The Relationship Between Inflation and Trade Openness: Evidence from Ghana

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Abstract

The correlation between economic growth, trade openness, and inflation has been extensively studied over the years, yielding varied outcomes. Recent disruptions caused by events such as the COVID-19 pandemic and the Russia-Ukraine war have significantly affected the global economy, resulting in a notable increase in inflation rates, particularly in developing countries. This study investigates the impacts of trade openness and inflation on the Ghanaian economy from 1990 to 2022. Employing the Autoregressive Distributed Lag (ARDL) bounds testing for cointegration and the Granger causality test for empirical analysis, the study reveals a mixed short-term effect, showing both positive and negative impacts of trade openness and inflation on economic growth in Ghana. While no long-term effect of trade openness is observed, inflation is found to have a negative long-term influence on growth. Additionally, the results of the Granger causality test suggest a unidirectional causal relationship between trade openness and economic development.

Keywords: GDP per capita, inflation, trade openness, economic growth, Granger causality test

JEL codes: E30, E43, F14, O11

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Introduction

Economic development within a nation is often shaped by a multitude of macroeconomic factors (Musa, 1974; Dachito & Minyahil, 2017; Cooke, 2010; Ahmad et al., 2012). Particularly in developing economies, high inflation rates and trade limitations wield significant influence, directly impacting living standards. Globalization, which fosters economic integration across nations, magnifies the repercussions of economic shocks experienced in developed nations on a global scale. Recent disruptive events like the COVID-19 pandemic and the Russia-Ukraine conflict have significantly hindered economic progress worldwide, with emerging economies, notably those in Africa, bearing a substantial brunt. Governments, irrespective of their developmental stage, acknowledge trade openness and inflation as pivotal determinants of economic activity (Yaya, 2017). Several nations implemented robust economic policies to leverage the beneficial aspects of trade openness and inflation. An essential observation is the positive contribution of trade openness to economic expansion. Proponents of the spillover theory argue that trade openness, intertwined with diminishing prices, has the potential to counteract inflation. This theory posits that trade openness fosters the dissemination of managerial expertise, novel technologies, and employment opportunities, thereby facilitating knowledge transfer, broadening the spectrum of available commodities, and promoting the cultivation of economies of scale and the exploitation of comparative advantages (Lippoldt, 2010; Barro & Sala-i-Martin, 1997; Rivera-Batiz & Romer, 1991).

Furthermore, trade openness precipitates the reallocation of resources towards the growth of productive enterprises, thereby edging out unproductive entities from the market (Romer, 1993). Conversely, an opposing viewpoint posits the concept of temporal consistency in conjunction with the association between openness and inflation. According to this perspective, economies with open trade policies tend to exhibit lower inflation rates compared to those with stringent trade agreements. Trade engagement with developed nations is perceived as particularly advantageous for emerging economies. The principal rationale underlying frequent advisories from international organizations and governments to developing economies to embrace trade liberalization policies is the envisaged benefits (Haussmann et al., 2007). Nevertheless, the adoption of trade liberalization policies by numerous developing nations, commencing in the late 1970s and entailing the elimination of non-tariff trade barriers and reduction of import and export tariffs, may have adverse effects on the economic development of nations producing low-quality goods (Yaya, 2017). This study endeavours to explore the nexus between inflation, trade openness, and economic development in Ghana through a multivariate approach. Ghana, amidst numerous episodes of military governance since the beginning of its independence in 1957, has encountered challenges in economic growth (Abel, 2012). Despite experiencing peak inflation rates in the early 1980s, Ghana emerged as one of Africa's success stories in the late 1980s and early 1990s, fueled by structural reforms and economic recovery (Charles & Richard, 2018).

However, macroeconomic fundamentals deteriorated due to suboptimal domestic policies and external constraints on fiscal and monetary realms, culminating in inflationary spikes, soaring borrowing costs, and currency depreciation against foreign currencies (Samuel et al., 2017). Subsequent to the enactment of the 1992 constitution, ensuring democratic governance and seamless power transitions, Ghana's economy demonstrated a lower inflation trajectory in the 2000s relative to the preceding decades. The successful democratic transition in 2000 underscores ongoing strides in the reform agenda (Emmanuel et al., 2015). Nevertheless, notwithstanding the continuous implementation of sound macroeconomic policies, the Ghanaian economy experienced significant growth in 2017 (Qunxi et al., 2021). Ghana's GDP growth stood at 8.13%, but during the peak of the COVID-19 pandemic, growth decreased to 0.51% in 2020, subsequently declining in the following years due to pre-existing imbalances and external shocks from the Russia-Ukraine conflict. The fallout from this conflict, coupled with macroeconomic uncertainties and tightened global financial conditions, precipitated a full-blown economic downturn in 2022, halting the post-COVID-19 economic resurgence.

The Ghanaian economy grapples with challenges stemming from elevated inflation rates and sluggish economic expansion. The recent performance in economic growth, coupled with high inflation rates and trade openness, prompts inquiries: Is there a substantial relationship between economic growth, inflation, and trade openness? If so, does this relationship exhibit positivity or negativity in both short- and long-term scenarios? This study endeavours to address these questions within the context of the Ghanaian economy, utilizing the Autoregressive Distributed Lag (ARDL) bounds testing to scrutinize the short- and long-term relationships between economic growth, inflation, and trade openness. The subsequent sections of this study are structured as follows: literature review in section two, methodology in section three, results and discussion in section four, and conclusion in section five.

1. Literature review

There have been numerous studies on inflation, trade openness, and real effective exchange rates, employing various methodologies and yielding diverse conclusions. This review focuses on past empirical works related to the current study. In a study by Emmanuel et al. (2015), the authors employed the Johansen cointegration test, the vector error correction model (VECM), and the Granger causality test to examine the effect of foreign direct investment (FDI), exchange rate, and inflation on economic growth in Ghana from 1980 to 2013. They established a long-run relationship between the variables and economic growth, concluding that the exchange rate and FDI negatively influence growth, whereas inflation positively impacts it. Mustapha et al. (2013) used the Autoregressive Distributed Lag (ARDL) bounds testing method to investigate the determinants of the real exchange rate in Ghana from 1985 to 2010, considering inflation. The study found that inflation positively impacts the real exchange rate in the long-run, but has

a negative influence in the short-run, suggesting that inflation depreciates the real exchange rate in the short-term but appreciates it in the long-term. Charles and Richard (2018) examined the impact of exchange rate and inflation on stock market returns in Ghana from 2000 to 2013 using the ARDL bounds test cointegration method. Their findings indicated a short- and long-term relationship between stock market returns and exchange rates. Similarly, Samuel et al. (2017) explored the relationship between exchange rate policy adjustment and inflation in Ghana from 1965 to 2015 through the ARDL approach. Their results showed that both long- and short-run devaluations of the currency are inflationary. Eunice (2019) applied autoregressive conditional heteroscedasticity (ARCH) and generalized autoregressive conditional heteroscedasticity (GARCH) to investigate exchange rate volatility and its effect on economic growth in Ghana from 1983 to 2010. The author concluded that exchange rate volatility negatively affects economic growth in both the short- and long-run. Additionally, Abel (2012) examined the connection between the real exchange rate and economic growth in Ghana from 1980 to 2010 using the Johansen cointegration test and the error correction model. Their empirical findings indicated a significant long-term relationship between the real exchange rate and economic growth, suggesting that the real exchange rate positively impacts GDP.

Conversely, Sadia et al. (2014) studied the role of trade openness, inflation, FDI, and exchange rate on economic development in Pakistan from 1980 to 2011 through the dynamic least squares method. Their findings indicated a negative effect of trade openness and inflation on economic growth. Rana (2016) examined the relationship between trade openness and inflation in Turkey from 1980 to 2011 using the ordinary least squares (OLS) method. The findings showed a negative correlation between trade openness and inflation towards economic growth. Yaya (2017) investigated the impact of trade openness on economic growth in Cote d'Ivoire from 1965 to 2014 through the ARDL model and the Toda and Yamamoto Granger causality test. The outcome indicated that trade openness positively influences economic growth in both the short- and long-run. Chhabra and Alam (2020) studied the factors influencing inflation and trade openness in India from 1974-1975 to 2015-2016 using the ARDL bounds testing method. The authors concluded that there is a positive relationship between trade openness and inflation. Sulehri and Khan (2020) examined the relationship between inflation and trade openness in Pakistan from 1980 to 2014 using the ARDL method. The study found no long-run linkage between trade openness and inflation towards economic growth.

Qunxi et al. (2021) investigated the connection between trade openness and economic development in China under the exchange rate changes from 1994 to 2008 through the ARDL method. Their findings confirmed a positive influence of trade openness on the quality of economic growth in both the short- and long-run. Muhammad and Benedict (2018) examined the impact of trade openness on economic development in Nigeria from 1981 to 2017 through the OLS approach. The results indicated that trade positively impacts economic growth. Aboubacar et al. (2014) assessed the impact of real exchange rate and trade openness on econom-

ic growth in Niger from 1980 to 2013 using the Johansen cointegration test and the VECM. The findings found a long-term relationship between the variables and a positive impact of the real exchange rate and trade openness on growth. Henok (2015) investigated the relationship between trade policy and economic growth in Sub-Saharan African countries from 2000 to 2008 through the panel method. The empirical results showed that trade openness stimulates economic development. Pam (2016) studied how trade openness influences economic growth in developing economies in Sub-Saharan Africa from 1980 to 2012 using the pooled mean group approach. The empirical outcome showed that a trading threshold exists below which greater trade openness has a favourable effect on economic development, but above which its effect decreases. Agyei and Idan (2022) assessed the role of institutions in trade openness on economic growth in Sub-Saharan Africa from 1996 to 2017 using the system general method of moment method. The findings showed that institutions strengthen the positive connection between trade openness and growth. As much of the above literature captures the selected variables' impact on economic growth before the COVID-19 pandemic and the Russia-Ukraine war, this study seeks to fill the gap by re-examining these variables' current impacts on growth.

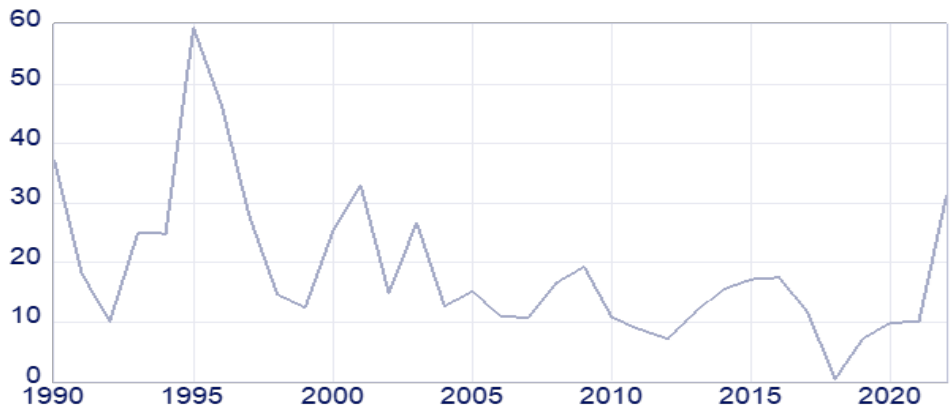
1.1. Recent sources of inflation in Ghana

Inflation, a phenomenon rooted in the pace of economic growth over a defined period, manifests as a continual escalation in the cost of living within an economy. This upward trajectory prompts a surge in the demand for currency, consequently diminishing its current value and eroding purchasing power (Prateek et al., 2022). In recent years, numerous developing economies, including Ghana, have grappled with heightened inflation rates, exacerbated by the interconnectedness of the global economy and the disruptive impacts of events such as the COVID-19 pandemic and the Russia-Ukraine war (Allam et al., 2022). Supply chain disruptions and fluctuations in commodity markets have severely unsettled macro-financial stability and growth, further complicating the policy environment for nations in the process of post-pandemic recovery. The persistent elevation of inflation is anticipated, stemming from imbalances in supply and demand and continued policy interventions implemented during the pandemic, which have already induced inflationary pressures in various countries (IMF, 2022). Ghana, over the past few decades, has consistently contended with elevated inflation rates as shown in Figure 1, indicative of insufficient management of inflationary concerns. The Ghanaian economy witnessed extreme inflationary periods from the late 1970s through 2009, reflecting ineffective financial management until 1983 (Nchor & Darkwah, 2015). Heightened budget deficits precipitated rapid expansions in domestic credit and broad money, leading to discrepancies between official and parallel market exchange rates, and exacerbating inflation and external imbalances (Ishan et al., 1991). Notably, the inflation rate persistently lingered around double digits, averaging 32 per cent annually. However, a pivotal shift occurred in 2007 when Ghana

emerged as one of the pioneering emerging market economies and low-income nations to formally adopt inflation targeting (Michael et al., 2020). This strategic move followed government initiatives aimed at mitigating the fiscal deficit, which had soared to record highs in 2008 amidst the economic crisis of 2009.

The Russia-Ukraine conflict in 2022 compounded Ghana's economic challenges, as it witnessed a sharp upsurge in crude oil prices. Given that crude oil constitutes a major revenue stream for Ghana through exports, the escalating prices contributed to heightened inflation and increased energy costs. Moreover, the surge in domestic gas prices and transportation expenses exerted additional strain, impacting various sectors, including food supply chains, thus perpetuating ongoing inflationary trends (GSS, 2023). The current inflationary climate in Ghana can be attributed to escalating food costs, initially spurred by panic buying preceding the COVID-19 lockdown in 2020 (GSS, 2023). Subsequent spikes in mid-2021 were driven by challenges in oil prices and delayed rainfall attributed to climate change. Furthermore, the depreciation of the Ghanaian Cedi, now among the world's poorest-performing currencies, remains a significant contributing factor to inflation. The Cedi's devaluation translates into heightened import costs, ultimately passed on to domestic consumers, exacerbating already elevated prices of food and transportation (Zubairu et al., 2024). The repercussions of the COVID-19 outbreak and surging global oil prices have further aggravated the depreciation of the Cedi. Exchange rates and inflation share an intimate relationship, where fluctuations in one invariably affect the other. In 2022, the Ghanaian Cedi's value against the US dollar plummeted by more than half, amplifying the cost of imported goods and contributing to inflationary pressures (GSS, 2023). The consequent decline in the purchasing power of the Cedi brought about a reduction in exchange rates. As of January 2023, the annual inflation rate stood at 53.6 per cent, as determined by the Consumer Price Index (CPI). Although there was a marginal decrease in the country's inflation rate to 40.1% in August year-over-year from 43.1% in July, it remains significantly higher than the central bank's targeted range of 6% to 10%. Figure 1 depicts historical data on Ghana's inflation rate (GSS, 2023).

Figure 1. Inflation rate in Ghana from 1990-2022



Source: Author's calculations

2. Methodology

This part explains the method employed in this study. It covers the data and model parameter estimation approach applied. The model estimation used in the study is based on the endogenous growth theory that supports the investigation of the linkage between GDP per capita, real effective exchange rate, trade openness, and inflation toward economic growth.

2.1. Data source and econometric method

Data utilized in this study were sourced from the World Bank covering the period from 1990 to 2022. This timeframe was selected for its availability of uniform data across all selected variables, namely Gross Domestic Product (GDP) per capita, real effective exchange rate, trade openness, and inflation rate. Notably, this period encompasses significant global economic events such as the 2008 global financial crisis and the COVID-19 pandemic, which greatly impacted economic growth worldwide. In the analysis, GDP per capita is defined as the nominal GDP measured in current prices (in United States dollars) divided by the total population. The real nominal effective exchange rate, on the other hand, serves as a measure of a currency's value against a weighted average of other foreign currencies, divided by the price deflator. The inflation rate is assessed through the Consumer Price Index, reflecting the percentage change in prices of goods and services consumed by households. Trade openness, a key metric indicating the significance of foreign transactions relative to domestic ones, is often measured using the trade-to-GDP ratio (OECD, 2011). It is calculated as the average of trade, comprising the aggregate of exports and imports of goods and services, relative to GDP. For the purposes of modelling in this study, GDP per capita is utilized as the dependent variable. However, the variables were transformed into natural logarithms to ensure proper model specification as indicated in Equation 1.

$$lnGDPpc_t = \beta_0 + \beta_1 lnReer_t + \beta_2 lnTop_t + \beta_3 lnInfla_t + \varepsilon_t \quad (1)$$

Where GDPpc represents the gross domestic product per capita, Reer indicates the real effective exchange rate, Top stands for trade openness, and Infla represents the inflation rate. $\beta_1, \beta_2,$ and β_3 are the estimated coefficients of the explanatory variables. The subscript t represents time.

2.2. Estimation technique

To evaluate the short- and long-term relationships between economic growth, real effective exchange rate, trade openness, and inflation rate, the study utilized the Autoregressive Distributed Lag (ARDL) bound testing method. In this analysis, particular emphasis was placed on the inflation rate and trade openness due to their pronounced impact on the Ghanaian economy. The choice of employing the ARDL method stemmed from its capability to capture both the short- and long-

run effects of the specified variables on economic growth. One of the notable advantages of the ARDL approach is its applicability to situations where the variables exhibit a mix of I (0) and I (1) processes, particularly in cases of limited sample sizes (Ang, 2007; Tong et al., 2020). The ARDL model to represented by Equation 2.

$$\Delta lnGDPpc_t = a + \sum_{i=1}^{\pi} \beta_i \, \Delta \ln GDPpc_{t-i} + \sum_{i=1}^{\sigma} \phi_i \, \Delta \ln Reer_{t-i} + \sum_{i=1}^{\tau} \mu_i \, \Delta \ln Top_{t-i} + \sum_{i=1}^{\rho} \varphi_i \, \Delta \ln Infla_{t-i} + \varepsilon_t \quad (2)$$

However, to ascertain the presence of cointegration using the ARDL model, the approach outlined by Pesaran and Shin (1999) and Narayan (2005) is adopted. This method involves assessing a long-run relationship among the variables. Specifically, the F-statistic of the correlation coefficient is compared with the critical value of the ARDL cointegration coefficient of the maximum asymptotic F-statistic to determine whether to accept or reject the null hypothesis (Pesaran et al., 2001). Given the constraints of a limited sample size, the principle proposed by Narayan (2005) for identifying cointegration among the variables is employed in this study. The ARDL bound testing cointegration model is represented by Equation 3.

$$\Delta lnGDPpc_t = a + \sum_{i=1}^{\pi} \beta_i \, \Delta \ln GDPpc_{t-i} + \sum_{i=1}^{\sigma} \phi_i \, \Delta \ln Reer_{t-i} + \sum_{i=1}^{\tau} \mu_i \, \Delta \ln Top_{t-i} + \sum_{i=1}^{\rho} \varphi_i \, \Delta \ln Infla_{t-i} + \lambda_1 lnGDPpc_{t-1} + \lambda_2 lnReer_{t-1} + \lambda_3 lnTop_{t-1} + \lambda_4 lnInfla_{t-1} + \varepsilon_t \quad (3)$$

Where β, φ, μ, and ϕ indicate the short-run coefficients to be estimated, whereas λ_1 , λ_2 , λ_3 and λ_4 are the long-run coefficient. The presence of cointegration can be gathered when the null hypothesis ($H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$) is rejected against the alternative hypothesis ($H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$). Δ represents the difference operator. Conclusions are drawn based on both the upper and lower critical bounds of the test. The lower critical bound assumes that all series are I (0), whereas the upper critical bound assumes that all series are I (1). If the F-statistic is higher than the upper critical bound, it indicates cointegration among the series. Conversely, if the F-statistic is lower than the lower critical bound, it suggests no cointegration. When the F-statistic is between the lower and upper critical bounds, the cointegration status is considered inconclusive. However, it is crucial to estimate the error correction model as well, as it offers insights into the short-term dynamics leading to the long-run. Within the error correction model framework, variables are reintroduced in an ARDL error correction model setup, and causal relationships are examined to understand short-term changes among the variables (Engle & Granger, 1987). The estimated error correction model is depicted in Equation 4.

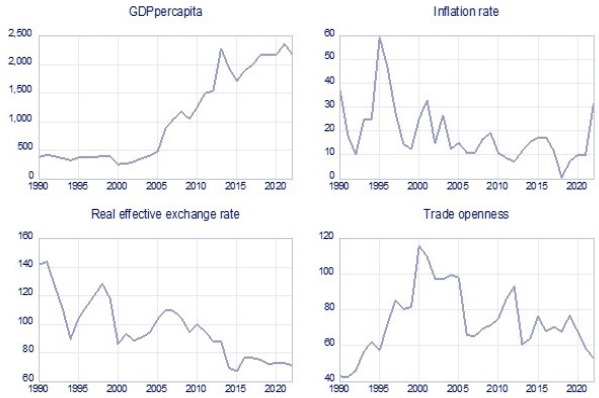
$$\Delta GDPpc_t = a + \sum_{i=1}^{\pi} \beta_i \, \Delta GDPpc_{t-i} + \sum_{i=1}^{\sigma} \phi_i \Delta Reer_{t-i} + \sum_{i=1}^{\tau} \mu_i \, \Delta Top_{t-i} + \sum_{i=1}^{\rho} \varphi_i \Delta Infla_{t-i} + \delta ECT_{t-1} + \varepsilon_t \quad (4)$$

Where δECT_{t-1} represents the error correction term. The symbol δ indicates the speed of adjustment from the short-run dynamics to the long-run relationship. The restriction under the error correction model states that the error correction coefficient must be negative and statistically significant to confirm a long-run relationship among the variables.

2.3. Trend analysis of variables under consideration

The top left chart in Figure 2, labelled GDP per capita, shows a clear upward trend with fluctuations from 1990 to 2022, indicating that the GDP per capita is increasing over time. This is a positive sign of economic growth, suggesting improvements in the average standard of living and economic well-being of the population. The fluctuations represent periods of rapid economic expansion followed by short-term slowdowns or contractions, which could be due to economic cycles, policy changes, or external factors such as global economic conditions. The top right chart, labelled inflation rate, exhibits high volatility with no clear long-term trend. This indicates that the inflation rate fluctuates significantly, reflecting periods of high and low inflation. Such volatility can lead to economic uncertainty, affecting consumer spending, investment decisions, and monetary policy. Stable inflation is crucial for economic stability, and significant fluctuations can erode purchasing power and economic confidence, presenting challenges for policymakers. The bottom left chart, labelled real effective exchange rate (REER), shows a downward trend with noticeable fluctuations. A decreasing REER suggests that the currency is depreciating in real terms against a basket of other currencies, adjusted for inflation. The fluctuations indicate periods of relative strength and weakness in the currency's value. A declining REER can make a country's exports more competitive, potentially boosting the trade balance, but it can also increase the cost of imports, contributing to domestic inflation. The bottom right chart, labelled trade openness, displays significant fluctuations with a slight upward trend. This indicates that the degree to which the country is open to international trade is increasing over time, with periods of more or less trade activity. Increasing trade openness generally promotes economic growth by allowing access to larger markets, advanced technologies, and greater competition. The fluctuations might reflect changes in trade policies, global trade conditions, or economic cycles, highlighting variable trade activity over the period.

Figure 2. Trend analysis of GDP per capita, real effective exchange rate, inflation rate and trade openness



Source: Author's calculations

3. Results and discussions

The descriptive statistics and correlation matrix provide valuable insights into Ghana's economic performance and the interrelations between key indicators. The descriptive statistics display the distribution and variability of the data for GDP per capita, real effective exchange rate, trade openness, and inflation rate in Table 1. For GDP per capita (GDPC), the mean and median values are $6.673 and $6.786, respectively, suggesting a relatively stable average income level. The wide range between the minimum and maximum values ($5.533 to $7.767) indicates considerable variability in economic prosperity over the observed period. The real effective exchange rate exhibits a mean of 4.551 and a median of 4.545, with a standard deviation of 0.211, indicating relatively low variability in exchange rate fluctuations. The negative skewness (-0.156) suggests a slight left-skewed distribution, implying more frequent occurrences of lower exchange rates. The negative correlation (-0.668) with GDP per capita indicates a potential trade-off between exchange rate stability and economic growth. Trade openness displays a mean of 4.271 and a median of 4.257, with a moderate standard deviation of 0.252, suggesting moderate variability in the degree of openness to international trade. The weak negative correlation (-0.202) with GDP per capita suggests that increased trade openness may not necessarily lead to higher economic prosperity in Ghana during the observed period. The inflation rate exhibits a mean of 18.778% and a median of 15.120%, with a high standard deviation of 12.204%, indicating significant variability and volatility in price levels. The negative correlation (-0.518) with GDP per capita suggests a potential inverse relationship between economic growth and inflation, highlighting the importance of price stability for sustained development.

Table 1. Descriptive statistics and correlation matrix

	lnGDPpc	lnReer	lnTop	lnInfla
Mean	6.673	4.551	4.271	18.778
Median	6.786	4.545	4.257	15.120
Maximum	7.767	4.969	4.754	59.460
Minimum	5..533	4.206	3.749	0.410
Std.Dev.	0.811	0.211	0.252	12.204
Skewness	0.079	0.156	-0.164	1.509
Kurtosis	1.299	2.158	2.636	5.420
Jarque-Bera	4.012	1.107	0.331	20.598
Prob.	0.134	0.574	0.847	0.000
Sum	220.215	150.190	140.955	619.650
Sum Sq.Dev.	21.062	1.431	2.047	4765.981
Observation	33	33	33	33
Correlation matrix				
lnGDPpc	1			
lnReer	-0.668	1		
lnTop	-0.202	-0.243	1	
lnInfla	-0.518	0.271	-0.127	1

Source: Author's calculation

The negative correlation between GDP per capita and the real effective exchange rate (-0.668) suggests that as the exchange rate appreciates, there tends to be a decrease in GDP per capita, indicating a potential adverse impact of currency strength on economic growth. Similarly, the negative correlation between GDP per capita and inflation rate (-0.518) implies that higher inflation rates may be associated with lower levels of economic prosperity, as rising prices erode purchasing power and constrain consumption and investment activities.

3.1. Stationarity Test

To ascertain the properties of the series, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are commonly utilized. These tests determine whether a time series possesses a unit root, which indicates non-stationarity and suggests that the series follows a random walk process. In the context of this study, Dickey and Fuller (1979) and Phillips and Perron (1988) provided foundational insights into unit root testing. Table 2 presents the results of the ADF and PP tests conducted on the variables. The findings reveal that GDP per capita, real effective exchange rate, and trade openness exhibit unit roots at the level, indicating non-stationarity. However, these variables become stationary at first-order differences, signifying integration at an order of one I (1). Conversely, inflation is stationary at the level, suggesting that it does not possess a unit root and is integrated at order zero I (0).

Table 2. Unit root test

Variable	Level	ADF	PP
lnGDPpc	0	-0.308	-0.397
lnGDPpc	1	-4.667***	-4.669***
lnReer	0	-1.798	-1.733
lnReer	1	-5.060***	-5.338***
lnTop	0	-2.309	-2.308
lnTop	1	-4.965***	-5.354***
lnInfla	0	-3.195**	-3.143**

Note: *p < 0.1; **p < 0.05; ***p < 0.01
Source: Author's calculation

3.2. ARDL bound test cointegration

To determine the optimal lag length for the variables, various information criteria were examined, following the methodology outlined in previous studies by Olayungbo (2021) and Shahbaz et al. (2013). The study employed automatic lag selection based on the Akaike Information Criterion (AIC) to determine the appropriate lag order for our model. The lag selection based on the AIC produced a lag of 3 for the real effective exchange rate and 4 for trade openness and inflation rate. The ARDL bounds test for cointegration presents a test statistic (F-statistic) value of 9.500, which can be seen in Table 3. In the context of significance levels of 10%, 5%, and 1%, the critical values for the F-statistic are provided. The values for I (0) and I (1) are also included, representing the orders of integration for the variables involved in the test. For example, at the 10% significance level, the critical value for I (0) is 2.37, and for I (1), it is 3.2. Similarly, at the 5% significance level, the critical values are 2.79 for I (0) and 3.67 for I (1). Finally, at the 1% significance level, the critical values are 3.65 for I (0) and 4.66 for I (1). The F-statistic, which measures the strength of cointegration, is reported as 9.500. This value exceeds the critical values at all common significance levels (10%, 5%, and 1%) for both I (0) and I (1), indicating significant evidence of cointegration between the variables examined. Therefore, the null hypothesis of no cointegration is rejected, suggesting the presence of a long-run relationship among the variables.

Table 3. ARDL bounds test cointegration results

Test Statistic	Value	Significance	I (0)	I (1)
F-statistic	9.500	10%	2.37	3.2
		5%	2.79	3.67
		1%	3.65	4.66

Note: The AIC selection criterion (1,3,4,4)
Source: Author's calculations

3.3. ARDL long- and short-run results

The long-run results, as presented in Table 4, provide insights into the relationship between the explanatory variables and GDP per capita in Ghana. The real effective exchange rate coefficient of (4.84), its lack of statistical significance, indicates that it does not have a significant impact on Ghana's GDP per capita. However, the positive coefficient suggests a potential positive association, albeit not robust due to the lack of statistical significance. This could imply that changes in the real effective exchange rate may have some influence on economic growth, but the relationship is not firmly established. Similarly, the coefficient for trade openness (-1.45) is not statistically significant, indicating that trade openness does not have a significant impact on economic growth in the long-run. Despite this lack of significance, the negative coefficient suggests a potential adverse relationship between trade openness and GDP per capita over the long-term. This implies that increasing trade openness may not necessarily lead to higher economic growth in Ghana, contrary to expectations. In contrast, the coefficient for the inflation rate (-0.20) is statistically significant at the 5% level, indicating its influence on Ghana's economic growth. The negative coefficient suggests that higher inflation rates are associated with lower GDP per capita, reflecting an adverse impact on economic growth. These findings are consistent with previous studies by Faraji and Kenani (2013) and Atigala et al. (2022), which also highlighted the detrimental effect of inflation on economic growth.

Table 4. ARDL estimated results

	Coefficient	Std. Error	t-statistic	Prob.
Long-Run				
lnReer	4.844	3.789	1.278	0.223
lnTop	-1.449	0.932	-1.554	0.144
lnInfla	-0.201**	0.083	-2.403	0.032
Constant	-4.575	16.428	-0.278	0.785
Short-Run				
Δ lnReer	1.279***	0.189	6.779	0.000
Δ lnReer (-1)	0.202	0.198	1.018	0.327
Δ lnReer (-2)	-0.331	0.199	-1.663	0.120
Δ lnTop	-0.498***	0.101	-4.927	0.000
Δ lnTop (-1)	0.101	0.110	0.918	0.376
Δ lnTop (-2)	-0.054	0.110	-0.485	0.636
Δ lnTop (-3)	0.356***	0.089	3.979	0.002
Δ lnInfla	-0.007***	0.002	-4.459	0.001
Δ lnInfla (-1)	0.009***	0.003	3.867	0.002

Table 4 continued

	Coefficient	Std. Error	t-statistic	Prob.
Δ lnInfla (-2)	0.007***	0.002	3.879	0.002
Δ lnInfla (-3)	0.005***	0.002	3.145	0.008
ECT_{t-1}	-0.109***	0.014	-7.881	0.000
Diagnostic test				
χ^2 Normality			0.474	0.789
χ^2 Serial			0.656	0.262
χ^2ARCH			0.099	0.905
χ^2 Reset			2.015	0.071
R-squared =0.92	Durbin-Watson stat =1.872			

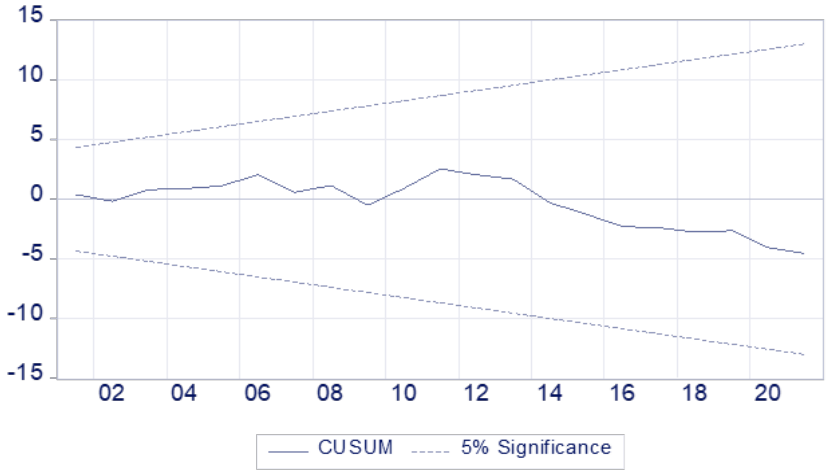
Note: *p < 0.1; **p < 0.05; ***p < 0.01; the AIC selection criterion (1,3,4,4)
Source: Author's calculations

Table 4 displays the short-run error correction results derived from the estimation of the ARDL model. The R-squared coefficient indicates that 92% of the changes in GDP per capita can be explained by the independent variables included. The simultaneous coefficient of (1.27) of the real effective exchange rate is statistically significant at the 1% level, indicating its significant influence on Ghana's economic growth in the short-run. This suggests that an increase in the real effective exchange rate is associated with a rise in GDP per capita, aligning with the findings of Mori et al. (2012). However, the simultaneous coefficients for the previous 1 year and 2 years of the real effective exchange rate are not statistically significant, indicating that their impact on the Ghanaian economy's growth is not significant. In contrast, the simultaneous coefficient of trade openness is significant at the 1% level, indicating its influence on economic development in the short-run. However, while the simultaneous coefficient for the previous 1-year lag and the negative coefficient for the previous 2-year lag of trade openness are non-significant, suggesting no significant impact on GDP per capita, the simultaneous coefficient for the previous 3 years is statistically significant at the 1% level, suggesting a positive impact on development. This mixed effect of trade openness in the short-run supports the findings of Khalid (2016).

Regarding inflation, the simultaneous coefficient is significant at the 1% level, indicating a negative impact on GDP per capita. This implies that a percentage-point change in the inflation rate leads to a decrease in economic growth in Ghana. However, the simultaneous coefficients for the previous 1 year, 2 years, and 3 years of inflation rate positively influence GDP per capita, indicating that previous inflation rates influence the current economic growth. This mixed effect of inflation confirms the results from Celil et al. (2016). Furthermore, the error correction term coefficient is statistically significant at the 1% level with a negative sign, suggesting a return to equilibrium following short-term shocks in the variables. The coeffi-

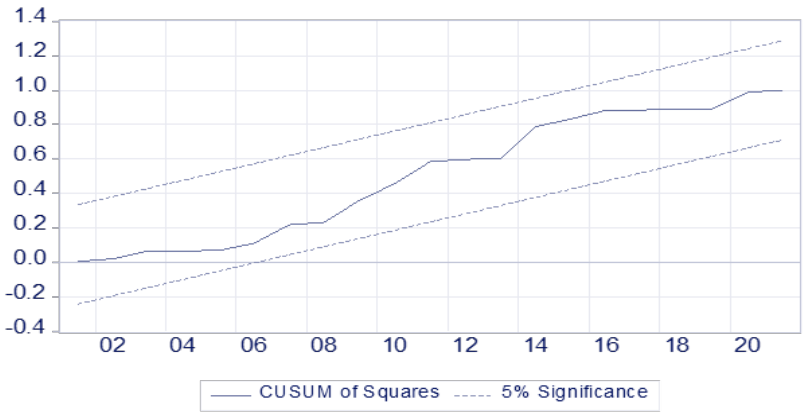
cient implies that there is an annual correction in the variation of the dependent variable in the occurrence of disequilibrium, supporting the notion of an adjustment towards equilibrium in the long-run (Appiah, 2018). Furthermore, the error correction term is anticipated to have a negative sign, indicating a long-term return to equilibrium following short-term shocks in the variables (Appiah, 2018). The error correction term coefficient (-0.109) is statistically significant at a 1% level. This suggests that, in terms of a deviation from equilibrium, the target variable needs to adjust by 10.9% in the preceding year. Therefore, the error correction term implies that there is an annual correction in the variation of the dependent variable in the occurrence of a disequilibrium. This correction mechanism underscores the model's ability to capture the adjustment process towards long-term equilibrium following short-term fluctuations, ensuring the stability of the economic system over time. Moreover, the diagnostic tests in Table 4 on correct specification (Ramsey reset), normality of residuals, serial correlation, and autoregressive conditional heteroscedasticity (ARCH) indicate that the estimated model is stable. The p-values for these tests are insignificant, suggesting that the model meets the criteria for correct specification, normality of residuals, absence of serial correlation, and absence of ARCH, ensuring the stability of the estimated model. In this study, the recursive CUSUM and recursive CUSUMSQ tests were employed to evaluate the stability of the ARDL model estimated. These tests are commonly used to assess the reliability and consistency of estimated models over time. Figures 3 and 4 illustrate the results of these tests, showing how the lines representing the test statistics compare to a threshold, typically set at 5% (Borensztein et al.,1998). If the lines remain within this threshold, it indicates that the estimated model is stable and consistent throughout the study period. The findings from the recursive tests confirm the stability and consistency of the estimated model in this study, as the lines fall within the 5% threshold.

Figure 3. Cumulative sum of recursive residuals



Source: Author's calculation

Figure 4. Cumulative sum of squares of recursive residuals



Source: Author's calculation

3.4. Granger causality test

The outcomes of the Granger causality test are presented in Table 6. Investigating the causal relations among variables, as highlighted by Granger (1969) and Shahbaz et al. (2013), provides valuable insights into the future policy implications of empirical results. Rejecting the null hypothesis of no causality occurs when the p-value of the F-statistic is statistically significant. According to the corresponding p-values of the F-statistic coefficients, a unidirectional causality from GDP per capita to the real effective exchange rate is established. Similarly, a unidirectional causality running from trade openness to GDP per capita is confirmed. Thus, an increase in the trade ratio to GDP leads to a rise in economic development in Ghana. However, there is no evidence of a causal relationship between GDP per capita and the inflation rate. Additionally, a unidirectional causality from trade openness to the real effective exchange rate was found. There was a bidirectional causality between the real effective exchange rate and inflation in the Ghanaian economy. The findings from the causality test imply that the real effective exchange rate and inflation rate play significant roles in Ghana's economic growth policies. The bidirectional causality between the real effective exchange rate and inflation validates the findings from Emmanuel et al. (2015).

Table 6. Granger causality test results

Null Hypothesis	F-Statistic	Prob.	Decision on H_o
lnReer Granger cause lnGDPpc	2.028	0.151	Fail to reject
lnGDPpc Granger cause lnReer	4.874	0.015	Rejected
lnTop Granger cause lnGDPpc	3.162	0.059	Rejected
lnGDPpc Granger cause lnTop	1.101	0.347	Fail to reject
lnInfla Granger cause lnGDPpc	0.038	0.961	Fail to reject

Table 6 continued

Null Hypothesis	F-Statistic	Prob.	Decision on H_o
lnGDPpc Granger cause lnInfla	2.101	0.142	Fail to reject
lnTop Granger cause lnReer	3.478	0.042	Rejected
lnReer Granger cause lnTop	1.014	0.376	Fail to reject
lnInfla Granger cause lnReer	5.952	0.007	Rejected
lnReer Granger cause lnInfla	5.184	0.013	Rejected
lnInfla Granger cause lnTop	0.963	0.394	Fail to reject
lnTop Granger cause lnInfla	0.819	0.451	Fail to reject

Source: Author's calculations

Conclusion and policy implications

The examination of trade openness and inflation's impact on economic growth has been a subject of extensive scrutiny among researchers, yielding varied outcomes in existing literature. The prevailing global economic uncertainties have notably cast shadows over the economic progress of numerous developing nations. This study delves into dissecting the ramifications of trade openness and inflation on Ghana's economic trajectory spanning from 1990 to 2022. Utilizing a multivariate framework with trade openness, inflation, and the real exchange rate as explanatory variables, the empirical analysis employs the ARDL bounds testing method of cointegration to scrutinize the short- and long-term relationships between the dependent variable (GDP per capita) and the independent variables. In the short-term, the study unveils a positive correlation between the real effective exchange rate and economic growth, while trade openness and inflation showcase diverse effects, oscillating between positive and negative impacts in the Ghanaian context. However, in the long-haul, the findings underscore that inflation adversely affects economic development, whereas trade openness and the real effective exchange rate do not wield significant influences. Consequently, the results lend credence to the notion that elevated inflation rates impede economic growth, indicating Ghana's susceptibility to external economic shocks. Additionally, alleviating the burden of import costs by addressing high taxes at ports can mitigate the cost burden borne by consumers. Given the deleterious impact of inflation on economic growth, prudent fiscal and monetary policies are recommended for implementation by the government, including the establishment of an inflation threshold to uphold economic stability. Extending support to domestic enterprises through access to credit facilities at preferential interest rates can incentivize large-scale production for both domestic and export markets, ultimately curbing the prices of imported goods and services. It is acknowledged that this study's findings are contingent on annual data, which may not comprehensively encapsulate all factors influencing the variables. Future research endeavours could delve into additional factors contributing to elevated inflation rates and delve deeper into the significance of trade openness. Expanding the sample size through various methodologies could also enrich the analytical depth.

References

Abel, F. (2012). Real Exchange Rate and Economic Growth: Determining the Direction of Impact in Ghana. *Annals of Management Science, 1*(1), 107-122.

Aboubacar, B., Xu, D., & Ousseini, A. (2014). Does Trade Openness Matter for Economic Growth in Niger?. *Theoretical Economics Letters, 4*, 916-927.

Agyei, K. S., & Idan, A. G. (2022). Trade Openness, Institutions, and Inclusive Growth in Sub-Saharan Africa. *Econ, Soc, Tech, & Climate Change*, *12*(2), 1-12. https://doi.org/10.1177/21582440221099008

Ahmad, J., Ghaderi, S., Hosseinzadeh, R., & Nademi, Y. (2012). Openness and inflation: New empirical panel data evidence. *Economics Letters, 117*(3), 573–577. https://doi.org/10.1016/j.econlet.2012.07.028

Allam, Z., Bibri, S., & Sharpe, S. (2022). The Rising Impacts of the COVID-19 Pandemic and the Russia–Ukraine War: Energy Transition, Climate Justice, Global Inequality, and Supply Chain Disruption. *Resources, 11*(99), 1-17. https://doi.org/10.3390/resources11110099

Ang, J. (2007). CO2 emissions, energy consumption, and output in France. *Energy Policy, 35*(10), 4772–4778. https://doi.org/10.1016/j.enpol.2007.03.032

Appiah, M. O. (2018). Investigating the multivariate Granger causalitybetween energy consumption, economic growth and CO2 emis-sions in Ghana. *Energy Policy, 112*, 198–208. https://doi.org/10.1016/j.enpol.2017.10.017

Atigala, P., Maduwanthi, T., Gunathilake, V., Sathsarani, S., & Jayathilaka, R. (2022). Driving the pulse of the economy or the dilution effect: Inflation impacting economic growth. *PLoS ONE, 17*(8), 1-17. https://doi.org/10.1371/journal.pone.0273379

Barro, R. J., & Sala-i-Martin, X. (1997). Technological diffusion, convergence, and growth. *Journal of Economic Growth, 2*(1), 1-26.

Borensztein, E., J. De Gregorio and Lee W.J (1998). How does FDI affect economic growth. *Journal of International Economics*, *45*(1), 115-135

Celil, A., Ömer, E., & Metin, B. (2016). Inflation and Economic Growth: A Dynamic Panel Threshold Analysis for Turkish Republics in Transition Process. *Social and Behavioral Sciences, 229*, 196-205. https://doi.org/10.1016/j.sbspro.2016.07.129

Charles, K., & Richard, K. A. (2018). A Study of the Effect of Inflation and Exchange Rate on Stock Market Returns in Ghana. *International Journal of Mathematics and Mathematical Sciences*, *2018*(1), 1-9. https://doi.org/10.1155/2018/7016792

Chhabra, M., & Alam, Q. (2020). An empirical study of trade openness and inflation in India. Decision, 47, 79–90. https://doi.org/10.1007/s40622-020-00237-7

Cooke, D. (2010). Openness and inflation. *Journal of Money, Credit and Banking, 42*, 267–287. https://doi.org/10.1111/j.1538-4616.2009.00287.x

Dachito, A., & Minyahil, A. (2017). Trade Liberalization and Inflation: Econometric Analysis to Ethiopian Economy. *Global Journal of Human-Social Science, 17*, 1–9.

Dickey, W., & Fuller, W. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*, 427-431. https://doi.org/10.1080/01621459.1979.10482531

Emmanuel, A., Eric, N., & Kwabena, A. (2015). FDI, Inflation, Exchange rate and Growth in Ghana: Evidence from causality and Cointegrated Analyssi. *European Scientific Journal*, *11*(31), 294-304.

Engle, R., & Granger, C. (1987). Cointegration and error correction: representation, estimation and testing. *Econometrica, 55*(2), 251-276. https://doi.org/10.2307/1913236

Eunice, A. (2019). Exchange rate volatility and Economic growth in Ghana. *International Journal of Business and Social Science, 10*(4), 105-118.

Faraji, K., & Kenani, M. (2013). Impact of Inflation on Economic Growth: A Case Study of Tanzania. *Asian Journal of Empirical Research, 3*(4), 363-380.

Granger, C. (1969). Investigating causal relations by econometric models and cross spectral methods. *Econometrica, 37*(3), 424-438. https://doi.org/10.2307/1912791

GSS. (2023). *Consumer Price Index (CPI) for January 2023* [Data set].

Haussmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth, 12*, 1–25. https://doi.org/10.1007/s10887-006-9009-4

Henok, A. A. (2015). Trade Policy and Economic Growth in Sub-Saharan Africa: A Panel Data Approach. *American Journal of Trade and Policy, 2*(4), 7-14.

IMF. (2022). Macroeconomic Developments and Prospects in Low-Income Countries. https://doi.org/10.5089/9798400227813.007.A001

Ishan, K., Michael, T. H., Paul, H., Jerald, S., & Philippe, S. (1991). *Ghana: Adjustment and Growth, 1983-91.* International Monetary Fund. https://doi.org/10.5089/9781557751829.084

Khalid, A. M. (2016). The Impact of Trade Openness on Economic Growth in the Case of Turkey. *Research Journal of Finance and Accounting, 7*(10), 51-61.

Lippoldt, D. (2010). *Trade and The Economic Recovery: Why Open Markets Matter.* OECD.

Michael, B., Atsuyoshi, M., & Zakari, M. (2020). Inflation Targeting and Monetary Policy in Ghana. *Journal of African Economies, 29*(2), 121–145. https://doi.org/10.1093/jae/ejz021

Mori, K., Rozilee, A., Jaratin, L., Dullah, M., & Nanthakumar, L. (2012). The Effect of Exchange Rateson Economic Growth: Empirical Testingon Nominal Versus Real. *The IUP Journal of Financial Economic, 10*(1), 8-17.

Muhammad, M. Y., & Benedict, N. A. (2018). Trade Openness and Economic Growth: Evidence from Nigeria. *European Journal of Business, Economics and Accountancy, 6*(4), 30-44.

Musa, M. (1974). Tariffs and the distribution of income. *Journal of Political Economy, 82*, 1191-1204.

Mustapha, I., Iddrisu, A.-A., & Ishaq, K.-B. (2013). The Determinants of the Real Exchange Rate in Ghana: A Focus on Inflation Usinga Bound Test Approach. *African Development and Resource Research Institute, 3*(3), 20-37. https://doi.org/10.55058/adrrij.v3i3.29

Narayan, P. (2005). The saving and investment nexus for China: evidence from cointegration tests. *Applied Economics, 37*(17), 1979–1990. https://doi.org/10.1080/00036840500278103

Nchor, D., & Darkwah, A. S. (2015). Inflation, Exchange Rates and Interest Rates in Ghana: An Autoregressive Distributed Lag Model. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 63*(3), 969-977. http://dx.doi.org/10.11118/actaun201563030969

OECD. (2011). *OECD Science, Technology and Industry Scoreboard 2011.* OECD. https://doi.org/10.1787/sti_scoreboard-2011-60-en

Olayungbo, D. O. (2021). Global oil price and food prices in food importing and oil exporting developing countries: A panel ARDL analysis. *Heliyon, 7*(3), 1-10. https://doi.org/10.1016/j.heliyon.2021.e06357

Pam, Z. (2016). Trade and economic growth in developing countries: Evidence from sub-Saharan Africa. *Journal of African Trade, 3*(1), 41-56. https://doi.org/10.1016/j.joat.2017.02.001

Pesaran, M. H., Shin, Y., & Smith, R. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*(3), 289–326. https://doi.org/10.1002/jae.616

Pesaran, M., & Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In S. Strom (Ed.), *Econometrics and economic theory in 20th century: the Ragnar Frisch centennial symposium* (pp. 371-413). Cambridge University Press.

Phillips, P., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335–346. https://doi.org/10.1093/biomet/75.2.335

Prateek, J., Avni, S., & Manoj, K. (2022). Recapitulation of Demand-Pull Inflation & Cost-Push Inflation in An Economy. *Journal of Positive School Psychology, 6*(4), 2980-2983.

Qunxi, K., Dan, P., Yehui, N., Xinyue, J., & Ziqi, W. (2021). Trade openness and economic growth quality of China: Empirical analysis using ARDL model. *Finance Research Letters, 38*, 1-9. https://doi.org/10.1016/j.frl.2020.101488

Rana, A. (2016). The Relationship between Trade Openness and Inflation in Turkey. *International Journal of Research in Business & Social Science, 5*(3), 137-145. https://doi.org/10.20525/ijrbs.v5i3.464

Rivera-Batiz, L. A., & Romer, P. M. (1991). International trade with endogenous technological change. *European Economic Review, 35*(4), 971–1001. https://doi.org/10.1016/0014-2921(91)90048-N

Romer, D. (1993). Openness and inflation: theory and evidence. *Quarterly Journal of Economics, 108*(4), 869-903. https://doi.org/10.2307/2118453

Sadia, B., Syed, T. A., & Hina, R. (2014). Impact of Trade Openness, FDI, Exchange Rate and Inflation on Economic Growth: A Case Study of Pakistan. *International Journal of Accounting and Financial Reporting, 4*(2), 236-257.

Samuel, A. N., Johnson, A.-A., & Daniel, K. O. (2017). Exchange Rate Policy and Inflation in Ghana. *American Scientific Research Journal for Engineering, Technology, and Sciences, 38*(1), 48-63.

Shahbaz, M., Solarin, S., Mahmood, H., & Arouri, M. (2013). Does financial development reduce CO2 emissions in Malaysian economy?. *Economic Modelling, 35*, 145-152. https://doi.org/10.1016/j.econmod.2013.06.037

Sulehri, F. A., & Khan, J. (2020). The Effect of Trade Openness on Inflation in Pakistan. *Bulletin of Business and Economics, 9*(3), 135-140.

Tong, T., Ortiz, J., Xu, C., & Li, F. (2020). Economic growth, energy consumption, and carbon dioxide emissions in the E7 countries: a bootstrap ARDL bound test. *Energy, Sustainability and Society, 10*(20), 1-17. https://doi.org/10.1186/s13705-020-00253-6

Yaya, K. (2017). The impact of trade openness on economic growth: The case of Cote d'Ivoire. *Cogent Economics & Finance, 5*(1), 1-14. https://doi.org/10.1080/23322039.2017.1332820

Zubairu, I., Alenezi, M., Iddrisu, A. J., & Dawson, S. (2024). The Dynamics of the Ghanaian Currency Depreciation: A Case Analysis of the Performance of Ghana Cedi (GHC) Against Its Major Trading Currencies. *International Journal of Economics, Finance and Management Sciences, 12*(1), 18-43. https://doi.org/10.11648/ijefm.20241201.13