

RE-VISITING THE VALIDITY OF PHILLIP'S CURVE IN THE CONTEXT OF THE BRICS COUNTRIES

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ABSTRACT. The coexistence of inflation and unemployment rates especially in developing economies has been generating a lot of debate among researchers concerning the validity of Phillip's curve. The current study examines the validity of Phillip's curve in the context of the BRICS countries comprises of Brazil, Russia, India, China, and South Africa using data from the World Bank database (2020) and analyzed using a random effect static panel regression analysis. We find that the unemployment rate and output negatively and significantly influenced the inflation rate in the BRICS countries, which validates Phillip's curve. This implies that raising unemployment and output level may likely reduce inflation rate in the BRICS countries. We, therefore, recommend the need for policymakers to choose to either stabilize prices or reduce unemployment. Also, the need for government to reduce inflation by increasing output thereby generating employment for the people. The BRICS countries should focus more on the labor-intensive technique of production to reduce the cost of production, create jobs and reduce prices.

1. INTRODUCTION

One of the thorniest and most persistent global challenges has been inflation. The BRICS (Brazil, Russia, India, China, and South Africa) economies are not immune to this issue. Inflation has been a subject of global concern as every economy, at one stage or the other, has had to grapple with its effects and consequences: especially, the attendant effect of the erosion of the purchasing power of the people transacting within such economies (Phiri, 2017).

The BRICS economies have experienced wobbled growth after the Global Financial Crises of 2007-2008. While China and India have posted steady and rising economic growth, Brazil has had unsteady growth. Russia and South Africa recorded slowing and sometimes declining economic growth (Mallick & Sousa, 2013).

Unemployment, like inflation, has become a worldwide issue. It is a challenge that has also attracted the attention of policymakers in the BRICS economies. In the near future, the BRICS countries of Brazil, Russia, India, China, and South Africa are likely to become the world's largest economies (Betul, 2015). The BRICS countries possess inherent potential. As a result, they are often known as "developing markets." Wilson and Purushothama (2003) predict that by 2050, China and India would be global players in the manufacturing and service sectors, while Brazil and Russia will be global players in the raw resources sector. China is anticipated

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to become the world's largest economy by 2050, with India coming in third, Brazil fourth, and Russia sixth.

The Phillips curve is a pivotal economic model developed by the New Zealand economist Alban William Phillips in 1958. According to the model, unemployment rates and inflation have an inverse connection, as depicted by the curve. Phillips studied the trends in yearly money pay growth and unemployment rates in the United Kingdom from 1860 to 1957 and plotted his findings on a scatter graph, which revealed that money-wage rates are higher when unemployment is low and vice versa. As a result, statistical data revealed a negative relationship between unemployment rates and wage inflation (Phillips, 1958). Later economists modified it to demonstrate the short-term relationship between price inflation and unemployment in a given economy.

The concept is based on the idea that changes in unemployment within an economy have a predictable impact on price inflation. Thus, the inverse relationship between unemployment and inflation is illustrated as a downward-sloping, concave curve. Inflationary pressures reduce unemployment and vice versa. In contrast, an emphasis on lowering unemployment raises inflation and vice versa.

In the 1960s, it was widely assumed that any fiscal stimulus would boost aggregate demand and trigger the following consequences. As labor demand rises, the pool of jobless workers shrinks, forcing employers to raise salaries to compete for a smaller talent pool. The cost of corporate wages rises, and corporations pass those expenses on to consumers in the form of price hikes.

Many governments used a "stop-go" policy, in which a goal rate of inflation was set, and fiscal and monetary policies were employed to grow or compress the economy to meet the target rate. The Phillips curve's validity was called into doubt in the 1970s when the consistent trade-off between inflation and unemployment broke down due to the onset of stagflation (Selvaraj, 2020). The concern stagflation started manifesting in the developing world, where inflation and unemployment co-exist. The BRICS countries are part of the developing countries but classified as emerging countries in recent times. Based on the literature reviewed little attention was given to the area of re-examining the validity of the Phillips curve, particularly in the BRICS countries, which necessitates a study to validate or invalidate the Phillips curve in those countries.

Therefore, the current study seeks to revisit the traditional Phillips curve by investigating its validity in the context of the BRICS economies and to establish if the inherent theoretical underpinnings of the concept still hold.

The paper is structured into five sections. Following the introduction, section two is the literature review, section three is the data and methodology, section four consists of the data analysis and discussion of results, section five is the conclusion and policy recommendations, and finally the references.

2. LITERATURE REVIEW

2.1. Theoretical discourse. The Phillips curve is a graph that depicts the link between inflation and unemployment. A. W. H. Phillips' research of wage inflation and unemployment in the United Kingdom from 1861 to 1957 is a watershed moment in macroeconomics, although having forerunners. Phillips discovered a persistent inverse relationship: wages climbed slowly when unemployment was high, but quickly when unemployment was low.

According to Phillips, the lower the unemployment rate, the tighter the labor market and, as a result, the faster companies must boost pay to attract scarce employees. The strain eased when unemployment rates rose. The average association between unemployment and wage behavior across the business cycle was illustrated by Phillips' "curve." It depicted the rate of wage inflation that would occur if a certain scenario were to occur.

Phillips curves for most developed economies were quickly approximated by economists. The majority of people linked unemployment to general price inflation rather than salary inflation. Of fact, a company's pricing is inextricably linked to the salaries it pays. Following the influence

of Paul Samuelson and Robert Solow, many economists began to regard the Phillips curve as a menu of policy alternatives due to the tight match between the predicted curve and the data. For example, if the unemployment rate is now at 6%, the government may decide to boost the economy and reduce unemployment to 5%.

Many economists and researchers attempt to explain the Phillips curve. For example, Keynesian economists believed that the Phillips curve offered policymakers a range of trade-offs: they might utilize demand management strategies to boost output and lower unemployment, but to do so would eventually result in higher inflation (Rangarajan & Sheel, 2013).

The Keynesian model implicitly relied on the idea that low unemployment could be sustained by allowing high inflation to erode real wages and thus boost labor demand. The rational expectation perspective was advocated by American economist John F. Muth in 1961. However, it was commonly applied in microeconomics as part of the new classical revolution and popularized by economists Robert and Sargent in the 1970s.

The Keynesian Phillips curve was sharply criticized by Milton Friedman. He disagreed with the way expectations were handled in particular. Friedman noted that wage-bargainers would become accustomed to the higher level of inflation and raise their nominal pay demands if policy attempted to maintain output above its "potential" or "equilibrium" level. Higher inflation without a stable low unemployment rate would be the outcome. Though Friedman agreed that the Phillips curve exists only in the short run, in the long run, the Phillips curve is vertical at the natural rate of unemployment. This implies that the trade-off between the unemployment rate and inflation postulated by Phillip only exists in the short run. On the other hand, the 1970s experienced the "stagflation" combination of high inflation and high unemployment that the Phillips curve relationship appeared to rule out, providing empirical evidence that looked to support Friedman's claim. The stagflation perspective found the coexistence of unemployment and inflation, particularly in developing countries like the BRICS countries. This implies that the Phillips curve does not exist even in the short run as the unemployment rate and inflation move in the same direction, hence increase in the unemployment rate could increase the inflation rate.

The rational expectations school of thought, founded by Robert Lucas and Thomas Sargent in the 1970s, was greatly influenced by this "demise" of the conventional Phillips curve and the perception that it was caused by inadequate modeling of expectations. Additionally, this school of economists relied more heavily on neoclassical "microfoundations" for macroeconomic models in addition to being more exact regarding expectations formation. These academics frequently challenged the entire tenet of Keynesian economics, particularly, the notion that monetary policy could systematically alter output even in the short run, in addition to denying the Phillips curve (Medel, 2021).

There is a growing concern among researchers over the validity of the Phillips curve, especially, in developing countries, hence the need to re-examine its validity in the context of the developing and the BRICS economies.

2.2. Empirical literature. Odo et al. (2017) in their works documented an extensive review in which the current study does not intend to repeat the exercise. Rather we try to bring to the fore important issues highlighted in the review that is critical for the motivation of our study. We also extended the review to capture more recent studies on the subject. Odo et al. (2017) investigate how unemployment and inflation relate in Nigeria and conclude that they relate negatively. This validates the Phillips curve. Similarly, Yizhou (2020) investigates the relationship between unemployment and inflation in the U. S. economy and concludes that the Phillips curve exists in the country both in the short and long term.

We are motivated by their results which are limited to specific countries by subjecting BRICS data to empirical scrutiny using static panel analysis and the PMG/ARDL techniques for robustness checks. We used the BRICS data to test the validity or otherwise of the Phillips curve of the countries. We are also motivated by later studies such as the works of Samuel et

al. (2021) which offer other insightful dimensions to the relationship between unemployment and inflation particularly, in Nigeria. Samuel et al. (2021) had three different models: the first model look at the relationship between unemployment and inflation with unemployment as the dependent variable, which is contrary to the traditional Phillips curve, and the second model linked unemployment and government expenditure and credit to the private sector, the third model linked inflation and money supply ignoring unemployment. They find a positive but insignificant relationship between unemployment and inflation in Nigeria. This implies that the Phillips curve does not exist in the context of the Nigerian economy. Their analysis, however, is limited to the unemployment and inflation relationship ignoring the importance of output and population growth, which the current study captures.

Some studies were also conducted to validate the Phillips curve such as Odo et al. (2017) used the causality test, VECM, and cointegration test on data from Nigeria on unemployment and inflation to validate the Phillips curve. They found a positive impact of inflation on unemployment, signifying the non-existence of the Phillips curve in Nigeria. However, the model of their study does not follow the Phillips equation as in the Phillips equation inflation is the dependent variable while unemployment is the independent variable. This could lead to the wrong specification and inconsistent results. In the same vein, Faith, Onur, and Eren (2019) investigates the validity of the Phillips curve in Turkey using Engle-Granger Causality and found that the Phillips curve is ineffective in Turkey. Also, Kairo, Solomon and Bitrus (2019) examine the relationship between inflation and unemployment in Nigeria using an ARDL model and OLS technique. They found that there was no trade-off between inflation and unemployment in Nigeria. This finding was also corroborated by Yildiz (2021) in Turkey who found that the inverse correlation postulated between inflation and unemployment does not exist.

Also, Muhammad, Rasheed and Saleem (2022) examine the existence of the Phillips curve in the middle east and North African countries. They employ an Autoregressive Distributed Lag pool PMG panel estimation technique and found that there is no trade-off between inflation and unemployment in the middle east and North African countries. They concluded that the Phillips curve does not exist.

On the contrary, many studies found support for the existence of the Phillips curve such as Husseini and Saleh (2015) who investigate the existence of the Phillips curve in Jordan using VECM. They prove the existence of a trade-off between inflation and unemployment in Jordan, hence, the Phillips curve is valid in the Jordanian economy. Also, Muchdie (2016) used cross-sectional data for 182 countries and observe that a negative correlation exists between inflation and unemployment, hence, the Phillips curve is valid. Similarly, Shaari et al. (2017) investigate the existence of the Phillips curve in high-income level countries of the world using the panel Granger causality test and found a bidirectional relationship between inflation and unemployment, which also support the existence of the Phillips curve.

Also, Karahan and Caglarirmak-Uslu (2018) examine the validity of the Phillips curve in Turkey using an Autoregressive Distributed Lagged (ARDL) model and found that a trade-off exists between inflation and unemployment in the long run. In the same vein, Sasongko, Huruta and Gultom (2019) investigate the validity of the Phillips curve in Indonesia using the panel Granger causality test and found unidirectional causation running from inflation to unemployment and that the Phillips curve only exists in the short run in Indonesia.

Again, Efayena and Olele (2020) evaluate the validity of the Phillips curve in Nigeria using a Generalized Method of Moment on quarterly data. The study revealed that the Phillips curve is valid in the context of the Nigerian economy from the period 2010Q1 to 2018Q4. In a similar development, Hafsa and Pooja (2020) examine the validity of the Phillips curve in Pakistan by employing Johansen and Engle-Granger co-integration technique. They found evidence for the existence of the Phillips curve in Pakistan. Similarly, Yizhou (2020) analyzed the relationship between unemployment and inflation in the U.S using Vector Autoregressive (VAR) model and found that the Phillips curve exists in the U.S in both the short and long term. Overall, our study is a blend of the salient features of both the earlier and later studies the relationship

between unemployment and inflation in the context of emerging economies (BRICS) which to the best of our knowledge has remained relatively understudied. In a similar study Jonela (2021) investigate the validity of the Phillips curve using OLS and found that the Phillips curve is valid.

3. DATA AND METHODOLOGY

The study examines the validity of Phillip's curve within the context of the BRICS countries.

Panel regression technique was used in the analysis particularly the random effect after testing the reliability of the pooled and fixed effect models and found that they are not reliable. The random effect was employed in Phillip's model to estimate the relationship between inflation and unemployment. Data was sourced from the World Bank (2020) database between 1993 and 2020 for Brazil, Russia, India, China, and South Africa (BRICS). The framework for the study is drawn from the original Phillip's model. The simple Phillips curve equation suggests that inflation is the function of the unemployment rate and the hypothetical unemployment rate that would exist if the inflation rate were zero. Changes in prices of goods and services would also affect output, hence the inclusion of output in our model. We also incorporated population growth in our model to control for the effect of unemployment on inflation in our study.

Following the simple Phillips equation, which is specified as follows:

$$\pi = -h(U - U_n) \quad (1)$$

Where π represents the inflation rate, U is the unemployment rate, U_n represents the natural rate of unemployment that would occur when the inflation rate is zero, and h is a positive constant that shows that the Phillips curve slopes downwards. The equation indicates that there is a trade-off between inflation and the unemployment rate.

The model of this study is specified by adopting the Phillips equation and modifying it to incorporate output and population growth as seen below;

$$\pi_{it} = -h(U - U_n)_{it} + b_{1t}LogGDP_{it} + b_{2t}POPg_{it} + \varepsilon_{it} \quad (2)$$

This model is further specified to capture the variables acronyms used in this study

$$INFL_{it} = -h(UNEM)_{it} + b_{1t}LogGDP_{it} + b_{2t}POPg_{it} + \varepsilon_{it} \quad (3)$$

Where INFL is the inflation rate, UNEM is the unemployment rate, LogGDP is the natural logarithm of GDP, and POPg is the population growth rate.

4. Results and Discussion

4.1. Discussion of descriptive statistics, correlations, unit root, and Static Panel results. Table 1 presents the mean, standard deviation, minimum, and maximum values of inflation, unemployment, gross domestic product, and population growth in the BRICS countries. The study used 140 observations. The combined inflation rate for the BRICS countries stood at 46.179 percent on average, the unemployment rate was 10.084 per cent on average, GDP stood at US\$1,865.484 on average, and population growth was 0.954 percent on average. This implies that both inflation and unemployment rates are high on average, hence the need to find out the relationship between them in the selected countries.

Variables	Observation	Mean	Std.Dev	Minimum	Maximum
INFL	140	46.179	249.410	-1.4	2075.888
UNEM	140	10.084	7.717	2.600	29.200
GDP	140	1865.484	2889.447	115.482	14722.730
POPg	140	0.954	0.664	-0.42	2.49

Table 2 presents the pairwise correlation results showing the extent to which the inflation rate relates to the unemployment rate, output, and population growth rate in the BRICS countries. The result reveals a negative correlation between inflation rates and unemployment rate, implying increase in inflation rate may be associated with decrease in unemployment in the BRICS countries. It was also found that inflation and output were negatively correlated. The implication of this finding is that rise in inflation rate may be associated with decrease in output. This is in line with the Phillip’s postulated and the theoretical expectation of this study.

Variables	INFL	UNEM	LogGDP	POPg
INFL	1.000			
UNEM	-0.076	1.000		
LogGDP	-0.083	-0.366	1.000	
POPg	0.061	0.370	-0.275	1.000

A positive correlation was found between inflation rate and population growth rate in the BRICS countries. The implication is that increase in inflation rate may be associated with population growth. This is also consistence with Phillip’s postulate. The correlation coefficients were found to be low (less than 0.80) implying that there is no multicollinearity between the independent variables of this study. This could validate the result of the study further.

Table 3 presents the panel IPS unit root test result. The study reveal that inflation and population growth rates across the BRICS countries were stationary at levels as indicated by their probability values of 0.000 and 0.018 respectively. On the other hand, the unemployment rate and output (LogGDP) became stationary at first difference as indicated by their probability values of 0.000 and 0.001 respectively. This implies that the null hypothesis of the unit root was rejected at levels for INFL and POPg, while at the first difference for UNEM and LogGDP.

Variables	IPS at levels	Probability	IPS at first Dif.	Probability	Levels of integration
INFL	-3.900	0.000*			I(0)
UNEM	-0.7884	0.215	-4.218	0.000*	I(1)
LogGDP	0.772	0.780	-3.286	0.001*	I(1)
POPg	-2.092	0.018**			I(0)

Table 4 shows the results of static panel regression for the relationship between inflation rate (INFL), unemployment rate (UNEM), gross domestic product (GDP), and population growth rate in the BRICS countries consisting of Brazil, Russia, India, China, and South Africa. The study focuses on revalidating the existence of the Phillips curve in the context of the BRICS countries. In the first place, we estimate the pooled regression and subject the result to a test using Breauch-Pagan to see if the data conform to the technique. The Breauch-pagan test relates the random effect and pooled regression with a null hypothesis in favor of pooled regression. The rejection of the null hypothesis indicates the presence of a country-specific effect in the data; this implies that the use of pooled regression will give an inconsistent and inefficient result. In this case, the alternative static panel estimation of fixed effect and random effect technique that could model unobserved individual country-specific – effects alongside the observed error term will be resorted to. However, the choice between the two depends on the result of the Hausman test. The null hypothesis of the Hausman test shows no systematic difference in coefficients. Rejecting the null hypothesis implies that random effect could not give consistent and efficient estimation; alternatively, fixed is to be used.

The result of the Breauch-pagan as can be seen in table 4 reject the null hypothesis of $\text{var}(u)=0$, which implies that the variance of the disturbance term possessed an individual-country-specific effect and that the use of pooled regression will give an inconsistent result and cannot be used for this study as indicated by the Breauch-pagan probability value of 0.000.

The results from the Hausman test could not be rejected, the null hypothesis of no systematic difference in coefficients is favored as indicated by the Hausman probability value of 0.160. We, therefore interpret the result from the random effect estimation as it gives consistent and efficient estimates. Based on the result of the random effect as can be seen in table 4, the coefficient of the unemployment rate (UNEM) of -1.215 and the corresponding probability value of 0.003 implies that a one percent increase in the unemployment rate may likely reduce the inflation rate by 1.215 percent and is statistically significant. The implication of this finding is that increase in unemployment rate may likely translate into reduction in inflation rate, as people may likely have little or no income to spend, which could reduce aggregate demand and hence reduce prices of goods and services (inflation).

Table 4: Summary of static panel Regression Results				
Variables	Pooled OLS	Random effect	Fixed effect	95% CI
Constant	6.606 (0.000)*	7.692 (0.000)*	9.557 (0.000)*	5.163 – -10.221
UNEM	-0.512 (0.009)*	-1.215 (0.003)*	-2.286 (0.000)*	-2.011 – -0.417
LogGDP	-0.543 (0.000)*	-0.488 (0.000)*	-0.437 (0.002)*	-0.747 – -0.230
POPg	-0.127 (0.352)	-0.026 (0.924)	-0.245 (0.516)	-0.568 – -0.516
Breauch-Pagan	Chi2(1)=19.930	Pooled regression		
LM Test	Pro>chi2=0.000*	is rejected		
Hausman test	Value=5.17	Null hypothes accepted,		
	Prob.=0.160	it favours random effect.		
Rho		0.41 (fraction of variation		Wald-stat. =
		due to individual effect)		26.100(0.000)*
Source: Author's compilation				
Note: * and ** is 1% and 5% significance level respectively				

This findings corroborates Phillip (1958), which posited that there is a trade-off between inflation and unemployment rates in an economy. It also corroborates Odo et al. (2017) and Yizhou (2020) who in their separate study observed that there was a negative relationship between unemployment and inflation in Nigeria and the US respectively. This finding is contrary to the finding of Samuel et al. (2021) who found a positive relationship between unemployment and inflation in Nigeria. According to them, unemployment and inflation coexist in Nigeria implying the existence of stagflation.

Similarly, the coefficient of output proxy by nominal GDP (LogGDP) of -0.488 with a corresponding probability value of 0.000 suggests that an increase in output by one percent may likely reduce the inflation rate by 0.488 percent. The implication of this finding is that increase in output (supply) may likely translate into reduction in inflation rate, as increase in output or supply may increase the availability of the products, hence making the commodity cheaper and affordable. This is also consistent with Phillip's (1958) postulation. Based on the findings, we conclude that Phillip's curve is valid in the context of the BRICS countries.

The result shows that population growth rate does not have a significant impact on inflation in the BRICS countries. The coefficient of population growth of -0.026 and the corresponding probability value of 0.924, implies that a one percent increase in population growth may likely lead to a 0.026 percent reduction in inflation rate in the BRICS countries. This could be attributed to the effective utilization of the human resources in enhancing productivity, increase supply of goods and services and reduce prices, especially in China, where increase in their population has become a blessing to them.

The rho value of 0.41 suggests that 41 percent of the fraction of variation in the inflation rate was explained by the error term, while 59 percent of the variation was explained by the unemployment rate, output, and population growth rate in the countries studied. This further confirmed that the unemployment rate, output, and population growth rate significantly explained the inflation rate in the emerging economies of the world (BRICS).

The Wald value of 26.10 and the corresponding probability value of 0.000 shows that the unemployment rate, output, and population growth rate jointly and significantly affect the inflation rate in the BRICS countries.

4.2. Summary of major findings. The major findings of this study are as follows:

A significant trade-off was found between unemployment and inflation rate in the BRICS countries. The implication is that raising unemployment rate may likely translate into decrease in inflation rate, which is in line with the theoretical expectation of this study (the Phillip's curve).

Also, a negative and significant relationship between output and inflation rate in the BRICS countries. The implication of this study is that raising output may likely lead to reduction in inflation rate in the BRICS countries, which is in line with theoretical expectation of this study (the Phillip's curve).

4.3. Robustness checks. The robustness check was carried out using the Panel Autoregressive Distributed Lag (PARDL) model propounded by Pesaran and Shin (1999) because the variables under study were found to be integrated in a mixed order of I(0) and I(1).

The PARDL model was specified following Phillip's postulate as follows:

$$\Delta INFL_{it} = \sum_{i=1}^p \alpha_{it} \Delta INFL_{it-1} + \sum_{i=0}^p \beta_{it} \Delta X_{it-p} + \varepsilon_{it} \quad (4)$$

Where: $INFL$ is as defined above at time t , X_{it} represents the independent variables (UNEM, LogGDP, and POPg) at the time t , α_{it} and β_{it} is the vector of the parameters of the model and ε_{it} is the error term for the model.

4.4. Discussion of robustness result. Table 5 shows that a trade-off exists between unemployment and inflation in the BRICS countries in the long run, as indicated by the coefficient of unemployment of -0.473 and statistically significant at a 1 per cent significant level with a probability value of 0.0052. The implication of this study is that increase in unemployment rate may likely translate into a reduction in inflation rate in the BRICS countries. Precisely, a one percent increase in unemployment rate may likely lead to a 0.473 percent decrease in inflation rate in the BRICS countries. This is in line with the Phillip's postulate and the theoretical expectation of this study. This finding further corroborated the first result using static panel analysis of random effect.

Table 5: Long run and short run PMG/ARDL result				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
UNEM	-0.473	0.165	-2.865	0.0052*
LogGDP	-1.037	0.787	-1.316	0.1913
POPg	0.333	1.746	0.191	0.8492

Table 6 shows that a trade-off exists between unemployment and inflation in the BRICS countries in the short run as indicated by the coefficient of unemployment of -0.681 only the relationship is not statistically significant. This implies that the Phillips curve exists both in the short and long run but is significant only in the long run.

Table 6: Short run PMG/ARDL result				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	-0.681	0.147	-4.627	0.0000*
D(INFL(-))	0.057	0.090	0.637	0.5259
D(UNEM)	-0.544	0.860	-0.632	0.5287
Source: Authors' compilation				
Note: * is a 1% significance level				

The coefficient of output of -1.037 shows that increase in output may likely lead to a reduction in inflation rate in the BRICS countries, as expected, though not statistically significant. This support the first result and corroborate the Phillip's postulate.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The current study examines the validity of Phillip's curve in the context of the BRICS countries comprising Brazil, Russia, India, China, and South Africa using data from the World Bank database (2020) and analyzed using a random effect static panel regression analysis. The Phillips type model was adapted and modified to capture the influence of output on the inflation rate in the BRICS countries. A panel Autoregressive Distributed Lagged (ARDL) model was also employed for robustness. Both the results of the static random effect analysis and the panel ARDL confirmed the existence of the Phillips curve in the BRICS countries.

We find that the unemployment rate and output negatively and significantly influenced the inflation rate in the BRICS countries, which validates Phillip's curve. This implies that a trade-off exists between inflation and unemployment in the BRICS countries, as well as between output and inflation rate. To achieve low inflation, unemployment should increase above its natural rate, and inflation could rise when jobs are created (low unemployment). Based on the findings we conclude that an increase in unemployment has a negative and significant impact on the inflation rate, also an increase in output has a negative and significant impact on the inflation rate. We, therefore, recommend the need for policymakers to choose to either stabilize prices (inflation) or reduce unemployment. This is because the two cannot be taken simultaneously as trade-offs exist. We also recommend that government should reduce inflation by increasing output thereby generating employment for the people. This is because more hands are needed to increase output, which would in turn reduce prices (inflation) and generate employment. Also recommended is the need for the BRICS countries to focus more on the labor-intensive technique of production to reduce the cost of production, create jobs and reduce the prices of goods and services.

We suggest that future studies should examine the validity of the Phillips curve in the ECOWAS countries by employing a panel nonlinear ARDL/pooled mean group estimate. Also, the current study used annual data, we, therefore, suggest that future studies should use high-frequency data, such as quarterly or monthly data for robustness and more generalized decisions.

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