Assessing the Effects of Macroeconomic Variables on Economic Welfare in Ghana

Samuel Erasmus ALNAA[1]
Juabin MATEY[2]

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ABSTRACT
This study employs the Auto-Regressive Distributed Lag (ARDL) bounds approach to investigate the relationship between Real GDP, which serves as an estimator of a nation's economic performance, and selected macroeconomic variables. Using data from the World Bank Development Indicators spanning the period from 1993 to 2022, our analysis reveals distinct patterns in the interplay between inflation, labour productivity, public consumption expenditure, and real GDP. The results highlight the negative impact of inflation on economic well-being. Conversely, a positive correlation emerges between real GDP and both labour productivity and public consumption expenditure. These findings contribute nuanced insights to the ongoing discourse on the appropriateness of Real GDP. The observed negative influence of inflation on Real GDP underscores the importance of vigilant inflation management for sustained economic stability. On the other hand, the positive association between real GDP and labour productivity, as well as public consumption expenditure, implies potential avenues for fostering economic growth and prosperity. These findings not only enhance our understanding of the dynamic interactions within economic systems, but also challenge conventional perspectives on real GDP as an indicator of economic health. These insights provide valuable considerations for crafting effective policies that go beyond GDP figures to ensure holistic and sustainable national economic well-being.

KEYWORDS: *Inflation Rates, Consumption Expenditure, Labour Productivity, ARDL Bounds Approach, RGDP, Economic Welfare, Economic Growth.*

JEL CLASSIFICATION: *E6, E62, E24, H51.*

1. INTRODUCTION

The economic performance of a country is typically assessed through the lens of its real GDP (RGDP). This is especially true in sub-Saharan Africa, where technological developments for surveillance lag those of the Western World, Asia, and other advanced regions. This lack of technological advancement hinders the gathering of necessary digital and physical data for the calculation and thorough comprehension of a nation's economic well-being (Coyle, 2014; Hulten & Nakamura, 2019). The research seeks to establish whether RGDP, as a proxy for economic welfare, has a long-run relationship with annual average inflation rate, consumption expenditure, and labour productivity. Stiglitz (1991) and Stiglitz et al. (2009) have argued for adjustments to the RGDP to gain a more accurate perspective on a country's economic performance. Nonetheless, there are still widespread disagreements regarding the primary objective of economic policies in most countries. These policies often target RGDP growth as an indicator of improved economic welfare.

[1] Bolgatanga Technical University, Bolgatanga, Ghana, sam.alnaa@gmail.com (Corresponding author)
[2] Bolgatanga Technical University, Bolgatanga, Ghana, e.juabin@gmail.com

The RGDP, as an estimator of economic welfare, is supported by readily available and reliable data from national data repositories and the World Bank Development Indicators website, making it easy to determine (Oulton, 2023). The suggested alternative measures of well-being (which are not the focus of this paper) (Aitken, 2019; David & Pilling, 2018; Phillipsen, 2015) have indeed fallen behind the mainstream GDP (Fioramonti, 2013; Ulfah, 2015) in the context of Africa and other developing economies due to the lack of standardised measurement and surveillance technologies. Indeed, these alternative measurements being suggested are nothing more than wishful ideals. Economic welfare is only a part of the overall welfare function, which is debated to include both positive and negative pleasures within the framework of the Utilitarian Tripartite Theories (UTT) (Crisp, 2017).

Most scholars and policymakers have not yet appreciated the fact that economic welfare is only a component of national well-being. National well-being is a broader concept that includes variables whose calculations are disputed and considered subjective assessments of aspects of well-being that are not measured in economic activities (Reinsdorf, 2020). Another inherent criticism of using the RGDP is that terms such as "superpowers," "advanced countries," "developed," „emerging", and "less developed" are often linked to the mainstream GDP as a benchmark (Ulfah, 2015). Again, the readers need to realise that the System of National Accounts (SNA) indicators have already accounted for economic welfare aspects such as income, consumption, pricing, and wealth (Reindorf, 2020). The arbitrary assignment of national welfare gains, partly due to the advent of digitalisation and other human leisure variables (as captured under the UTT), is quite strange to the RGDP. Unlike the effects of climate change and environmental sustainability on well-being, which pose significant measurement challenges, the data for computations in RGDP are readily accessible (Reindorf, 2020).

Oulton (2008, 2012, 2023) revealed that the RGDP is a reliable indicator of economic welfare, as it exhibits a strong positive correlation with other welfare measures such as the Human Development Index (HDI), Human Capital Index (HCI), and Social Progress Index (SPI), even when analysing cross-country data. Particularly, it has a positive correlation with life expectancy and a negative correlation with inequality and infant mortality. Infant mortality may be viewed as a measure of well-being, as captured under the tripartite theories, because people naturally experience grief when their loved ones pass away. Oulton (2012b) further argues that countries with higher RGDP generally experience lower infant mortality rates, longer life expectancies, and reduced inequality. Although there is significant evidence to support the idea that better health is correlated with higher RGDP per capita, though the correlation does not necessarily imply causality, as cautioned (Fogel, 2004; Oulton, 2012).

This study argues that the absence of appropriate surveillance technology, which could help collect suggested data on variables that are perceived to affect the RGDP as an economic welfare estimate, makes the RGDP an ideal alternative model for estimating economic welfare (not economic well-being) (Oulton, 2022; Reindorf, 2020) in the African context. The responses in this article address some of the criticisms and argue that the Gross Domestic Product (GDP) statistic is a reasonably accurate measure of economic well-being in global economies. However, it mainly focuses on economic activities and only partially reflects sustainability and human welfare (Dynan & Sheiner, 2018; van de Ven, 2018). It is arguably the most easily accessible and data-driven model available to scholars for assessing a country's economic performance and reflecting the economic well-being of citizens in many African countries, including Ghana.

2. LITERATURE

2.1 Theory

The diversity of opinions and theories surrounding the concept of well-being has led to the development of the stylised Utilitarian Tripartite Theories (UTT) of well-being (Fletcher, 2013; Griffin, 1986; Parfit, 1984). These theories offer different perspectives on how to assess well-being. The current research focuses on using RGDP as an estimate of economic growth and welfare, aligning with the objective list theory that considers various valuable components as contributors to well-being (Chappell & Meissner, 2023). As a matter of clarification, the tripartite theories have been explained in their respective subheadings. The widespread disagreements on the components of welfare led to the emergence of the UTT, which is primarily of theoretical interest. This is because, in practice, these UTTs overlap significantly.

2.1.1 The Hedonism Theory (HT): This theory has its roots traced back to classical utilitarian philosophy, which considers well-being as a valence experience primarily centred on intrinsic pleasures such as enjoyment and contentment. However, it acknowledges criticism due to the difficulty in estimating an individual's intrinsic pleasures and also points out the existence of "evil pleasures," where satisfaction is derived from causing harm to others. The connection between this classical utilitarian theory and the present study lies in the challenge of estimating welfare and determining what truly constitutes well-being, especially when certain segments of society find solace in the suffering and pain of others. And so, the RGDP, which at least has available data from the System of National Accounts for estimation, should see a reduction in overall criticism. The HT conceives happiness, for instance, as not only encompassing paradigmatic sensory contentment, such as enjoying a delicious meal or experiencing sexual intimacy, but also the happiness and satisfaction derived from resolving a family or friend's issue as well as reading a novel (Chappell & Meissner, 2023). We realise that in all these instances, there are significant challenges in estimating appropriate values for pleasures, which can be assigned arbitrarily at worst.

2.1.2 The Desire Theory (DT): The Desire Theory emphasises whatever brings satisfaction to an individual, whether it is intrinsic or extrinsic. However, this theory can be vague and challenging to estimate because it raises questions about whether certain desires that may not align with ethical or moral standards should be considered as contributing to well-being. Building on the HT, the desire theory attempts to incorporate the concept of welfare or well-being that is universally accepted by everyone. That explains the diversity in what brings happiness, contentment, or fulfilment to individuals. Estimating well-being individually and autonomously and consolidating these estimates is neither here nor there. These are mere conjectures of happiness, welfare, and well-being with no national or international recognition.

2.1.3 The Utilitarian Objective List Theory (UOLT): The UOLT posits that well-being consists of a set of valuable components, which can include various elements. One of these components is economic welfare. It suggests that total well-being is a combination of these valuable components. This study builds on the objective list theory and aims to establish the RGDP as an economic indicator of welfare in several African countries, including Ghana. This implies that the study considers economic prosperity to be one of the factors contributing to overall well-being. The UOLT sees welfare as an aggregate of all factors that directly or

indirectly contribute to individuals' contentment. Various estimates of welfare are suggested and used across the globe to suit different environments.

2.2 Selected empirical studies.

This section reviews empirical literature on previous research on the impact of inflation, consumption expenditure, and labour productivity on economic growth. In this context, economic growth is measured by real GDP, which serves as an estimate of economic welfare.

2.2.1 Real GDP/Welfare and Inflation

One area of interest in macroeconomics is inflation, particularly in developing economies, where opinions vary widely. Inflation has been the subject of extensive academic discourse regarding its effects on the national economy. Agarwal and Baron (2023) examined the impact of inflation on disintermediation through the bank credit channel. They found the deteriorating effects of inflation on the capital market (bank) and the macro economy, for that matter. Rising inflation has a contractionary effect on bank lending and indirectly negatively impacts the construction industry in terms of employment creation. Higher inflation rates adversely affect the bank credit-to-GDP ratio, thereby deteriorating individual welfare. This is because inflation erodes purchasing power, leading to reduced consumption (Agarwal & Baron, 2023). Another research finding with mixed results on the relationship between general inflation and GDP growth is from Kankpeyeng et al. (2021). Whereas a negative link between high inflation levels and GDP growth rate was reported in one study, another study by Mavikela et al. (2018) revealed a positive effect of general inflation on GDP growth rates. This suggests that as the prices of factors of production rise, nominal GDP can improve. In their experimental framework investigating the quantity theory of money and its impact on inflation in an economy, Jiang et al. (2023) found a negative correlation between inflation and welfare as well as output.

Lagos and Rocheteau (2005) support the notion that inflation has a detrimental effect on the economy, resulting in negative impacts on welfare. It is consistent with the idea that rising prices, which are characteristic of inflation, can erode the purchasing power of individuals, thereby reducing their overall well-being. A study by Haslag (1997) using the neoclassical growth model asserts that citizens experience welfare losses in the presence of inflation. The study suggests that even when inflation starts at a low level and remains steady, it can ultimately lead to a decrease in welfare. Tenaglia (2022) in reference to a survey by the Office for National Statistics in the UK highlights public concerns about inflation. The survey findings indicate that a significant proportion of participants are concerned about the escalating cost of living, which includes the increasing prices of energy, food, and transportation. This suggests that inflation can have a negative impact on individual economic welfare.

These references provide evidence and perspectives which support the idea that inflation can have a negative impact on economic growth and individual welfare. Inflation, particularly when it persists and results in increased prices for necessary goods and services, can diminish the actual buying power of individuals, potentially resulting in lower living standards and adverse impacts on overall economic welfare. These findings are consistent with the broader discourse on the consequences of inflation in macroeconomics.

2.2.2 Real GDP/Welfare and Consumption Expenditure

This highlights the nuanced perspective held by economic scholars regarding the impact of public consumption expenditure on economic activities. This study acknowledges that the effects of public consumption spending on real GDP or economic welfare can vary depending on the circumstances. We first consider the study results of Mose (2021), who identified public consumption expenditure as having a negative relationship with economic growth. This negative relationship can also be extended to real GDP or welfare, as used in this current study. Empirical evidence on the link between consumption expenditure-led GDP growth (private and public) has not been conclusive. Kharroubi and Kohlscheen (2017) have disagreed with the notion that GDP growth is favoured by consumption. The results of their study show a significant medium- to long-term negative impact on GDP due to consumption-led growth and increasing debt burdens from external economies.

Al Gifari (2015) found that government expenditure has a negative impact on economic growth. However, when examining specific components of government expenditure, such as the housing sector and development expenditure, it was discovered that they have a significantly lower positive impact on economic growth. Some studies have also provided evidence of a negative relationship between government expenditure and economic growth (Ghura, 1995; Hsieh & Lai, 1994; Nurudeen & Usman 2010). Other studies which have shown a positive relationship between government expenditures, whether aggregated or disaggregated, include Alshahrani and Alsadiq (2014), Knoop (1999), Yasin (2000), and Alexiou (2009). Viren's (2022) assessment of the consumption-led expansion of economic growth, using global and European Union panel data, revealed that both aggregated and disaggregated consumption expenditure resulted in lower growth compared to investment-led growth.

2.2.3 Real GDP/ Welfare and Labour Productivity

There is a body of evidence from identified studies (Campell, 2009; Kazuya, 2009; Wu, 2013; Zulu & Banda, 2015) indicating that labour productivity has a positive impact on both economic growth and welfare. This implies that when labour become more productive and efficient in their tasks, it can lead to improvements in an economy's overall productivity, growth, and the welfare of its citizens. This assertion is linked to the tripartite theory of well-being. Workers who feel content in their own perceived ways give their best at work, thereby improving productivity. Oulton (2022) and Sharpe and Mobasher (2022) equally studied the linkage between productivity and welfare. They found that lowering labour output per head negatively affects welfare, as a deterioration in welfare reduces productivity and vice versa. Thus, productivity growth positively affects sustained gains in living standards of the citizens. Largely, studies on labour productivity and welfare have been positively linked. Isham et al. (2021) re-examined the link between worker wellbeing and labour productivity and suggest that improved wellbeing is a function of increased labour productivity.

3. METHODS

Estimated as an economic growth indicator and traditionally welfare, we used the RGDP as a dependent variable. Annual average inflation rates, national final consumption, and labour productivity served as predictors. Data were downloaded from the repository of the World Bank Development Indicators spanning 1993-2022. The Dickey-Fuller (1979) method was adopted to test for Stationarity (Unit Root Test)] of variables in the study. The Pesaran and

Shin (1999; cited in Chandio *et al.* 2019) Cointegration Estimation Model was then used to determine the long-run relationships among the variables.

3.1 Variable Definition

It is important to define the key variables used in the study to have a more thorough understanding.

Table 1. Variable definition

Variable acronym	Variable interpretation	Definition
RGDP_W	Economic Growth/Citizens' Welfare	Nominal GDP divided by GDP Deflator (R) multiplied by 100
INFLR	Inflation Rates	Consumer price index (Annual Average%)
FCON	Final Consumption	Sum of private and government expenditure after providing for computational errors
LPR	Labour Productivity Rate	Real GDP/National Employment Rates

Source: World Bank Development Indicators (1993-2022)
Note: All definitions of variables are as per the World Bank and ILO.
Researchers' computation from WDIs dataset (1993-2022)

Table 1 contains definitions of variables that are fundamental to the analysis of the study and helps to assess the relationships and interactions between them, especially regarding their influence on the dependent variable, which represents economic welfare or performance. The study aims to determine how changes in inflation rates, final consumption expenditure, and labor productivity affect the well-being or economic performance of the country, as indicated by real GDP.

3.2 Empirical econometric model

Our simplified empirical model follows a study by Ackah (2016) on the determination of interest rate spread in Ghana, whose model was also derived and modified from studies by Demirguc-Kunt and Huizinga (1999) and Bawumia et al. (2005).

$$RGDP_{w_t} = \varphi\, Z_t + \varepsilon_t \qquad (1)$$

Where:

RGDP_W: Real GDP has been used in literature to estimate economic growth and, by extension, economic welfare in Jin (2009), Katircioglu (2009), and Chaudhary et al. (2009), Afzal et al. (2010).

Z_t : represents all macroeconomic explanatory variables at time 't'.

INFLR: Annual average Inflation Rate as defined in Table 1 (Average Annual consumer price index). This regressor has been used by Jiang et al. (2023), Sinn (1999), Kankpeyeng et al. (2021), Agarwal and Baron (2023).

FCON: Annual Final Consumption Expenditure comprising both private and government consumption expenditure. This variable was incorporated in an econometric model in a study by Kharroubi and Kohlscheen (2017), Mose (2021), and Thaddeus et al. (2021).
LPR: The Labour Productivity Rate is the RGDP over the National Employment Rates. It has been used as an independent variable by Fischer (1993), Zulu and Banda (2015), Oulton (2022), Sharpe and Mobasher (2022), Campbell (2009), Kazuya (2009), and Wu (2013).
φ = denotes various coefficients of the macroeconomic variables
ε_t = Error term
Equation (1) is rearranged by substituting the macroeconomic variables to produce equation (2).

$$RGDP_{w_t} = \alpha_0 + \beta_1 (INFLR_t) + \beta_2 (FCON_t) + \beta_3 (LPR_t) + \varepsilon_t \quad (2)$$

Due to the tendencies of high skewness in nonlinear variables, the log of the variables is usually taken (Cookson et al., 2016) for normalisation. In addition, the convenient reason for taking the log of the variables in the model is the easy interpretation of the results. Logging both the exposure (Y) and independent (X) variables, the coefficients (βs) turn to elasticities which make interpretation take the form of "a 1% change in the X, all things being equal, would lead to β change in Y (Cookson et al., 2016).
Following Cookson et al.'s (2016) explanation, equation (3) will look as below.

$$\text{Log}(^{RGDP_{w_t}}) = \alpha_0 + \beta_1 log\ INFLR_t) + \beta_2 log\ (FCON_t) + \beta_3\ log(LPR_t) + \varepsilon_t \quad (3)$$

Where β_1 , β_2 , β_3 are the respective elasticities of the variables relative to real GDP (economic welfare).

3.3 Justification of variables

The study chooses specific variables based on their relevance and impact on the macro economy relative to its growth and welfare in both the short-run and long-run equilibrium. This suggests a thoughtful consideration of factors that can affect economic conditions. Using the bank credit channel approach (Agarwal & Baron, 2023), a sudden increase in inflation can have a short-term negative effect on the macro economy. It explains that rising prices can lead to reduced lending activities by banks, affecting the construction industry's ability to invest due to a lack of available loaned funds, which in turn can negatively impact employment. Similarly, times of recession are associated with negative GDP growth. During recessions, consumption tends to rise, but investment declines more rapidly, leading to an increase in the ratio of consumption to aggregate output. This consumption behaviour can have implications for national economic welfare. Solow's (1956) standard growth accounting model highlights its importance in understanding the positive relationship between labour productivity and economic growth. It is supported by the work of various authors (Campbell, 2009; Kazuya, 2009; Wu, 2013), emphasising the significance of labour productivity as a driver of economic growth.

3.4 Justification of the Cointegration Test (ARDL/Bounds Approach)

Pesaran and Shin (1999) and Pesaran et al. (2001) provided the bound test (Autoregressive Distributive Lag [ARDL]) to establish the existence of a long-run relationship between time series variables irrespective of whether they are integrated of first difference order one, but not of order two and beyond (Nkoro & Uko, 2016). The cointegration test was originally postulated by Granger (1981) and Eagle and Granger (1987). The bound approach is

appropriate because of its ability to detect the presence of vectors and to deal with endogeneity challenges. Besides, the ARDL approach to cointegration is a valuable method in econometrics for analysing the relationships between variables in time series data. It addresses issues of autocorrelation and omitted variables, and allows for the estimation of both long-run and short-run components of the model. This approach is considered flexible and effective for various types of data (Afzal et al., 2014).

$$\triangle RGDP_{w_t} = \alpha_0 + \beta_1 \log INFLR_{t-1} + \beta_2 \log FCON_{t-1} + \beta_3 \log LPR_{t-1} + \sum_{t=1}^{m} \phi_i \triangle logRGDP_{w_t} + \sum_{i=1}^{m} \delta_i \triangle logINFLR_{t-1} + \sum_{t-1}^{m} \hbar_i \triangle logFCON_{t-1} + \sum_{t-1}^{m} \eta_i \triangle logLPR_{t-1} + \varepsilon_t \quad (4)$$

Having established cointegration, the next level of the bound technique is to state the conditional ARDL (p, q_1, q_2, q_3, q_4) relative to the long run model of $RGDP_{w_t}$.

$$logRGDP_{w_t} = \alpha_0 + \sum_{t=1}^{p} \beta_1 logRGDP_{w_t} + \sum_{t=0}^{q_1} \beta_2 \log INFLR_{t-1} + \sum_{t=0}^{q_2} \beta_3 \log FCON_{t-1} + \sum_{t=0}^{q_3} \beta_4 \log LPR_{t-1} + \varepsilon_t \quad (5)$$

This is done by the ARDL order selection (p, q_1, q_2, q_3, q_4) model per the Final Prediction Error Criterion (FPE).
The final stage in this empirical model is the short run dynamic parameters that formulate the error correction model linked to the long run model.

$$\triangle RGDP_{w_t} = \alpha_0 + \sum_{t=1}^{m} \phi_i \triangle logRGDP_{w_t} + \sum_{i=1}^{m} \delta_i \triangle logINFLR_{t-1} + \sum_{t-1}^{m} \hbar_i \triangle logFCONt_{t-1} + \sum_{i=1}^{m} \varphi_i \triangle logLPR_{t-1} + \Psi ECM_{t-1} + \varepsilon_t \quad (6)$$

The short run dynamic coefficients are represented by Φ, δ, ħ, ϕ in the equilibrium convergence of the model and the symbol Ψ is the equilibrium adjustment speed in the long run should there be an economic shock in the system.

4. RESULTS AND DISCUSSION

This section presents a thorough examination of the effects of each variable on real GDP, explaining the implications of our results in light of previous research and outlining potential directions for policy development.

4.1 Unit Root Test

To make sure all variables were stationary at the same order, the study tested for unit root.

Table 2. Augmented Dickey-Fuller (ADF) Test for Unit Root (Constant Only)

Variable	t-Statistic	Lag Diff.	Coefficient of t-Statistic	Test Critical Values		
				1%	5%	10%
LOGRGDP	z(t)	(1)	-5.212***	-3.712	-2.981	-2.631
LOGINFL	z(t)	(1)	-5.886***	-3.699	-2.976	-2.627
LOGFCON	z(t)	(1)	-7.226***	-3.689	-2.972	-2.625
LOGLP	z(t)	(1)	-5.640***	-3.711	-2.981	-2.629

*** indicates 1% level of significance
Note: all figures are run to 3-decimal places for easy tabulation
Source: Researchers' computation from WDIs dataset (1993-2022)

Table 2 contains the results of the unit root test conducted for all variables used for analysis in this study. The Augmented Dickey-Fuller [ADF] (1979) test was used to establish the stationarity of these variables. Using only the constant option, all variables (Real GDP, Inflation, Final Consumption [both private and public], and & Labour Productivity) were all stationary of order one (*I* [1]), none was found to be stationary of order zero (at levels). Applying the ARDL approach to cointegration, variables of interest in the study need to either be integrated of levels, of order one, or a mixture of these property requirements. It is observed that the t-statistic of all variables have achieved 1% significance level as their values are greater than the test critical values under 1%, 5%, and 10%.

Table 3. Augmented Dickey-Fuller Test for Unit Root (Constant & Trend)

Variable	t-Statistic	Lag Diff.	Coefficient of t-Statistic	Test Critical Values		
				1%	5%	10%
LOGRGDP	z(t)	(1)	-5.038***	-4.356	-3.595	-3.233
LOGINFL	z(t)	(1)	-5.901***	-4.339	-3.588	-3.229
LOGFCON	z(t)	(1)	-7.277***	-4.324	-3.581	-3.225
LOGLP	z(t)	(1)	-5.516***	-4.356	-3.595	-3.233

*** indicates 1% level of significance
Note: all figures are run to 3-decimal places for easy tabulation
Source: Researchers' computation from WDIs dataset (1993-2022)

Likewise, all variables were stationary of order one (*I* [1]) under constant and trend option as indicated in Table 3. This again satisfies the main ARDL approach condition for cointegration.

4.2 Descriptive Statistics

This section provides a foundational glimpse into the characteristics of a dataset, summarising its central tendencies, variability, and distribution, such as mean, median, and standard deviation. It also delves into the relationships between variables, unveiling patterns of association or dependence by quantifying the strength and direction of these connections.

Table 4. Descriptive and correlation analyses

Variable	Obsvs	OGRGDP	LOGINFL	LOGFCON	LOGLP
Mean	30	20.654	2.788	4.495	16.035
Std. Dev	30	1.312	0.605	0.085	1.955
Min	30	18.827	1.582	4.357	8.497
Max	30	22.809	4.085	4.634	18.520
Correlation					
LOGRGDP		1.000			
LOGINFL		-0.564**	1.000		
LOGFCON		0.379*	0.049	1.000	
LOGLP		0.605**	-0.285	-0.474**	1.000

*. Correlation is significant at 0.05 level (2-tailed)
**. Correlation is significant at 0.01 level (2-tailed)
Source: Authors' Computations with data from WDI (993-2022)
Note: All variables are in their log form.

From Table 4, RGDP statistics show that it has witnessed quite a fluctuating trend throughout the period the data covered (1993-2022). The mean stood at 20.654 with a Standard Deviation (Std. Dev) of 1.312. Ghana recorded a minimum RGDP of 18.827 and a maximum of 22.809 across the data span. In the case of inflation, Ghana released a mean rate of 2.788, making a Std. Dev of 0.605. Even though the mean inflation for the period was 2.788, there were years that recorded as low as 1.582 inflationary rate with a maximum rate of 4.085. Labour productivity had a minimum rate and a maximum rate of 8.497 and 18.52 respectively. While the mean OGLP stood at 16.035, the Std Dev. Was 1.955. It is important to emphasise that, under descriptive statistics, as its name suggests, the intent is to describe the trend and behaviour of variables across the data coverage period, but not to make inferences.

There correlation between LOGLP and LOGRGDP is significantly positive (r = .605, n = 30, *p*- value = .000) There is also a significant but negative average relationship between LOGINFL and LOGRGDP (r = -.564, n = 30, *p*- value = .001). What that means is that as labour productivity and annual average inflation rate increases and decreases, RGDP is expected to improve and deteriorate, respectively. Thus, economic growth and welfare equally witness positive changes in terms of labour productivity. In the case of inflation rates, the higher the rates, the more welfare gets deteriorated. Final consumption (FCON) has a positive but weak correlation with RGDP (r = .379, n = 30, p- value .039). Generally, it is expected that increases in public and private outlays boost welfare, especially if expended to decrease unemployment and on health through investment.

4.3 Lag Length Selection

Accurate selection of a lag length in time series analysis is important for policy makers to rely on for macro decisions of the country.

Table 5. Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-85.8281	NA	0.007190	6.416294	6.606609	6.474475
1	-50.0524	58.77444*	0.001778*	5.003741*	5.955315*	5.294647*
2	-41.6144	11.45155	0.003302	5.543885	7.256719	6.067515

Source: Researchers' computation from WDIs dataset (1993-2022)

The results of Table 5 indicate that lag length 1 is preferred by all the information criteria. However, one of the selection criteria should be selected for analysis. This is done by filtering the information criteria (IC) with a least value as a rule of thumb. And so, FPE (Final Prediction Error) obtained the least IC and was selected.

Table 6. ARDL cointegration test results

Variable	LOGRGDP	LOGINFLR	LOGFCON	LOGLPR
Selected ARDL model	(1,0,2,0)	(4,4,4,0)	(2,1,4,4)	(4,3,1,4)
Bounds F-statistic	3.672**	6.415***	2.93	6.899***
Critical values (%)	5	1	-	1
Lower bounds I(0)	2.45	4.3		5.17
Upper bounds I(1)	3.63	5.23		6.36
Diagnostic tests	Statistics	Statistics	Statistics	Statistics
R-sq.	0.805	0.877	0.788	0.929
Adj-R-sq.	0.761	0.764	0.592	0.852
F-sq statistic	25.069***	7.733***	8.405***	12.104***
Serial	0.595 (0.561)	1.398 (0.309)	0.675 (0.536)	-
Normality	4.479 (0.106)	2.446 (0.294)	-	0.373 (0.829)
Ramsey RESET	1.427 (0.246)	0.868 (0.379)	1.199 (0.302)	-

Note: Decimal places are at most to 3.

Source: Researchers' computation from WDIs dataset (1993-2022)

Having selected the appropriate lag length (FPE) for analysis, this study employed the ARDL approach by Pesaran et al. 2001 and Chandio et al. 2019. The findings in Table 6 show that the ARDL bounds test produced a cointegrated set of variables. Thus, there is a long-run relationship between the identified dependent variable and the independent variables, although in ARDL approach, each variable functions as a dependent variable, as they are all endogenous. In terms of LOGRGDP, the *F*-statistic is 3.672, which is greater than the corresponding values of the lower (2.45) and the upper (3.63) bounds at the 5% significant level. The research implication here is that real GDP which serves as proxy for economic growth and welfare has a long-run relationship with inflation rate, final consumption expenditure (private and public sector), and labour productivity. Using the log of INFL, FCON, and LP as dependent variables, we realise there are cointegration relationships as reflected by their *F*-statistic values along with corresponding values lower and upper bounds, except in the case of log FCON. The Johansen cointegration using the Trace statistic was used to confirm the long-run relationship established in the ARDL bounds test approach (see Table 7).

Table 7. Johansen cointegration test results

Null hypo.	Trace test statistic	p-value	Null hypo.	Maximum Eigenvalue	p-value
$r = 0$	60.954***	0.004	r=0	26.973**	0.037
$r \leq 1$	33.981**	0.064	$r \leq 1$	19.069**	0.029
$r \leq 2$	14.912	0.143	$r \leq 2$	11.409	0.281
$r \leq 3$	3.502	0.061	$r \leq 3$	3.502*	0.161

Notes: r implies number of cointegrating equations. *, ** indicate that the null hypothesis has been rejected at 10% and 5% significant levels respectively

Source: Researchers' computation from WDIs dataset (1993-2022)

The confirmation of the existence of cointegration among variables led to the analysis of both the long-run and short-run using equations (5) and (6). In Table 7, we estimate the long-run coefficients and the corresponding statistics in Panel I. Analysis indicates that the regressor variables, namely the inflation rate, final consumption expenditure, and labour productivity rate, have different relationships with real GDP, which represents economic welfare. Whereas both final consumption expenditure and labour productivity have a significant positive relationship at 1% level, inflation rate negatively impacts real GDP but is not significant. With our focus on significant variables, we find that final consumption exhibits a positive and significant relationship with real GDP.

4.4 Analysis of the Long-run and Short-run Results

Using real GDP as proxy for economic growth and for that matter welfare, this research established the existence of a long-run relationship (Tables 6 & 7) with the three variables used as predictors (annual average inflation rate, final consumption expenditure, and labour productivity). The long-run (Panel I estimates) and short-run (Panel II estimates) are shown on Table 7. Except for annual average inflation rate which has an insignificant negative relationship with RGDP, the other predictors (LOG of Final Consumption Expenditure [LOGFCON], and LOG of Labour Productivity [LOGLP]) have significant positive relationship. The long-run estimates indicate that annual average inflation rate with an insignificant negative relationship would have deteriorated Real GDP/Economic growth proxied as welfare by about 0.12 percent following a one percent increase in annual average inflation rate. This suggests that higher annual average rate of inflation can have adverse effects on individuals' welfare by eroding their purchasing power, leading to reduced consumption, and motivating them to shift their wealth out of cash to hedge against inflation.
However, the relationship between inflation and welfare can be complex and depends on various factors, including individuals' income levels and their ability to adjust to changing economic conditions. Agarwal and Baron's (2019, 2023) research findings support this, as they emphasise that rising inflation has a contractionary effect on bank lending and a transitive negative effect on the construction industry, resulting in increased unemployment. Higher inflation rates adversely affect the bank credit to GDP ratio, which in turn has a negative impact on individual welfare. This erosion of purchasing power leads to reduced consumption.

Similarly, real GDP as proxied by economic welfare will improve by .742 percent if final consumption expenditure (private and public) is increased by one percent. Contrary to this finding, Mose (2021) identified public consumption expenditure as having a negative relationship with Economic growth, and by extension, real GDP or welfare. In another development, the long-run results point to the fact that with a one percent increase in labour productivity through improved working conditions and employee contentment as proposed by

the tripartite theory, real GDP/economic growth gauged by welfare will significantly improve by .596.

Short-run analysis of the results in Table VIII (Panel II estimates) has almost the same revelation as in Panel I. Real GDP is significantly positive in terms of its relationship with LOGFCON and LOGLPR. A one percent increase in final consumption will see a .0721 percent improvement in RGDP/Economic growth or welfare. LOGLP improves welfare by .737 at one percent significance level if there is one percent increase in worker improved conditions and contentment. Oulton (2022) as well as Sharpe and Mobasher (2022) support this finding in their study of the linkage between productivity and welfare. They contend that lowering labour output per head negatively affects welfare, as a deterioration in welfare reduces productivity and vice versa. Thus, productivity growth positively affects sustained gains in living standards of the citizens.

Table 8. ARDL coefficient results for long-run and short-run

Variable	Coefficient	SE	T-statistic	p-value
Panel I: long-run estimates				
C	0.754***	0.193	3.903	0.001
LOGINFLR	-0.119	0.073	-1.638	0.115
LOGFCON	0.741***	0.190	3.887	0.002
LOGLPR	0.596***	0.189	3.143	0.004
Panel II: short-run estimates				
ECM_{t-1}	-0.837***	0.157	-5.322	0.000
INFLR	-0.257	0.214	-1.202	0.242
FCON	0.721**	0.258	2.791	0.016
LPR	0.737***	0.219	3.361	0.004
Panel III: residual diagnostic tests				
R-square	0.659			
Adjusted R-square	0.618			
Durbin-Watson	2.662			
F-statistic	16.071***			
Serial	1.238 (0,278)			
Normal	0.538 (0.288)			
Ramsey RESET	0.906 (0.167			

Notes: **, and *** denote 5% and 1% significance level. All figures are run to 3 decimal places.
Source: Researchers' computation from WDIs dataset (1993-2022)

R-square and the adjusted R-square values were estimated at 66 percent 62 percent, confirming the model's goodness of fit. 16.071 *F*-statistic value. Given any prior-year shock in the explanatory variable, the error correction term (ECT-1) is negative, statistically significant at the 1% level, and has a high coefficient (.837), indicating that the disequilibrium can be adjusted to the long-run more quickly.

Through a series of diagnostic tests, including the Jarque-Bera normality test, the LM serial correlation test, and the Ramsey Reset test, we tested the stability of the model. Table VIIII

(Panel III) presents the findings. The ARDL model has successfully passed the diagnostic tests, according to the empirical findings of this study.

We also investigated the stability of long-run and short-run parameters using two stability tests, namely the CUSUM (Figure 2) and CUSUMSQ (Figure 3). Pesaran and Shin (1999) suggested these stability tests for data validation purposes. Figures 2 and 3 graphically represent those stability tests, which show that at a significance level of 5 percent, the plots are inside critical bounds. This demonstrated the reliability of both long-run and short-run characteristics that affect Real GDP from 1993 to 2022.

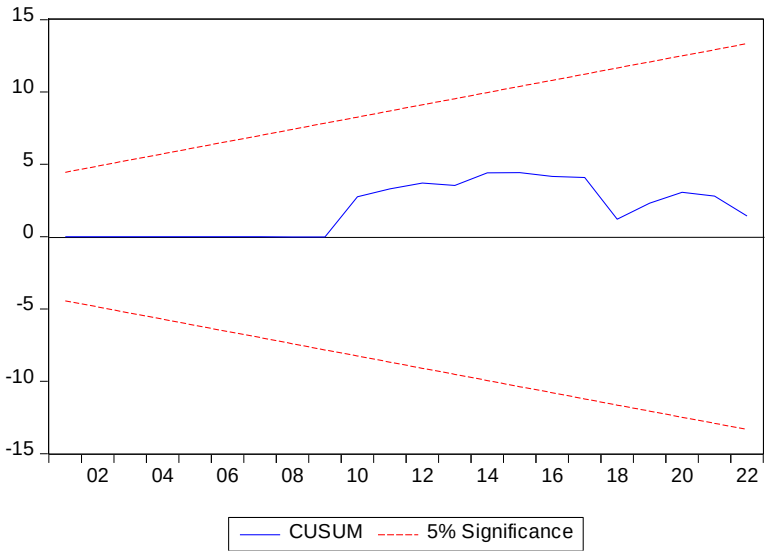

Figure 2. Cumulative sum of recursive residuals

Source: Researchers' computation from WDIs dataset (1993-2022)

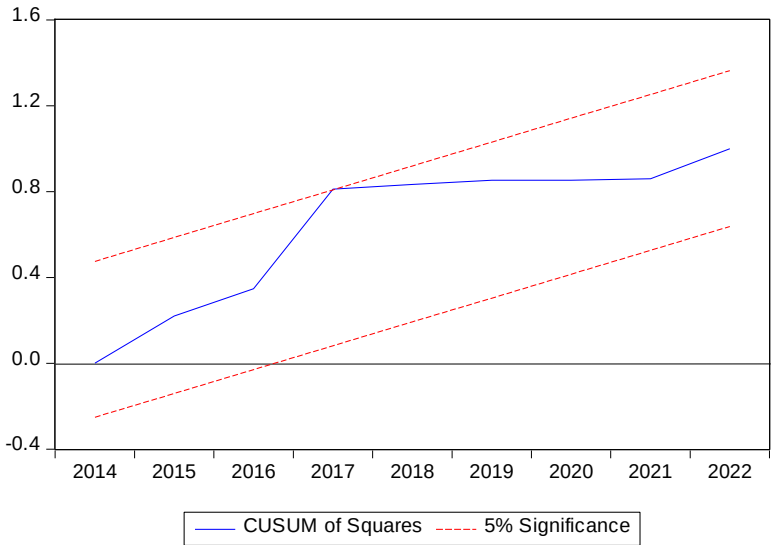

Figure 3. Cumulative sum of squares of residuals

Source: Researchers' computation from WDIs dataset (1993-2022)

As the Q-Stat remained statistically insignificant at the 1 and 5 percent levels of significance, the results of the correlogram statistics show and validate that there is no autocorrelation and partial correlation in the ARDL model (see Table X).

Table 9. Correlogram test statistics for autocorrelation

Autocorrelation	Partial Correlation	Lags	AC	PAC	Q-Stat	Prob*
. |* . |	. |* . |	1	0.121	0.121	0.4697	0.493
. | . |	. | . |	2	-0.031	-0.046	0.5021	0.778
. | . |	. | . |	3	-0.038	-0.029	0.5515	0.907
. |* . |	. |* . |	4	0.103	0.112	0.9328	0.920
. |* . |	. | . |	5	0.095	0.067	1.2674	0.938
. | . |	. | . |	6	-0.008	-0.023	1.2699	0.973
. *| . |	. *| . |	7	-0.124	-0.111	1.8991	0.965
***| . |	***| . |	8	-0.429	-0.426	9.7695	0.282
.**| . |	.**| . |	9	-0.233	-0.225	12.219	0.201
. *| . |	. *| . |	10	-0.094	-0.150	12.639	0.245
. *| . |	. *| . |	11	-0.103	-0.164	13.171	0.282
. | . |	. |* . |	12	0.018	0.143	13.189	0.355

Source: Researchers' computation

5. CONCLUSIONS AND RECOMMENDATIONS FOR POLICY

Using the ARDL approach, this study analysed both the long-run and short-run effects of inflation, final consumption expenditure, and labour productivity on real GDP as a proxy for welfare in Ghana from 1993 to 2022. The ADF unit root tests were used to determine the order of stationarity for variables. The results show that all variables are stationary of order one. Furthermore, the empirical analysis revealed that in both long-run and short-run, final consumption expenditure and labour productivity have significant positive impacts on welfare. However, the annual average inflation rate has an insignificant negative relationship with welfare.

The significant long- and short-run positive impacts of consumption expenditure and labour productivity on welfare have several important policy implications for governments and policymakers. First, it communicates to policymakers the need to promote consumer confidence and spending by implementing policies that boost consumer confidence, such as maintaining stable prices and low inflation. This can lead to increased consumer spending and higher final consumption expenditure. Tax cuts or stimulus packages during economic downturns can also incentivise consumers to spend more, which can have a positive impact on the economy. Investment in education and skills development programmes to enhance labour productivity is another policy initiative that the government could consider. A well-educated and skilled workforce is more productive, which in turn positively impacts economic well-being. Training and retraining initiatives can help workers adapt to evolving industries and technologies, thereby further improving productivity. Infrastructure projects can enhance labour productivity by improving transportation, communication, and overall business efficiency. Investments in technology and innovation can also boost productivity, making businesses more competitive and improving economic well-being.

The significant positive labour-welfare relationship prompts the government to initiate labour market reforms that promote flexibility while protecting workers' rights. This can create a more dynamic and adaptable labour force, leading to higher labour productivity. Besides, the government should consider the recommendation of encouraging job matching and re-employment services to ensure that workers are placed in positions where their skills are effectively utilised.

Policymakers should consider prioritising macroeconomic stability, particularly by focusing on controlling inflation, despite the lack of significant results in relation to inflation. High and volatile inflation can erode the benefits of increased consumption expenditure and labour productivity.

Continuous monitoring and evaluating the impact of policies related to consumption and productivity is another way to move forward. Regular assessments can help adjust strategies to ensure that the positive effects on welfare are sustained and maximised. Overall, the policy implications underscore the importance of striking a balance between short-term economic stimulus and long-term investments in human capital, infrastructure, and innovation in order to achieve sustainable improvements in economic well-being. These policies should be tailored to the specific context and challenges of each region of Ghana.

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