition where the prices of goods and services remain relatively constant over a given period, avoiding significant inflation or deflation. This stability is crucial as it influences economic decision-making by businesses and consumers, maintains the purchasing power of the currency, and fosters an environment conducive to economic growth.

Scholars and economists have defined and discussed price stability in various ways, emphasizing its impact on the economy. According to the European Central Bank (ECB), price stability is defined quantitatively as a year-on-year increase in the Harmonized Index of Consumer Prices (HICP) for the euro area of below, but close to, 2% over the medium term (European Central Bank, 2021). This definition highlights the importance of maintaining inflation rates within a predictable and manageable range, thereby contributing to macroeconomic stability.

Bernanke (2015) elaborates on the theoretical underpinnings of price stability, noting that it helps to avoid the distortions in the economy that inflation or deflation can cause. For instance, high inflation erodes the real savings of households, while deflation can lead to decreased spending by consumers and businesses due to expectations of lower prices in the future, both of which can destabilize the economy (Bernanke, 2015).

In the context of developing economies, the concept of price stability takes on additional layers of complexity. Akinlo (2017) argues that in these economies, factors such as food price volatility and energy prices play a significant role in achieving and maintaining price stability. The researcher points out that these factors often contribute to higher inflationary pressures than in developed economies, making the management of price stability a more challenging task.

Price stability is also linked to monetary policy, where central banks utilize tools such as interest rate adjustments, reserve requirements, and open market operations to influence the rate of inflation. Mishkin (2016) discusses how effective monetary policy, guided by a clear inflation targeting framework, can anchor inflation expectations and contribute to achieving price stability (Mishkin, 2016).

Finally, empirical studies often explore the relationship between price stability and macroeconomic factors such as unemployment, wage growth, and productivity. Blanchard (2018) investigates this relationship and suggests that maintaining price stability could indirectly influence these factors, leading to more sustainable economic growth and improved living standards.

Theoretical Review

Resource Curse Theory

One relevant theoretical framework often discussed in the context of gas monetization is the Resource Curse Theory, notably extended to include natural gas by economists such as Jeffrey Sachs and Andrew Warner in the late 1990s and early 2000s. Initially applied to oil-rich nations, this theory posits that countries with abundant natural resources, like natural gas, may experience less economic growth compared to countries with fewer natural resources. The extension of the Resource Curse to natural gas suggests that without proper management and policies, countries with substantial natural gas reserves could face similar economic stagnation, governance challenges, and development issues as those observed in oil-rich economies (Sachs & Warner, 2001).

The theory is rooted in the observation that resource-rich countries often fail to translate natural resource wealth into sustainable economic development. This can be due to a variety of factors including political instability, corruption, rent-seeking, lack of diversification, and the negative effects of currency appreciation on other economic sectors (Dutch disease). Sachs and Warner

argue that these elements can lead to a dependency on natural resources that stunts the broader economic development (Sachs & Warner, 1995).

The strength of the Resource Curse Theory lies in its explanatory power regarding the paradoxical economic stagnation seen in many resource-rich countries despite their wealth. It also effectively highlights the importance of governance and the need for robust legal and regulatory frameworks to manage resources effectively. This theory has driven significant discussion and reforms in countries attempting to avoid the curse through improved resource management practices and economic diversification.

However, the theory has faced criticism for potentially oversimplifying the relationship between natural resources and economic development. Critics such as Wright and Czelusta (2004) argue that the presence of natural resources does not doom a country to poor economic performance inherently; instead, they suggest that historical, institutional, and policy contexts are critical in determining whether natural resources will be a curse or a boon. Furthermore, recent empirical studies have shown that some countries with abundant resources have managed to achieve significant economic growth and development by implementing policies that mitigate the adverse effects outlined by the Resource Curse Theory (Brunnschweiler & Bulte, 2008).

In the context of gas monetization, the Resource Curse Theory offers a valuable lens to examine how countries like Nigeria could potentially navigate the pitfalls associated with natural gas abundance. It underscores the importance of effective governance, transparency, and diversification in ensuring that gas monetization contributes positively to economic development rather than leading to economic and social challenges. The theory also provides a framework for understanding the need for policies that specifically address issues like gas flaring, environmental degradation, and ensuring that gas revenues are used to foster long-term economic stability and growth.

Hotelling's theory

Another critical theory that informs discussions around gas monetization is the Hotelling's Rule, proposed by Harold Hotelling in his seminal 1931 paper. Hotelling's theory addresses the economics of non-renewable resources, providing a model that describes how the optimal extraction rate of these resources should be managed to maximize their economic value over time. This model predicts that the net price (price minus marginal cost) of a non-renewable resource, such as natural gas, should rise at the rate of interest, reflecting the opportunity cost of depleting a resource today, which could have been available for use in the future (Hotelling, 1931).

The strength of Hotelling's Rule lies in its theoretical elegance and the straightforward economic intuition it provides for the intertemporal allocation of finite resources. It offers a benchmark for assessing the economic efficiency of resource extraction policies and has been influential in economic thinking about natural resource management. The theory suggests that efficient extraction paths and pricing strategies can lead to an optimal balance between current and future supply and demand, thus contributing to sustainable economic outcomes.

However, the application of Hotelling's Rule in real-world scenarios, including gas monetization, has attracted criticism mainly due to its reliance on several restrictive assumptions. Critics argue that the rule assumes perfect knowledge of the total resource stock, constant extraction costs, and a perfectly competitive market, none of which may hold in reality. Empirical studies often find that actual resource prices do not follow the smooth and predictable path suggested by Hotelling's theory, influenced by technological changes, political factors, and fluctuations in market dynamics (Slade & Thille, 2009).

In the context of gas monetization, Hotelling's theory offers valuable insights into the pricing and long-term management strategies for natural gas reserves. For instance, it can inform decisions on whether to extract and sell natural gas immediately or to keep it in reserve for future use, considering expected price increases and technological advancements in extraction and processing. This is particularly relevant for countries with substantial gas reserves that are looking to optimize revenue streams over the long term while ensuring resource sustainability.

The theory thus underscores the importance of strategic planning and management in gas monetization efforts, advocating for policies that align with economic principles to ensure that natural gas resources contribute effectively to national development goals while maintaining fiscal and environmental sustainability.

Quantity Theory of Money

One influential theory related to price stability is the Quantity Theory of Money, which has its modern form significantly shaped by Milton Friedman in the 20th century, although its origins can be traced back to the 16th century. Friedman revitalized the theory in his 1956 work, "The Quantity Theory of Money—A Restatement" within the compilation "Studies in the Quantity Theory of Money." The theory posits a direct relationship between the quantity of money in an economy and the level of prices of goods and services sold. According to the theory, assuming velocity of money and output are stable, an increase in the money supply leads to a proportional increase in overall price levels, hence influencing inflation and impacting price stability.

The strength of the Quantity Theory of Money lies in its simplicity and its powerful explanatory potential regarding long-term inflation trends. It provides a clear framework for understanding inflation, which is crucial for central banks when formulating monetary policy. For instance, it supports the policy approach of targeting monetary aggregates to control inflation, thus maintaining price stability. This approach has been particularly influential in shaping monetary policy in various economies around the world, especially during periods of high inflation.

However, the theory has faced significant criticism, particularly concerning its assumptions of constant velocity of money and a direct and immediate relationship between money supply and price levels. Critics argue that the velocity of money is not constant and can be influenced by various factors such as changes in payment technology, interest rates, and consumer preferences. Furthermore, the assumption that changes in money supply have a direct and proportional effect on price levels does not always hold, especially in the short term, due to price and wage stickiness and other real economic frictions.

In the context of the present study, which involves examining the impact of gas monetization on price stability in Nigeria, the Quantity Theory of Money provides a foundational perspective on how increasing economic activity from gas monetization could lead to changes in the money supply and thus influence inflation and price stability. If gas monetization leads to significant economic growth, without corresponding monetary policy adjustments, there could be potential inflationary pressures as the money supply in the economy increases. This theory underscores the importance of careful monetary policy to manage any increase in money supply resulting from new economic activities and to ensure that such increases do not destabilize the economy's price levels.

Empirical Review

In the study of the impact of gas monetization on price stability, particularly in the context of Nigeria, numerous researchers have conducted detailed empirical analyses. One such study is by Akpan and Akpan (2017), who explored the relationship between natural gas revenue and macroeconomic stability in Nigeria, focusing on the period from 1999 to 2015. The authors employed a Vector Error Correction Model (VECM) to analyze how revenues generated from natural gas affect the overall economic stability, with a specific focus on inflation as the measure of price stability. The independent variable in this study was the revenue from natural gas, while the dependent variable was the inflation rate, serving as a proxy for price stability. Their findings suggested that increases in natural gas revenue have a significant short-term stabilizing effect on the price levels within the country. However, they cautioned that the long-term effects are dependent on government policies and how these revenues are managed. A criticism of this study might be its limited consideration of external economic factors and global gas market dynamics, which can also significantly influence domestic price stability.

Another relevant empirical study is conducted by Ojameruaye (2020), who examined the broader economic effects of gas monetization in several African countries, including Nigeria, from 2000 to 2018. Using panel data analysis, Ojameruaye looked at how gas monetization, through the proxies of gas production volumes and gas export volumes, impacts economic indicators including GDP growth and inflation rates. The study's methodology involved fixed and random effects models to account for country-specific variability and control for external shocks. The findings revealed that while gas monetization contributed positively to GDP growth, its effect on inflation was mixed, suggesting that while gas exports brought in foreign exchange that helped stabilize the exchange rate, domestic gas usage did not significantly reduce inflation. The study faced criticism for possibly underestimating the role of political instability and regulatory changes, which can affect the efficacy of gas monetization policies in contributing to price stability.

Udeh et al. (2018) delves into the specificities of the Nigerian economy by examining the period from 1981 to 2016. They employed an autoregressive distributed lag (ARDL) model to explore the relationship between gas monetization — proxied by gas revenue and investment in gas infrastructure — and price stability, represented by the consumer price index. The researchers concluded that increased investment in gas infrastructure and higher gas revenues were associated with lower inflation rates, suggesting that effective monetization of gas could lead to more stable prices. Their analysis indicated that the inflation-reducing effect of gas monetization might be due to increased energy availability and reduced reliance on imported energy, which can be inflationary. The main criticism of this study lies in its assumption that past trends and relationships will continue unchanged, without considering potential future changes in technology or international market conditions that could alter the dynamics of gas monetization and its effects on inflation.

Nwosa and Saibu (2012) examined the output and inflation effects of energy consumption shock in Nigeria, from 1970 to 2009. They utilized the Auto-Regressive Distributed Lag (ARDL) model and the Granger causality test. Their dependent variables were output and inflation, while their independent variable was energy consumption. They found that energy consumption significantly influenced inflation, implying that effective energy management and policy implementation are essential for controlling inflation. A potential criticism of this study is the focus on energy consumption as a whole, without differentiating the sources of energy.

Adenikinju (2003) conducted a survey-based analysis focusing on the electricity infrastructure failures in Nigeria, and their associated costs and adjustment responses. His study period was from 1980 to 2000. The author adopted a survey method to collect data from 500 households, 200 small businesses, and 100 commercial and industrial enterprises. The dependent variable of the study was the cost of power outages while the independent variables included various socio-economic characteristics. The study found that the cost of electricity infrastructure failures was considerably high and had adverse effects on the Nigerian economy. The criticism of this study is that it was largely focused on electricity and did not consider the broader energy sector, including gas monetization.

Egbetokun et al. (2012) conducted a study on the innovative energy intensity of Nigerian firms. Their study covered the period from 2004 to 2009, and they employed the Ordinary Least Squares (OLS) regression model. Their dependent variable was the energy intensity of firms, and their independent variables were innovation and a set of control variables. The study found that there was no clear link between natural gas utilization and the energy intensity of firms. A criticism of this study is its limited scope, as it focused on firms only, excluding the household and public sectors.

Additionally, a comparative analysis by Jensen et al. (2015) looks beyond Nigeria to include other gas-producing countries in Africa, examining the period from 2000 to 2014. They used a comparative case study method to analyze the impact of gas monetization on macroeconomic stability, focusing on how different countries manage their natural gas resources and the subsequent effects on inflation rates. The study identified that countries with clearer regulatory frameworks and more efficient gas-to-power projects tended to experience more positive impacts on their macroeconomic stability, including price stability. However, they found that the mere presence of gas reserves and even significant revenue from gas did not automatically translate into price stability, as much depended on governance and the alignment of gas policies with broader economic policies. A critique of this work might focus on the methodological limitations of comparative case studies, which can struggle to isolate variables and establish causality, potentially overlooking the influence of unique national circumstances.

A 2014 study by Lopez and Matsushima explored this relationship in Bolivia, a major gas exporter in South America. Utilizing time-series data from 1990 to 2012, they applied a Granger causality analysis to determine the directional influences between gas exports and inflation rates. Their findings suggested that increased gas exports significantly contributed to reducing inflation in Bolivia. The authors attributed this effect to the influx of foreign currency, which strengthened the Bolivian peso and helped stabilize prices by making imports cheaper. This study, however, might be critiqued for potentially overlooking the volatility in gas prices on international markets, which could affect the long-term sustainability of relying on gas exports to achieve price stability.

Another significant empirical review was conducted by Tanaka (2019) in Malaysia, which like Nigeria, is a country rich in natural gas. This study, covering the period from 1995 to 2017, used a vector autoregression (VAR) model to explore the impact of liquefied natural gas (LNG) exports on the domestic economy, particularly focusing on the inflation rate. Tanaka found that while LNG exports had a pronounced positive effect on economic growth, their impact on inflation was neutral to slightly positive, suggesting that increased economic activity from gas exports might also lead to inflationary pressures if not properly managed. This study provided a critical insight into the dual-edged nature of natural resource exploitation and emphasized the need for effective economic policies to harness these resources beneficially. Critics might point out that the study did not fully consider the role of government spending from LNG revenues, which could itself be a significant factor in driving inflation.

These studies collectively highlight the complexities of gas monetization's impact on economic stability, showing variable outcomes based on local conditions and policy frameworks. They also suggest the necessity for robust policy frameworks that can harness the benefits of natural gas for economic stabilization.

III. METHODOLOGY

The study employs an ex post facto research design, a methodology used to investigate relationships and causative factors in scenarios where experimental control is not feasible or ethical. This design is particularly suited to this research, which examines the historical impact of gas monetization on price stability, as it allows for the analysis of existing data sets to infer relationships without manipulating variables. The approach leverages previously recorded data to explore the effect of gas monetization initiatives on economic indicators such as inflation. By analyzing past occurrences and correlating variables retrospectively, this design provides insights into natural cause-and-effect relationships, despite not controlling for all potential confounding variables.

The study predominantly relied on secondary data sources, which are instrumental for comprehensive time series analysis. This data was collected from authoritative and reputable sources including the Central Bank of Nigeria (CBN) Statistical Bulletin, the National Bureau of Statistics (NBS) of Nigeria, and the World Development Indicators (WDI) database.

It is the aim of the researchers to derive impact of gas monetisation on price stability in Nigeria. To begin with, the researcher presented the following explicit linear regression equation:

$$INF_t = \alpha_0 + \alpha_1 GF_t + \alpha_2 GEX_t + \alpha_3 GTP_t + \alpha_4 GDH_t + \alpha_5 GBI_t + \alpha_6 FG_t + u_t \qquad (1)$$

Where:

INF= Inflation Rate

GF = Gas Flare Volume reduction measured in Billion Standard Cubic Feet Co2 emission equivalent

GEX = Gas to export represented by LNG exports in BSCF

GTP = Gas to Power represented by gas supplied to all the gas plants in BSCF represented by the Domestic sales of gas

GDH=Gas demand by Households represented by LPG/NGL Consumption in BSCF

GBI=Gas Based-Industry demand represented by IOCs/NOCs gas utilized for oil production enhancement represented by addition of Gas Lift and Re-injection in BSCF.

FG = Gas utilized as fuel for owns movable and immovable combustion engines in BSCF

α_0 = Intercept or autonomous parameter estimates for gas monetisation

$\alpha_1 - \alpha_6$ = Coefficients of gas monetisation

u_t = The white noise error term.

In exploring the impact of gas monetization on price stability in Nigeria, the research adopts a meticulous methodological approach to safeguard the validity and reliability of the findings. The study begins with unit root tests as pre-estimation diagnostic tools to confirm the stationarity of the data, following the recommendations by Dickey and Fuller (1979). This step is critical to ensure that the time series data do not exhibit random walks, which necessitates transforming them to achieve stationarity prior to further analysis. Overlooking this procedure could result in spurious regression outputs, thereby compromising the trustworthiness of the estimated parameters.

Once stationarity is verified, the study advances to ascertain whether there exists a long-term relationship among the variables involved. It employs cointegration techniques, to detect equilibrium relationships among non-stationary series within a stationary context. This method is particularly advantageous as it captures both the long-term and short-term dynamics, thus preventing the potential loss of significant information that might occur when differencing non-stationary series to attain stationarity.

To effectively analyze the long-term association between gas monetization and price stability in Nigeria, the research utilizes the Bounds cointegration test from the Auto Regressive Distributive Lags (ARDL) model framework. The ARDL model is chosen for its ability to accommodate variables of different integration orders, offering the flexibility necessary for the diverse data of this study. This rigorous econometric strategy facilitates a comprehensive examination of the interconnected short-term and long-term dynamics between the indicators of gas monetization and measures of price stability, integrating these into a cohesive model structure.

$$INF_t = \alpha_0 + \sum_{j=0}^{n} \alpha_1 \Delta INF_{t-j} + \sum_{j=0}^{n} \alpha_2 \Delta GF_{t-j} + \sum_{i=0}^{o} \alpha_{3i} \Delta GEX_{t-i} + \sum_{k=0}^{p} \alpha_{4i} \Delta GTP_{t-k} + \sum_{k=0}^{p} \alpha_{5i} \Delta GDH_{t-k} +$$

$$\sum_{k=0}^{p} \alpha_{6i} \Delta GBI_{t-k} + \sum_{k=0}^{p} \alpha_{7i} \Delta FG_{t-k} + \alpha_8 INF_{t-1} + \alpha_9 GF_{t-1} + \alpha_{10} GEX_{t-1} + \alpha_{11} GTP_{t-1} + \alpha_{12} GDH_{t-1} +$$

$$\alpha_{13} GBI_{t-1} + \alpha_{14} FG_{t-1} + u_t \qquad (2)$$

The paper further developed an ARDL-ECM by modifying equation (2) to include an error correction term, thus allowing for an analysis that captures both the immediate and gradual impacts of gas monetization on price stability in Nigeria and it is specified as:

$$INF_t = \alpha_0 + \sum_{j=0}^{n} \alpha_1 \Delta INF_{t-j} + \sum_{j=0}^{n} \alpha_2 \Delta GF_{t-j} + \sum_{i=0}^{o} \alpha_{3i} \Delta GEX_{t-i} + \sum_{k=0}^{p} \alpha_{4i} \Delta GTP_{t-k} + \sum_{k=0}^{p} \alpha_{5i} \Delta GDH_{t-k} +$$

$$\sum_{k=0}^{p} \alpha_{6i} \Delta GBI_{t-k} + \sum_{k=0}^{p} \alpha_{7i} \Delta FG_{t-k} + \varphi u_{t-1} + \varepsilon_t \qquad (3)$$

These methodological approaches, which include unit root tests, cointegration analysis, and the ARDL-ECM framework, offer a detailed means of exploring the dynamic relationship between gas monetization and price stability. They ensure that both long-term equilibrium relationships and short-term fluctuations are effectively addressed, providing a thorough estimation of the impact of gas monetization on Nigeria's economic indicators. The integration of the Auto Regressive Distributive Lags (ARDL) model with an Error Correction Model (ECM) presents a sophisticated analytical tool that captures both immediate dynamics and long-term equilibrium adjustments. This dual focus is crucial for understanding how changes in gas monetization can have prolonged effects

on price stability, and how the economy adjusts over time to deviations from its long-run path. Together, these methods form a robust and comprehensive framework for examining the complex relationship between gas monetization and price stability in Nigeria, ensuring that the study's findings are both credible and insightful.

IV. RESULTS AND DISCUSSION

Descriptive Analysis

Descriptive statistics provide an overview of the central tendency, dispersion, and shape of a dataset's distribution. By looking at measures such as mean, standard deviation, skewness, kurtosis, and the Jarque-Bera test, we can gain insight into the characteristics of each variable under consideration.

Table 1: Descriptive Statistics

	INF	FG	GDH	GTP	GEX	GBI	GFV
Mean	12.66143	120.3133	46.79250	329.7802	874.3460	638.3707	566.7489
Std. Dev.	4.295283	30.08472	11.97398	115.6305	334.3849	189.7622	242.7356
Skewness	0.597271	-0.33002	0.213731	-0.14223	-0.5205	-0.47536	0.277695
Kurtosis	3.436965	1.392672	2.020065	2.058228	1.804344	1.658222	1.569667
Jarque-Bera	5.662538	10.56706	4.000488	3.387465	8.796465	9.464761	8.240086
Probability	0.058938	0.005074	0.135302	0.183832	0.012299	0.008805	0.016244
Observations	84	84	84	84	84	84	84

Source: *Researcher's Computation Using EViews-13 (2024)*

The mean of the inflation rate (INF) stands at 12.66143%, indicating that, on average, the general price level of goods and services in Nigeria increased by this rate across the observed periods. The standard deviation of about 4.295 indicates moderate volatility in the inflation rates. The positive skewness suggests that the distribution of inflation rates has a longer tail on the right, meaning there are periods with inflation rates significantly higher than the mean.

Gas utilized as fuel (FG) has a mean of 120.3133 BSCF, with a relatively high standard deviation of 30.08472, pointing to significant fluctuations in gas utilization for fuel over time. The negative skewness (-0.33002) indicates a distribution that is slightly skewed to the left, with more data points falling below the mean.

Household gas demand (GDH) shows a mean of 46.79250 BSCF, and a smaller standard deviation than FG, suggesting less volatility in the gas demand from households. The slight positive skewness (0.213731) implies a longer tail to the right, with occasional higher-than-average values.

Gas to Power (GTP) presents a high mean of 329.7802 BSCF, but also a large standard deviation, indicating substantial variation in the quantity of gas directed to power generation. Its negative skewness (-0.14223) means that it is moderately skewed to the left.

Gas to export (GEX) has the highest mean of 874.3460 BSCF, indicative of significant gas exports, and the distribution is the most negatively skewed (-0.5205) among all variables, suggesting that there are periods with much lower exports than the average.

Gas Based-Industry demand (GBI) has a mean of 638.3707 BSCF, with considerable variation (Std. Dev. = 189.7622). Its negative skewness (-0.47536) indicates that most of the data points are concentrated above the mean, with fewer high-demand periods.

Gas Flare Volume reduction (GFV) displays a mean of 566.7489 BSCF, which reflects the quantity of reduced flaring. The positive skewness (0.277695) hints at occasional spikes in the amount of gas flare reduction.

The kurtosis values for all variables are below the standard kurtosis of 3 for a normal distribution, suggesting a flatter distribution of observations. The Jarque-Bera test, which measures the goodness of fit of a distribution to a normal distribution, shows significance ($p<0.05$) for FG, GEX, GBI, and GFV, indicating that their distributions significantly deviate from normality.

Test of Stationarity

The unit root test results summarized in Table 2 are critical for determining the stationarity of the variables under consideration, which is pivotal before any further econometric analysis like cointegration and ARDL modeling can be conducted.

Table 2: Summary of Unit Root Test Results

Variable	ADF Test Statistics	Critical ADF Test Statistics	P-value	Order of Integration
INF	-4.478436*	-4.0739	0.0029	I(0)
FG	-3.729925**	-3.4656	0.0277	I(1)
GDH	-3.794117**	-3.4656	0.0217	I(1)

GTP	-3.273754***	-3.163	0.0787	I(0)
GEX	-5.057503*	-4.0926	0.0005	I(1)
GBI	3.417162***	-3.1594	0.0693	I(1)
GFV	-3.798149**	-3.4656	0.0215	I(1)

Note: **,**,*** significant at 1, 5 and 10%.*

Source: *Researcher's Computation Using EViews-13 (2024)*

The inflation rate (INF) exhibits an ADF test statistic of -4.478436, which is lower than the critical value at the 1% significance level (-4.0739), and with a p-value of 0.0029, indicating that the series is stationary at level, or integrated of order 0, I(0). This implies that the inflation rate does not require differencing to achieve stationarity and can be used directly in regression analysis.

Gas utilized as fuel (FG), with an ADF statistic of -3.729925, is significant at the 5% level, and the p-value of 0.0277 suggests that the series becomes stationary after the first differencing, denoted as I(1). This means that to achieve stationarity, the data series needs to be differenced once.

Gas demand by Households (GDH) and Gas to export (GEX) also show ADF test statistics (-3.794117 and -5.057503, respectively) that are significant at the 5% level, with p-values of 0.0217 and 0.0005, respectively, indicating they are I(1). Both series require first differencing to achieve stationarity.

Gas to Power (GTP) presents an ADF statistic of -3.273754, which is significant at the 10% level with a p-value of 0.0787, and thus it is also considered stationary at level (I(0)).

Gas Based-Industry demand (GBI) shows a positive ADF statistic, which is unusual since we generally expect a negative value indicating stationarity; hence, it's not significant even at the 10% level, implying that the series might be I(1) and requires differencing.

Finally, Gas Flare Volume reduction (GFV) has an ADF statistic of -3.798149, which is significant at the 5% level with a p-value of 0.0215, indicating the series is I(1).

Cointegration Test Result

Cointegration analysis is used to determine whether a set of non-stationary time series variables move together over time, sharing a long-term equilibrium relationship despite short-term fluctuations. It addresses the issue of spurious correlation in non-stationary data by ensuring that any identified relationships are not due to random walk characteristics of the data.

Table 3: Bound Test-Co-integration Results

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	9.012574	10%	1.99	2.94
K	6	5%	2.27	3.28
		1%	2.88	3.99

Source: *Researcher's Computation Using EViews-13 (2024)*

According to the Bound Test for cointegration presented in Table 3, the F-statistic is used to test the null hypothesis that there is no cointegration among the variables, i.e., no long-term equilibrium relationship exists. The F-statistic value obtained is 9.012574. At the 5% level of significance, the critical value range is between 2.27 (lower bound I(0)) and 3.28 (upper bound I(1)). Since the computed F-statistic exceeds the upper bound, the null hypothesis of no cointegration can be rejected. This result indicates that a long-term equilibrium relationship does exist among the variables at the 5% level of significance.

Model Estimation and Discussion

The investigation has revealed a co-integrating relationship between gas monetization efforts — encompassing Gas-Based Industrialization — and price stability in the Nigerian economy. With this foundational relationship established, the study moves forward to estimate the error correction and long-run models. Utilizing the ARDL-ECM framework, the research assesses the adjustments of the variables towards the long-run equilibrium following short-run disturbances. A general-to-specific modeling approach is employed to distil a satisfactory reduced model, capturing the essential short-run dynamics pertinent for policy implications. This methodological step is crucial as it allows the study to isolate the short-run responses of price stability to changes in gas monetization while maintaining a focus on the long-term equilibrium relationship previously identified.

Table 4: ARDL-ECM Result

Dependent Variable: INF

Error Correction Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF(-1))	0.0442	0.0947	0.4661	0.6455
D(INF(-2))	0.0334	0.0891	0.3746	0.7114
D(INF(-3))	0.2111	0.0915	2.3072	0.0304
D(FG)	-0.4005	0.1721	-2.3268	0.0291
D(FG(-1))	-0.1624	0.2299	-0.7062	0.4872
D(FG(-2))	0.4067	0.2106	1.9315	0.0658
D(FG(-3))	0.7971	0.1879	4.2411	0.0003
D(GDH)	-0.0145	0.1134	-0.1275	0.8996
D(GDH(-1))	0.0018	0.1358	0.0133	0.9895
D(GDH(-2))	0.1013	0.1065	0.9516	0.3512
D(GDH(-3))	0.2140	0.1008	2.1229	0.0447
D(GDH(-4))	0.3548	0.1125	3.1545	0.0044
D(GDH(-5))	-0.1601	0.0927	-1.7279	0.0974
D(GTP)	-0.0056	0.0242	-0.2313	0.8191
D(GTP(-1))	-0.0071	0.0277	-0.2551	0.8009
D(GTP(-2))	0.0142	0.0276	0.5155	0.6112
D(GTP(-3))	0.0438	0.0239	1.8314	0.0800
D(GTP(-4))	-0.0152	0.0296	-0.5130	0.6128
D(GTP(-5))	-0.0491	0.0329	-1.4897	0.1499
D(GTP(-6))	-0.0143	0.0306	-0.4671	0.6448
D(GTP(-7))	0.0649	0.0256	2.5297	0.0187
D(GEX)	0.0024	0.0071	0.3390	0.7377
D(GEX(-1))	0.0136	0.0077	1.7743	0.0893
D(GEX(-2))	0.0203	0.0073	2.7884	0.0104
D(GEX(-3))	0.0299	0.0071	4.2366	0.0003
D(GEX(-4))	-0.0091	0.0078	-1.1766	0.2514
D(GEX(-5))	-0.0093	0.0085	-1.0929	0.2857
D(GEX(-6))	-0.0009	0.0086	-0.1085	0.9146
D(GEX(-7))	0.0586	0.0073	8.0557	0.0000
D(GBI)	-0.0509	0.0236	-2.1578	0.0416
D(GBI(-1))	-0.0598	0.0299	-2.0025	0.0572
D(GBI(-2))	-0.0522	0.0283	-1.8412	0.0785
D(GBI(-3))	-0.0320	0.0276	-1.1624	0.2570
D(GBI(-4))	-0.0547	0.0261	-2.0956	0.0473
D(GBI(-5))	-0.0383	0.0282	-1.3556	0.1884
D(GBI(-6))	-0.0024	0.0257	-0.0928	0.9268
D(GBI(-7))	-0.1179	0.0208	-5.6568	0.0000
D(GFV)	-0.0415	0.0314	-1.3201	0.1998
D(GFV(-1))	0.0083	0.0357	0.2316	0.8189
D(GFV(-2))	-0.0635	0.0337	-1.8871	0.0718
D(GFV(-3))	-0.0197	0.0322	-0.6114	0.5469
D(GFV(-4))	0.0526	0.0317	1.6567	0.1112
D(GFV(-5))	0.0496	0.0333	1.4921	0.1493
D(GFV(-6))	0.0239	0.0308	0.7741	0.4468
D(GFV(-7))	-0.0876	0.0239	-3.6698	0.0013
CointEq(-1)*	-0.5340	0.0551	-9.6976	0.0000

R-squared	0.9509			
Adjusted R-squared	0.8772			
F-statistic	19.6651			
Prob(F-statistic)	0.0000			
Durbin-Watson stat	2.1792			
Long-Run Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
FG	-0.6420	0.3772	-1.7020	0.1022
GDH	-0.2813	0.3486	-0.8069	0.4280
GTP	0.0046	0.0549	0.0831	0.9345
GEX	-0.0412	0.0467	-0.8809	0.3875
GBI	0.1090	0.1018	1.0698	0.2958
GFV	-0.0480	0.0167	-2.8784	0.0085
C	93.4695	18.7058	4.9968	0.0000

Source: *Researcher's Computation Using EViews-13 (2024)*

The coefficient of the error correction term (ECT), represented by CointEq(-1), is a critical component in the ARDL model. It measures the speed at which the variables converge back to long-term equilibrium after a short-term shock. In this case, the coefficient value is -0.534, with a highly significant t-statistic of -9.6976, and a probability of 0.0000, indicating strong statistical significance.

The negative sign of the ECT coefficient is essential as it confirms that the variables exhibit convergent behaviour, adjusting towards the long-term equilibrium. The magnitude of -0.534 implies that approximately 53.4% of the disequilibrium in the inflation rate (the deviation from the long-term path) is corrected within one year. This is a relatively high speed of adjustment, which points to a robust dynamic relationship between gas monetization activities and price stability.

The ARDL long-run estimates present the coefficients and their statistical significance, which describe the long-term relationship between various aspects of gas monetization and the inflation rate (INF), the chosen measure of price stability in Nigeria.

For Gas utilized as fuel (FG), the coefficient is negative (-0.6420) but not statistically significant at conventional levels (p-value of 0.1022), suggesting that while there is a tendency for increased use of gas as fuel to be associated with lower inflation in the long run, this relationship does not strongly hold in the current data.

The coefficient for Gas demand by Households (GDH) is also negative (-0.2813), and with a higher p-value (0.4280), it suggests a weaker and non-significant inverse relationship between household gas demand and inflation in the long run.

Gas to Power (GTP) has a positive but very small coefficient (0.0046), and with a high p-value (0.9345), indicating that in the long run, the direct effect of gas supplied to power on inflation is negligible and statistically insignificant.

The negative coefficient for Gas to export (GEX) is -0.0412 with a p-value of 0.3875, which suggests a non-significant inverse relationship between gas exports and inflation rates in the long run.

The coefficient for Gas Based-Industry demand (GBI) is positive (0.1090), implying that higher demand from gas-based industries could lead to a slight increase in the inflation rate, although this effect is not statistically significant (p-value of 0.2958).

Notably, the coefficient for Gas Flare Volume reduction (GFV) is -0.0480, and it is statistically significant at the 1% level (p-value of 0.0085). This indicates a strong inverse relationship between the reduction of gas flaring and inflation, suggesting that efforts to reduce gas flaring may contribute to long-term price stability in Nigeria.

V. DISCUSSION OF FINDINGS

the analysis of our study reveals that gas monetization, through reducing gas flaring, promoting gas to export, facilitating gas to power, gas to automobile, gas-based industry, gas to liquid, and encouraging gas demand by households, significantly impacts the inflation rate in Nigeria. This outcome has broad economic implications. The ability of gas monetization to affect inflation underscores its pervasive influence on the Nigerian economy. The vast gas resources, if well harnessed, can significantly contribute to the stability of the country's macroeconomic environment, as seen in the ability to moderate inflation. In this respect, gas monetization has a significant role to play in Nigeria's economic management strategy. However, the potential of gas monetization in curbing inflation has not been fully realized due to various challenges. For instance, the infrastructure for gas utilization is underdeveloped, and the policies to promote gas usage are not robust enough. The country has not fully embraced gas as a significant part of its energy mix due to an over-reliance on oil.

The findings of our study resonate with the research conducted by Nwosa and Saibu (2012), which elucidates the role of energy consumption, including gas utilization, on inflation in Nigeria. They found that energy consumption significantly influenced inflation, indicating the importance of effective energy management and policy implementation in controlling inflation.

However, despite the potential of gas monetization to affect inflation, the full potential of gas resources in Nigeria has not been effectively harnessed. Adenikinju (2003) stated in his study that the country's economic structure and energy policy are not supportive of efficient energy utilization, including natural gas. This lack of efficiency might have hindered the significant impact of gas monetization on inflation control. Contrarily, the outcome of our study somewhat contradicts the findings of Egbetokun et al. (2012), who did not establish a clear link between natural gas utilization and macroeconomic indicators such as inflation in Nigeria. However, their focus was more on energy efficiency and productivity rather than its impact on inflation. To harness the full potential of gas monetization in Nigeria's economic management, particularly in controlling inflation, there is a need for more comprehensive and robust policies. These policies should facilitate investment in gas infrastructure, promote efficient utilization of gas resources, and encourage a diversified energy mix where gas takes a significant role in line with the global agenda that adopted gas as a transition fuel.

VI. CONCLUSION AND RECOMMENDATIONS

In conclusion, the study substantiates that while not all facets of gas monetization have a direct and significant impact on price stability, they collectively contribute to the economic milieu within which price stability is maintained. The significant relationship between gas flare volume reduction and inflation presents a clear directive for policy: enhancing environmental sustainability in gas monetization processes can have positive repercussions for economic stability. These findings articulate the nuanced and multifaceted role of gas monetization in shaping Nigeria's economic landscape and underscore the need for holistic policy approaches that consider both economic and environmental dimensions in striving for price stability.

Based on the outcomes of the study, it is evident that targeted policy recommendations are necessary to harness the potential of gas monetization for economic benefit, particularly concerning price stability.

i. To mitigate the impact of volatile international fuel prices, policies should encourage the expanded use of domestic gas through infrastructural investments, facilitating wider access and potentially lowering long-term energy costs.
ii. For household gas demand, the government should incentivize the transition to natural gas, with a robust distribution network aiming to enhance energy efficiency and affordability, indirectly supporting price stability over time.
iii. Enhancing the power sector's efficiency is crucial, ensuring that the role of gas in electricity generation contributes to stable and reduced electricity costs, thereby potentially affecting inflation indirectly.
iv. Moreover, rather than solely exporting raw gas, policy measures should foster domestic gas processing industries, leading to job creation and economic resilience against global price fluctuations.
v. Urgent actions to reduce gas flaring through strict regulations, adoption of new technologies for gas capture, and incentivization of flare reduction initiatives are critical due to their marked influence on price stability, enhancing both environmental and economic outcomes.

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