Survey of Reserves Reactions to the GDP Per Capita in Ghana

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Abstract: This study provides empirical evidence for determining the benefits of reserves, including gold in supporting the Gross Domestic Product (GDP) per capita in Ghana period between 1960 and 2019. This study aims is to ascertain the undulating trend tendencies of financial vulnerability in reserve management and estimate the extent of reserve benefits that persist to increase GDP per capita earnings using the Markov switching model. This study uses the Makov switching model as an estimator of the undulating trend propensities and persists the benefits of reserves to the earnings of GDP per capita in Ghana. The study obtained data from the 2019 World Development Indicators of the World Bank. The results reveal that reserve benefits are more persistent in regime 1, with positive significance at the 1% level, achieving higher scores of both 50th and 75th percentiles and lower variance scores. Howeve r, the result for regime 2 do not support sufficient benefits to the earnings of GDP per capita. A better explanatory model should identify other factors to test the estimation for future research. The study will be encouraged to expand the sample to cover more countries in Sub-Saharan Africa, by using existing empirical archival data. This study empirically tests the evidence of persistent reserve benefits to GDP per capita in Ghana's context which can have resemblance lessons on other African countries using the Markov switching model.

Keywords: Reserves; including Gold; GDP per capita; Markov switching model; IPSAS; Ghana

JEL Classification: B26

Background

There is a common belief that the endowment of a nation's natural resources determines its financial wealth for capital flow management, particularly during 'bad times' (Jeanne, 2007). This assertion becomes a reality where nations have the technological capacity to harness said natural resources for promoting income level for growth trajectory (Malloy, 2013). The synergy between nations' reserves and economic production brings into focus the dichotomy between the policy results and the ability to use the reserves judiciously to increase the income capacity level. The sufficiency of reserves provides reasonable assurance of quality incomes that lead to improved gross domestic product (GDP) per

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capita, particularly in resilient financial information quality for meeting the developmental project aspirations of citizens in the nations (Malloy, 2013). However, to date, reserves such as gold, special drawing rights (SDRs), and holdings of foreign exchange deposit (Bayram et al., 2018) benefits offered to countries show undulating trend patterns of the dangers that are present in monetary reserves with an apparent effect on GDP per capita (Fouquau, 2011). This assertion has received little research attention in Ghana, especially when employing the Markov regime-switching model (Hamilton, 1989) to examine the tipping point within the reserves that remit in contributing to the GDP per capita of Ghana.

Several countries have witnessed that reserves serve as a resource buffer in executing government programs of infrastructural development in the likes of quality health and education, thereby improving citizenry life satisfaction of the citizenry (Malloy, 2013). Theoretically, there is no doubt that reserves are a strong source of financing for meeting a nation's budgetary controls in creating wealth to achieve the long-term strategic objectives and growth trajectory of countries (Rodrik, 2006). However, reserves have a dwindling behavior in planned management decisions and, therefore, could plunge to abject periods of fluctuations (Abdul-Gafaru, 2017). In this respect, fluctuating reserves can negatively influence gross domestic product per capita earnings, ultimately affecting the timely completion of government programs amidst higher debt covenants or restrictions (Bastourre et al., 2009). Furthermore, such fluctuating reserves would inhibit the central government from discharging its citizenry obligations, especially for improving impoverished regions with economic activities (Jeanne & Ranciere, 2011). This research adds to the body of knowledge in the fields of quantitative accounting and finance, employing the Markov switching approach in a non-linear behavior (Hansen, 1992, 1996) of Ghana's reserves to explain gross domestic product per capita earnings. The majority of prior research that has advocated for national reserves in financial time series has shown nonlinearity in various forms (Hansen, 1992, 1996) inside the financial sector (Herris, 2018). Empirical studies have explained the causes of fluctuations in reserves to include a material change in exchange rate regimes arising from the economic vulnerability of slums inherent in our weakened currency footprint (Aizenman & Lee, 2005). Ghana is deemed to be endowed with mineral reserves, including gold and bauxite. The contribution of reserves to GDP per capita appears to be tremendous, especially in foreign exchange earnings, to support fiscal budgets (Buchardt et al., 2014; Obstfeld et al., 2010). However, the contribution of reserves to GDP per capita has not been pronounced in central government-accountable obligations in programs (Agbozo et al., 2019). It is believed that a lack of technological machinery, requisite manpower, regulated mineral prices in the world market, political corruption, lack of enforcement of regulatory measures, and dwindling reserves have caused intermittent fluctuations that have negatively affected gross domestic product per capita (Nneka, 2012). Reserves provide time-series moves towards establishing varying regimes due to abrupt economic recessions and financial time-series of panic conditions in Ghana. The recent global financial crisis also caused a downturn in reserve prices of Ghana, thereby affecting the revenues of the reserve market, resulting in retrogressive economic transformation in a non-linear pattern (Ayodeji, 2017). The rest of the paper is structured as follows: Section 2 touches on the theoretical and empirical underpinnings of the study, section 3 focuses on the methods and materials employed, and sections 4 and 5 highlight the empirical results, discussion, and concluding remarks.

2. Porter's Diamond Reputation Theory

The theory posits that natural reserves tend to drive and give assurance of strategic competitive advantage and opportunities to improve GDP per capita over another country (Diamond, 1991; Hale & Santos, 2008) in the form of prescriptive insurance on behalf of governments. It is clear that nations' reserves accrue strategic competitive advantage to one country over another under efficient and effective monetary policy-related liquidity assistance by governments. Regime changes in a country's reserves can cause structural changes, thereby promoting the application of the nonlinear Markov switching model in the nexus between reserves and GDP per capita in Ghana.

2.1 Snowball Effects of Natural Reserves

Snowball's concept of reserves states that initial profits are woefully inadequate to satisfy too many goals, but that momentum builds over time. Ghana's natural resources are unquestionably important for repairing how financial vulnerabilities adapt to and manage unanticipated changes and fluctuations in regime-affected interrelationships and functions. As a result, an unobserved state of the designated regime is predicted to persist in response to self-correcting status in order to fulfill certain aims. Natural reserves can be harnessed and collected (Bastourre et al., 2009) to show a snowball effect to boost any stream of earnings ability to increase investment willpower strength in a financially constrained economy (Obstfeld et al., 2010). (Meadows & Donella, 2008).

2.2. Reserves Outlook and Financial Sector in Ghana

Ghana's economy is expected to witness stagnant growth of reserve minerals by 2.5%, as the impact of 'galamsey' has sustained and has weakened effect for over seven years (Agbozo & Spassov, 2019; Abulai, 2017; Afriyie et al., 2016). It is envisaged that growth is projected to rise amidst downside financial risk (Bianchi et al., 2014). These risks include uncertain exchange rates, tensions from trade partners, and increasing debt levels (Dominguez et al., 2012). The exploration of reserve resources has long been impeded by long-standing problems and increased financial vulnerabilities of technological and innovative machinery, a skilled workforce, and appropriate policy tools to serve as local content contractual agreements for health production and extraction (Bianchi et al., 2014; Bastourre et al., 2009).

As reserve resources are uncertain, financial vulnerability and risk tend to heighten and pose a threat to the gross domestic product per capita, affecting sustainable growth and other investment vehicles, thereby legging the 2030 Sustainable Development Goal (SDGs) 8 (Cobbina, 2015; Pacheco et al., 2012). The IMF has ongoing policy discussions on reserve adequacy determination levels sufficient for country-specific circumstances. It is undoubtedly true that reserves are sufficiently managed to ensure the risk of uncertainty in reserve stock during fluctuations in exchange rate management by the Bank of Ghana (BoG). Enhanced control of reserves could play a crucial role in Ghana, especially for solidifying financial stability as a precautionary motive for preserving reserves and a beckon for financial sector development and integration during financial crises (Asare et al., 2022). Ghana is an agrarian economy, whose reserves depict an undulating trend amidst thin and illiquid cash flows (Buchardt et al., 2014) in the capital market of Ghana (Jeanne & Ranciere, 2011).

2.3 Reserves within IPSAS Effect

Reserves are recognized as financial assets by the International Public Sector Accounting Standards (IPSAS) when they accrue at fair value, as they are not monetary assets (Spindt & Tarban, 1983). Hence, gains or losses arising from the prevailing world market are recognized as income under financial instruments of available-for-sale, in compliance with recognition and measurement in IPSAS 29 as net assets. Therefore, the market price fluctuation effects of reserves may weaken the financial assets (Radetzki et al., 2008) base of Ghana and could determine different states in a random transition of time. With the dwindling nature of reserves in Ghana, the Bank of Ghana's primary motivation for keeping reserves in both micro-prudential and liquidity-related objectives could be undermined and affect Ghana's economic growth trajectory. Relatively, the reserves of Ghana exhibit slower growth due to their high usage in granting foreign currency liquidity assistance and to support budget deficits, most occasionally to destabilize fluctuating conditions. This study examines the extent to which Ghana's prevailing state of natural reserves contributes to achieving an optimal level of GDP per capita.

3. Research Methods

Volatility and unpredictable reserves are believed to thwart GDP per capita earnings growth in different periods (Reserve BoA, 2018). The Markov switch model is used within time variation in this study (Hamilton, 1989, 1990) in the parameters for capturing the prudent usage of reserves in each regime to ascertain the optimal contribution to GDP per capita. Indeed, there are few studies on this subject matter in Ghana, compared to the acceptable application of linear time-series techniques of autoregressive models, moving average (MA), and interaction ARMA models (Md.Kamrul, 2012; Adoma-Worae et al., 2021). Data for this study were obtained from the World Development Indicators (WDI) of the World Bank database for Ghana reserves for the period 1960–2019.

Measurement of variables

This study attempts to determine the extent to which Ghana reserves contribute to the GDP per capita earnings. The GDP per capita variable is dependent, while reserves serve as an independent variable and unit of research interest. All variables are in the form of a natural logarithm to reduce bias within the data (see Table 1).

Table 1. Operational definitions and data source

Variable	Definition	Notation	Data source	Support theory	Expected sign
Dep var: GDP per capita	Natural log of GDP per capita	LNGDPC	WDI 2019	Resource-based theory	?
Ind. Var: reserves (gold, etc)	Natural log of reserves	LNRESV	WDI 2019	Diamond theory	-/+

Model specifications

In the presence of stochastic tendencies, the fundamental changes in behavior are set in random variables to depict the frequent back and forth underlined by the common probability conditions to set the Markov switch state in motion. The Markov regime observed values could depend on the regime prevailing a year ago under assumed normal distribution with mean and variance parameters as in

$$X_t = \mu_{st} + \sigma_{st} + \varepsilon_{t-1,} t = 1,...,T, \quad (1)$$

where ε_t +N(0,1) is a set of standard normal variables and normal distribution parameter conversions.

To dissipate unplanned variations of the Markov switching model to enable movements of the state variable (St) between regimes, the Markov switch model recognizes the value of unobservable signals in models of financial time-series data that exhibit volatility affected by uncontrollable turbulent external determinants (Hamilton, 1989, 1990). The discrete state variable (St) tends to accord with possible regimes (M) for time (t), when St = 1, …, M to attain a first-order Markov process. This condition gives rise to different regression models that represent each regime. The Markov switch model permits different regime parameters that are invariant at defined periods with transition probabilities as in $P(s_t = i\text{Is}_{t-1} = j, zt) = Pij(Z_t)$ (2)

Z_t = an exogenous variable, where Z_t may include elements of Xt.

$s_t = i$ is the state variable

i = regimes 1 and 2

Pij = probability that state i is followed by state . j

The equation depicts the transition probabilities from State 1 at time t-1 to State j at time t. Regimes tend to develop the density function to give regime transition probability values as parameters under the assumption of time-invariant $Pij(t) = P_{ij}$ for all t. The transition probabilities identify the specific regime that tends to persist in attaining an optimal regime level with filtered probabilities under the Markov transition matrix. The regime probability estimates were subject to improvement based on the available contemporaneous information of the study sample to achieve filtered smoothed probabilities for regime parameter maximization.

The data were subjected to the natural logarithm, unit root test, and other diagnostic tests noted in the financial time-series data. Reserves are resources the country employs to manage the economy regarding GDP growth in education, health, and other recreational developments of volatile performance of reserve risk-off periods. Such unpredicted behavior has shifted with declining performance in reserves of Ghana's national income, leading to poor monetary policies, market conditions, and a lack of confidence in the Ghanaian currency. This would inhibit the growth of the reserve market in Ghana. In addition, there may be other interconnected factors that account for the decline in reserves.

4. Empirical Results

The descriptive statistics in Table 2 reveals fundamental values for both the dependent (LNGDPC) and independent (LNRESV) variables used in the study. The mean values were recorded at 6.12 and 20.1 for LNGDPC and LNRESV respectively. The LNRESV values of various percentiles were higher than the LNGDPC percentile values for the same study period. Therefore, it is inferred that reserves (LNRESV) could explain Ghana's gross domestic product per capita, amidst the behavior of the undulating trend, the reserves downside exposure still positioned (see Figure 1).

Table 2. Descriptive Statistics

Var	Mean	Std.Dev	Std error	25%	50%	75%
LNGDPC	6.122	0.743	0.095	5.595	5.916	6.137
LNRESV	20.120	1.444	0.185	18.952	19.864	21.32

Figure 1 displays the trend of the financial time series for both gross domestic product per capita and reserves of Ghana between 1960 and 2019. The values of GDP per capita (RESID02) experienced random walks with a slow rising trend on 0.0 at the y-axis, with an average yearly growth rate of 7.47% in 2020 (GLSS7, 2017). However, the values of reserves (RESIDO3) depict a sharply rising trend in the years 00, 87, and 75 in sustained sharp volatility and dynamic changes over time, especially in the mid-periods, but experienced stable behavior at the tail ends, exhibiting an average yearly growth of 18.23% in 2020. The values of reserves portray a robust predictive power at the tail end amidst straggling stability, providing a stronger argument for using the Markov switching model in this research. Within the two-time series data, both trends demonstrated the recurrent nature of the time series with irregular time intervals of comparable tendencies.

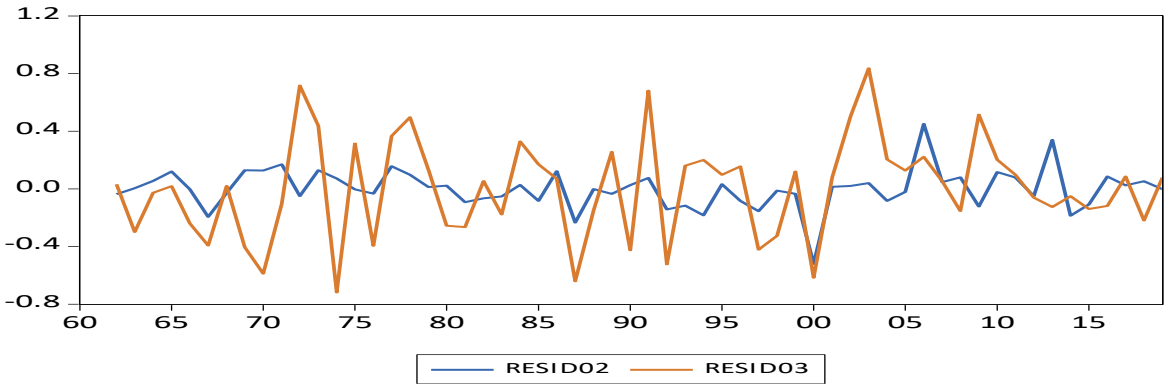


Figure 1. Trend of patterns of RESID02 (GDP) and RESID03 (RESERVES)

Table 2 shows the unit root test of reserves (LNRESV) and gross domestic product per capita (LNGDPC) under the Dickey-Fuller and Philip–Peron techniques. The unit root test results revealed that none of the variables were stationary in level, perhaps because of the relatively unstable variables employed in the study (Nelson et al., 2001). Again, the instability and planned shift of variables justify the application of the Markov model in this study. All variables were stationary at first, failing to comply with the null hypothesis assumption. Table 2 shows the variables integrated at the same order and levels. From Table 2, the joint tests of Jacque Bera, serial correlation, heteroscedasticity, and ANOVA F-test do not support the null theory. Therefore, the misspecification of the variables is nonexistent.

Table 2. Results of unit root and residual diagnostic tests

TEST: ADF	Intercept	Trend and intercept	Joint tests	Statistics	Prob.	Dec
variable	Levels	1st Diff				
LNGDPC	0.0061 (0.8239)	-0.8803 (0.0000)	Normality J.B.	0.324	0.850	Normally distr
LNRESV	-0.0032 (0.9223)	-0.0041 (0.0000)	Serial correlation	32.167	0.000	No correlation
TEST:PP			Ramsey RESET	7.846	0.000	No missp.
LNGDPC	0.1263 (0.9652)	-6.6416 (0.0000)	Heteroskedasticity	25.651	0.000	No homosked.
LNRESV	0.1605 (0.9677)	-8.2734 (0.0000)	Anova F-test	4454.038	0.000	Ho is rej. Supp evid.

The study further explains the results of ordinary least squares (OLS) of the variables employed (see Table 3). The results reveal that reserves contribute to GDP per capita earnings at a statistically 1% significance level with a positive coefficient of 0.471 under a t-value of 17.441. This result implies that a substantial value of reserves, including gold, causes an increase in the earnings capacity level of GDP per capita in Ghana, predicting massive support for government programs to augment the standard of living, all things being equal. Even though undulating strikes of natural reserves paradigm, financial crises, the COVID19 Pandemic and subsequent rebounds support the application of the Markov switching model.

Table 3. OLS Fit Results (Dep var: LNGDPC)

Var	est	Std err	t-value	Pr(>|t|)
Cons	-3.3653	0.5453	-6.1705	0.0000***
LNRESV	0.4715	0.0270	17.4411	0.0000***
Adj. R-Square = 0.837, F-statistic = 304.193, Prob (F-stat) = 0.000				

Significant codes: 0 '***' , 0.001 '**', 0.05 , 0.1 '*'

The OLS model achieved an adjusted R-squared of 83.7%, with an overall model fit of a P-value of 0.000. However, given unplanned changes within the management of reserves arising from the market price fluctuations of the economy, characterized by time variations, politicians' passions and sentiments of risk perceptions, and abrupt inability to meet the OLS assumptions, this study adopts the Markov model to determine which regime level is more marked to contribute to GDP per capita in Ghana.

Markov Switching Model Results

Given that the Markov switching model is applicable, it is relevant to test the nonlinearity of reserves' financial time series by checking the estimation procedures of the BDS test and the structural break test of the CUSUM of squares test.

Table 4. BDS Test for LNRESV

Dimension	BDS Statistics	Std Error	z-Statistics	Prob.
2	0.155185	0.007673	20.22583	0.000
3	0.253393	0.012319	20.56916	0.000
4	0.310401	0.014817	20.94953	0.000
5	0.347307	0.015597	22.26708	0.000
6	0.366771	0.015192	24.14179	0.000

To establish the existence of nonlinearity within the reserves, the BDS test revealed nonlinearity results, as all the P-values (see Table 4) were less than the alpha value of 0.05, which rejects the null hypothesis of 'the series are linearly dependent. Furthermore, the BDS test recognizes the integral correlation concept under the mean probability of regimes that exhibit different closed times and tests for misspecification within the segment of the recuring and frequent signal (Brock et al., 1987). Similarly, the structural break test results of the CUSUM of squares test show that a large portion of the cumulative sum of squares is outside the 5% significance level (see Figure 2), suggesting evidence of instability. Therefore, the aggregate effect commands the application of Markov switching models, indicating the behavior of the financial time-series.

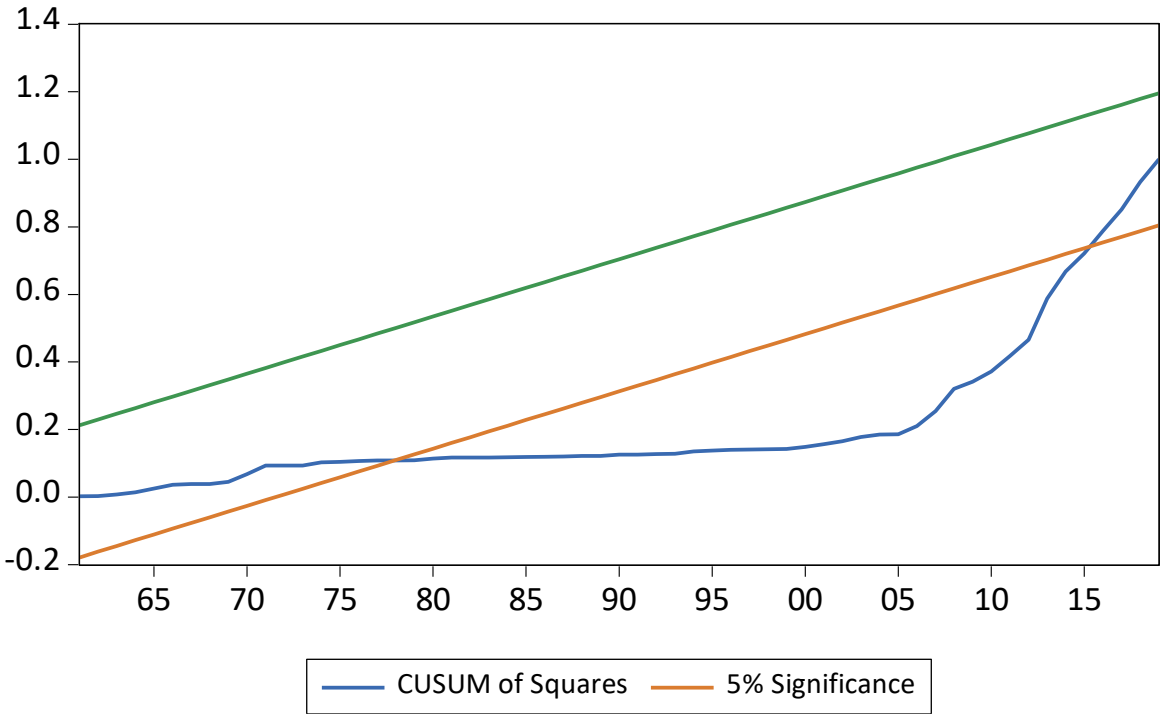


Figure 2. Stability test of CUSUM of Squares

The Markov switching model of the transition between regimes is deemed to recognize a dynamic system's behavior persisting for a long time. Therefore, the dynamic result of the Markov switching model regressions is under the theory of normal distribution within the mean and variance parameters to identify the state or regime. To represent aspects of transition probabilities, the unobserved state variable (St) assumes circumstances within the Markov chain, which allows inference decisions based on both filtered and smoothed possibilities of the observed regime value to establish the expected duration of regime choice.

Table 5. Markov Switching Model results for regime 1 and 2

Test statistic	Regime 1		Regime 2	
	LOG(Sigma)	LNRESV	LOG(Sigma)	LNRESV
Est	-2.2682	0.1597	-3.0054	0.1419
Z-statistic	-18.2492	4.9845	-11.2347	4.4721
Std error	0.1242	0.0320	0.2675	0.0317
Prob	0.0000	0.0000	0.0000	0.0000
Mean		0.7875		0.2124
Median		0.9368		0.0631
Max		0.9368		0.7374
Min		0.2625		0.0631

Table 5 shows the Markov model results for both regimes, indicating that the extent of reserves, including gold, could explain the GDP per capita earnings in Ghana. The results for regime 1 revealed a coefficient of 0.1597 at a statistically positive 1% significance level higher than that of regime 2, with a coefficient of 0.1419. In addition, regime 1 had a mean score of 0.7875, which was higher than that of regime 2, with a mean score of 0.2124. Mean score efficiency and accuracy were measured using standard error estimations. Regime 1 achieved a higher standard error (0.0320) compared to regime 2 (0.0317), suggesting that the mean score of regime 1 widely occurred in several periods. The median score of regime 1 (0.9368) demonstrated more favorable descriptive amounts than regime 2 (0.631). This perhaps indicates that the volatility of reserve assets within Ghana's GDP per capita earnings is more persistent in relaying crucial advantages to Ghana's social development, especially in times of critical budgetary support needs. The period of regime 1 demonstrates strong reserve availability to affirmatively influence GDP per capita earnings. Regime 1 revealed a high volatility that subsists the Markov chain in that period. The results (regime 1) exhibit more significant amounts of mean and variance adjustments that are inherently ascribed to the dynamic behavior of reserves in supporting Ghana's earnings.

Regime switches depict transitional probabilities of P11=0.937, P12=0.0.063, P21=0.0.261, and P22=0.738 to determine the transformation of unobserved variables. Regime 1 of the probability transition matrix of 0.937 reveals a period of higher volatility associated with extremely persistent difficult experiences to transit into a few switches to regime 2. The Markov switching model for Regimes 1 and 2 shows the general outlook in both the one-step predicted regime probabilities and filtered probability graphs for the study periods. Regime 1 of the graphs emerges as a prevalent period of persistence in explaining more earnings support from reserves to GDP per capita.

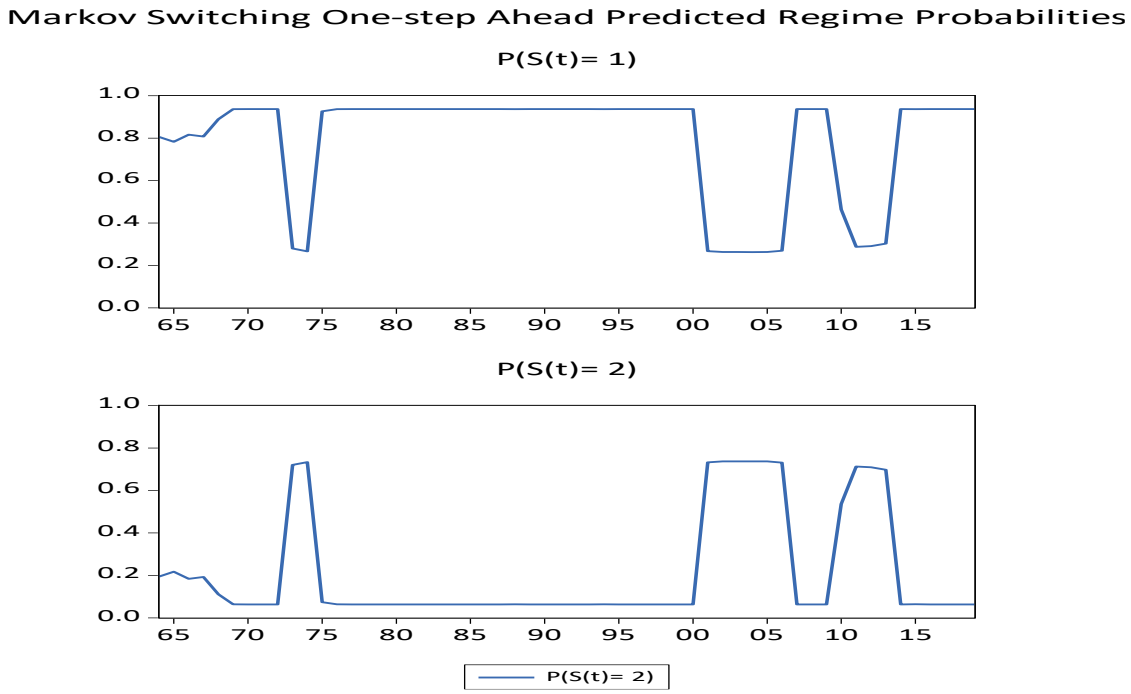


Figure 3. One-step ahead predicted probabilities graphs of regime 1 and 2

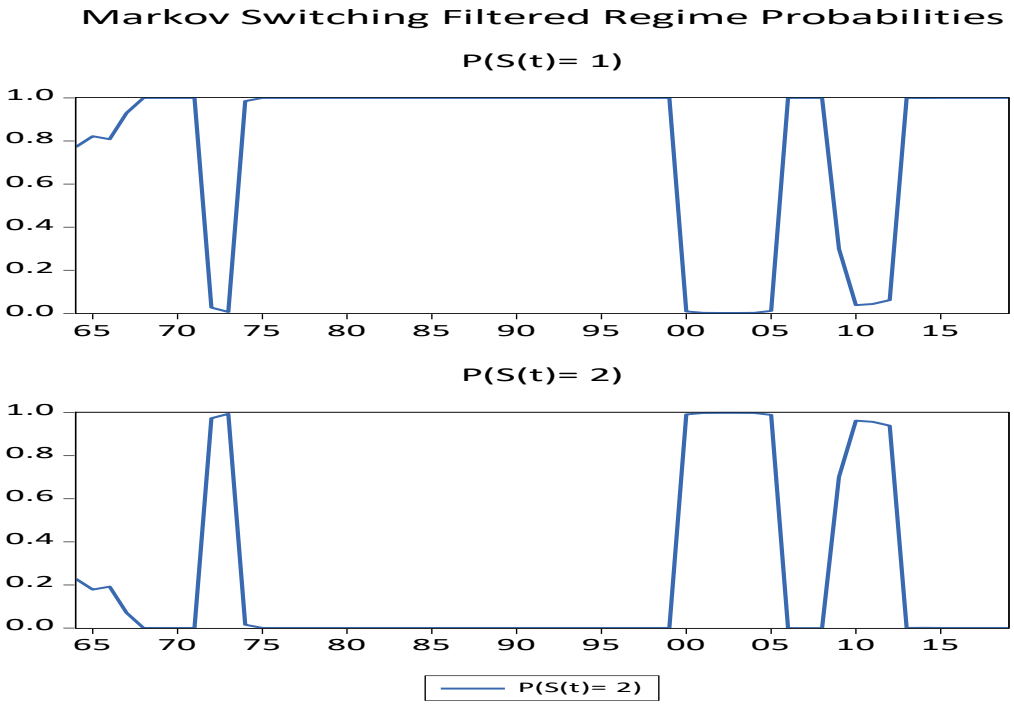


Figure 4. Filtered Regime Probabilities graphs of regime 1 and 2

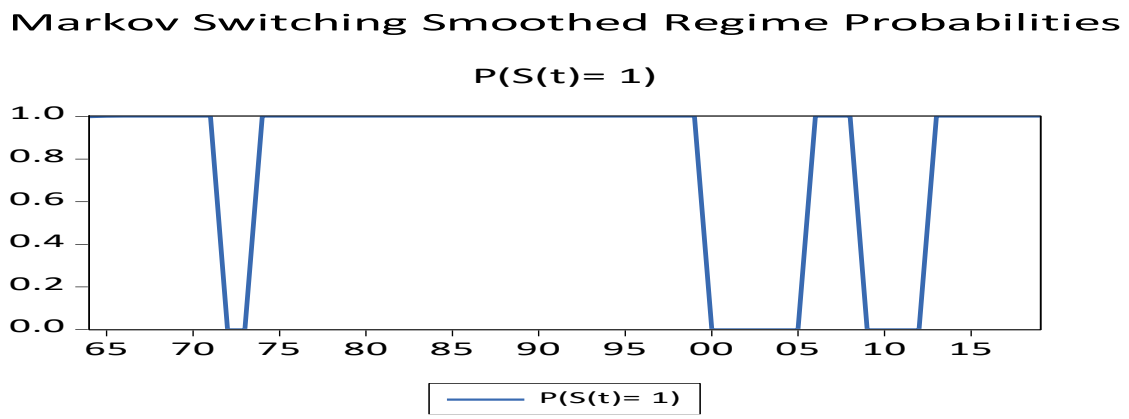
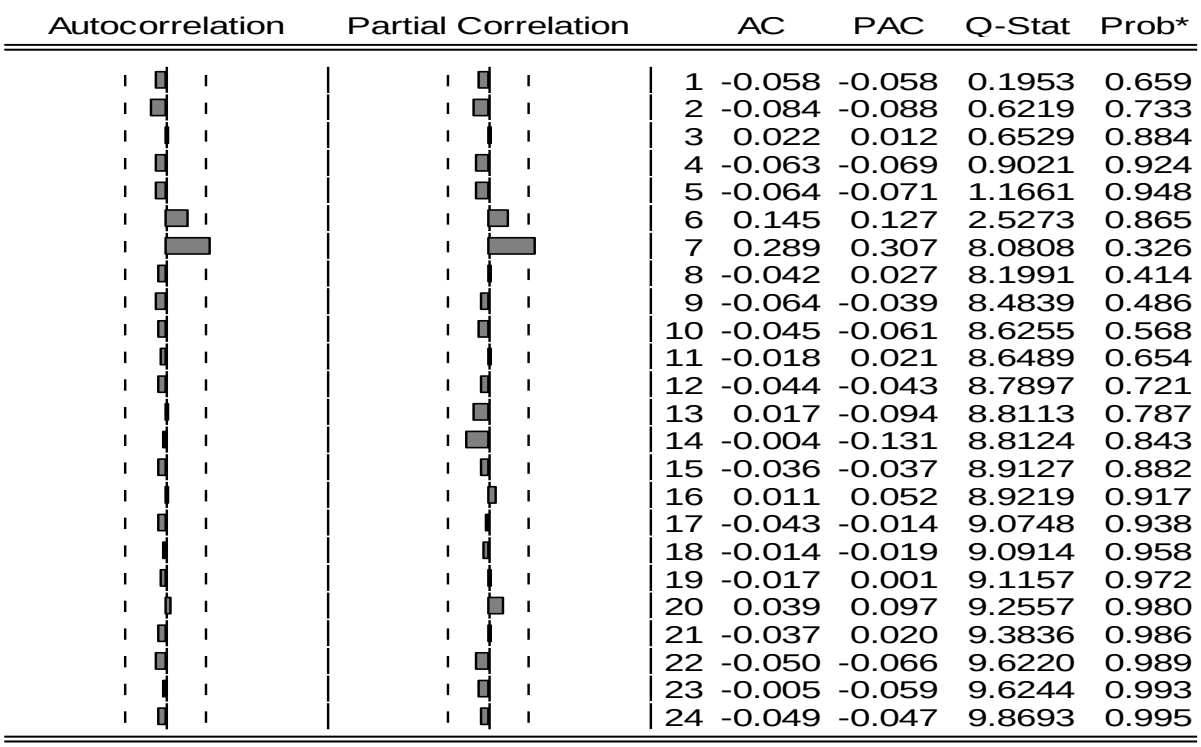


Figure 5. Smoothed Regime Probability graph of regime 1

Regime 1 shows a filtered persistent duration of more than 15 years out of the total study period, indicating high volatility, in contrast to regime 2. The constantly expected duration for regime 1 is 15.838 years, compared to 3.821 for regime 1. This implies that reserve postulates react to support GDP per capita earnings due to favorable economic conditions at minimal interruptions in the reserves marketplace for Regime 1. Regime 2 depicts moderate volatility, suggesting fragile reserve market situations that facilitate a faster switch to regime 1. Evidence of the high volatility of regime 1 may indicate that the pragmatic utilization of reserves positively affects Ghana's GDP per capita earnings. It is undoubtedly true that reserve management with high volatility will significantly affect economic growth, which enhances the absolute advantage of mineral endowments in the mineral marketplace in Africa. The model demonstrates an optimal level of reserve benefits in regime 1, which suggests prevailing better conditions, especially in ameliorating earnings for shaping Ghana's GDP per capita.

Diagnostic for Normality Tests

Figure 6 shows correlograms of ACF and PACF that consider the time lags within time-series analysis. The time-varying patterns demonstrate serial dependence in determining business cycles and seasonality movements of patterns that resemble the observed data. The results revealed insignificant values but demonstrated no misspecification for determining meaningful conclusions.



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.058	-0.058	0.1953	0.659
		2	-0.084	-0.088	0.6219	0.733
		3	0.022	0.012	0.6529	0.884
		4	-0.063	-0.069	0.9021	0.924
		5	-0.064	-0.071	1.1661	0.948
		6	0.145	0.127	2.5273	0.865
		7	0.289	0.307	8.0808	0.326
		8	-0.042	0.027	8.1991	0.414
		9	-0.064	-0.039	8.4839	0.486
		10	-0.045	-0.061	8.6255	0.568
		11	-0.018	0.021	8.6489	0.654
		12	-0.044	-0.043	8.7897	0.721
		13	0.017	-0.094	8.8113	0.787
		14	-0.004	-0.131	8.8124	0.843
		15	-0.036	-0.037	8.9127	0.882
		16	0.011	0.052	8.9219	0.917
		17	-0.043	-0.014	9.0748	0.938
		18	-0.014	-0.019	9.0914	0.958
		19	-0.017	0.001	9.1157	0.972
		20	0.039	0.097	9.2557	0.980
		21	-0.037	0.020	9.3836	0.986
		22	-0.050	-0.066	9.6220	0.989
		23	-0.005	-0.059	9.6244	0.993
		24	-0.049	-0.047	9.8693	0.995

*Probabilities may not be valid for this equation specification.

Figure 6. Residuals of ACF AND PACF plots of Auto correlation with Regime 1

Figure 7 shows the impulse response function results for regimes 1 and 2. The results of the regimes considered the eigenvalues in the standard deviation (LOG_SIGMA) derived from the variance decomposition test. The results of regime 1 depict persistent stationarity within the accumulated response lying on the zero to sustain long-run values denoting horizontal lines throughout but depicting a slightly wider apart at the tail end.

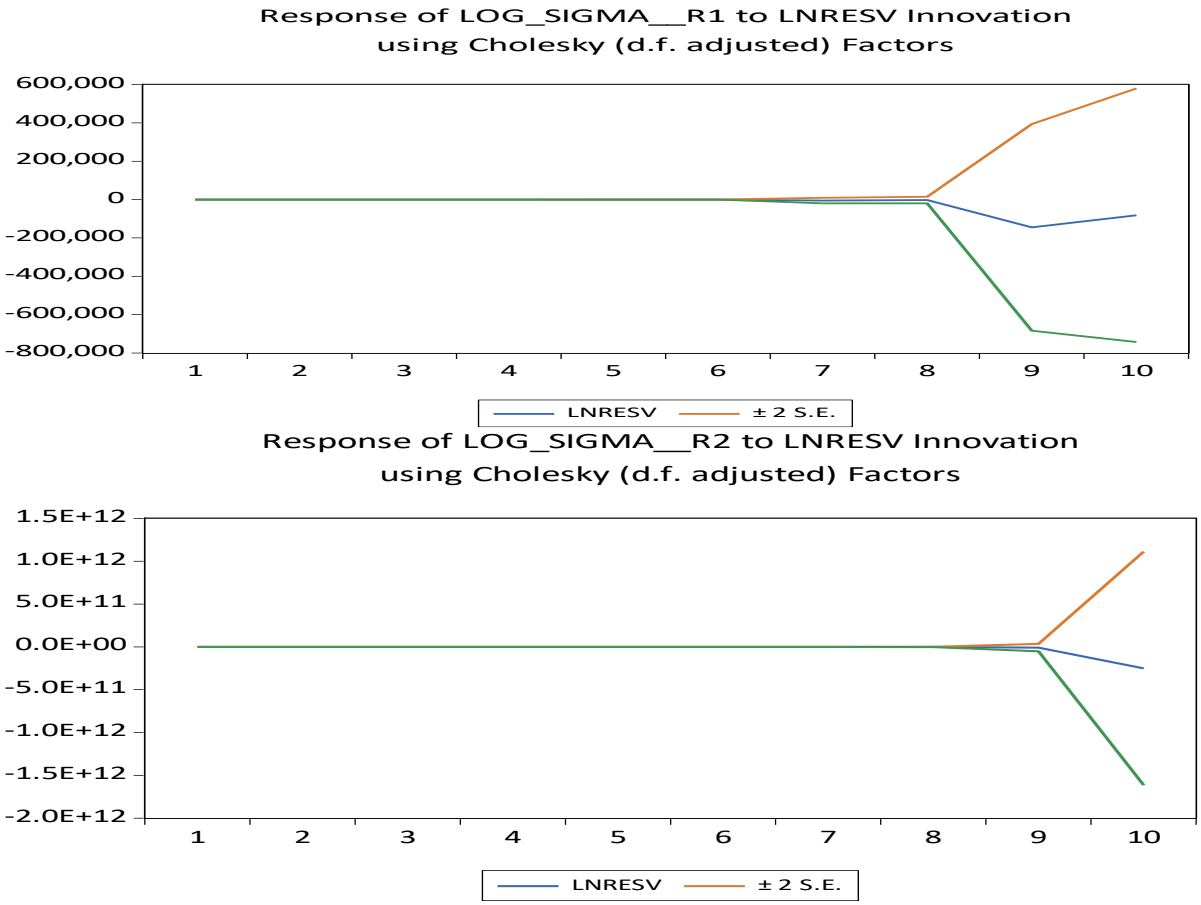


Figure 7. Impulse response of Eigen values of regime 1 and 2 to LNRESV

Discussion

This study examines the undulating and planned changes in volatility exhibited by reserve management and its support in the form of earnings in Ghana's reserves international market. Although this study concludes that regimes persist in supporting GDP per capita earnings within a time-invariant, using the Markov switching model.The results revealed extensive volatilities associated with the financial time series of reserve information.Therefore, this analysis resorted to two regimes, of which the mean and standard deviation parameters fit better under regime 1 model choice identified with a long persistent duration.

The results of regime 1 are more relevant in accounting information for all types of outcomes, and they may force regime 2 to switch to regime 1. The resulting outcome of regime 1 demonstrated highly volatile reserves in supporting the GDP per capita of Ghana for sustained periods. Regime 1 allows considerable earnings to be released to support GDP per capita compared with regime 2, with low volatility reactions. Since the Ghana government is the only investor in the country's reserves, the government would perceive lower risk at higher exchange rates to command total judicious usage of earnings gain to improve the GDP per capita for a reasonable assurance of attaining a growth trajectory. On the contrary, regime 2 alerts the Ghana government to be cautious in dealing with reserves amidst lower exchange rates for trading with financial assets, perhaps reframing from selling

out but ensuring to accumulate more in minimizing any perceived disorder in trading activities (Nazemi et al., 2017).

5. Conclusion

This study investigated planned changes within reserves of Ghana for a defined period and the impact of ongoing reserve earnings support on GDP per capita using the Markov switching model. This estimation technique is rarely used in studies of this nature, as witnessed in the prior empirical literature. Regime 1 results demonstrated significant positive and more considerable means and standard deviation values of high volatility compared to the lower values of regime 2 for the same variables. Regime 1 exhibited better positive and higher amounts of descriptive statistics, which display high volatility with extensive duration to persist in earnings to support the GDP per capita in the consistent application of resource-based theory.

Ghana tends to achieve more earnings during this persistent period of regime 1 in facilitating reliable predictive power to promote economic growth, which is the bedrock of a resilient economy, in conformity with diamond theory.

Earnings predictive power associated with regime 1 findings supports the competitive diamond theory, which posits that a country's natural reserves exploration provides reasonable assurance of strong earnings for achieving strategic competitive advantages.This study has established evidence that the persistent fluctuation of reserves under dynamic volatility could support Ghana's GDP per capita earnings (resource-based theory) using the Markov switching model from accounting and finance perspectives.This study is relevant in detailing information quality displayed by the Markov model-defined time-variant in supporting the GDP per capita of Ghana. Furthermore, the study is also relevant to the government in the information quality overlay within the application of the Markov model in aiding an optimal decision reach-out for supporting the growth trajectory of Ghana in a defined period.

Although quality reserve management emits earnings, the process is highly influenced by exchange-rate structural changes in the international reserves market in applying diamond theory. However, this study could not include the volatilities of the exchange rate and its pernicious effects on reserve earnings. The conclusions could have been complex and compromised if structuring fluctuations in the currency rate had been taken into account. As a result, future studies should include currency rates in reserve management to properly assess profits streams within regime periods for policy and regulatory suggestions from an African viewpoint.

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