Critiquing the Phillips Curve in Zimbabwe through Econometric Modelling

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Abstract

Inflation and unemployment in Zimbabwe seem to have been moving in the same direction, contrary to the Phillips curve theory which holds the view that the relationship is inverse. This study sought to determine the extent to which the theory is relevant in Zimbabwe. Yearly data for inflation and unemployment from 1990 to 2017 were used for the study. Ordinary Least Squares (OLS) was used to determine the relationship. A few Stationarity and Cointegration tests were carried out, with data becoming stationarity after first differencing. The Augmented Dickey Fuller test was used. There was also evidence of cointegration between the two variables using the Johansen Cointegration test technique. The results of the study established a stable and permanent inverse relationship between Inflation and Unemployment in Zimbabwe, conforming to the Phillips Curve theory. The Zimbabwean government should, therefore, work towards growing its economy through adopting a policy mix which embraces macro-economic indicators that have a direct impact on both inflation and unemployment.

Keywords: Inflation, Unemployment, Ordinary Least Squares

Introduction

Myth is stubborn, and in the case of the Phillips Curve, it has taken a considerable time of obvious contradictory evidence to convince many economists that there is no fixed inverse relationship between unemployment and price inflation. Resurreccion (2014) argued that the relationship between inflation and unemployment never existed, not even at the purely empirical level. Zimbabwe is one of the countries whose economic development is measured in terms of variables such as unemployment and inflation, which are considered as important economic indicators in Zimbabwe, with the unemployment rate considered as one of the macroeconomic factors that are used to measure the state of the economy. High inflation is coupled with increased price variability and at times can work against investors. The reduction of the country's international competitiveness may be a result of inflation as the country's exports become expensive. In fact, the relationship between unemployment and inflation in Zimbabwe seem to be in contrast with the Phillips Curve. High-rate inflation is being accompanied by high-rate of unemployment for Zimbabwe. This study, therefore, seeks to evaluate the relevance of the Phillips Curve in the Zimbabwe economy so that informed polices premised on inflation and unemployment may be recommended.

Background of the study

The Phillips Curve shows the relationship between unemployment and inflation in an economy. Since its discovery by British economist AW Phillips in 1945, it has become an essential tool to analyse macro-economic policy world over, impliedly suggesting that it also applies in Zimbabwe. After 1945, fiscal demand management became the general tool for managing the trade cycle. The

consensus was that policy makers should stimulate aggregate demand (AD) when faced with recession and unemployment and constrain it when experiencing inflation. It was also generally believed that economies faced either inflation or unemployment, but not together, and whichever existed would dictate the macro-economic policy objective to pursue at any given time. In addition, the accepted wisdom was that it was possible to target one objective, without having a negative effect on the other. However, following the publication of Phillips' research in 1958, both of these assumptions were called into question.

Phillips analysed annual wage inflation and unemployment rates in the United Kingdom for the period 1860-1957, and then plotted them on a scatter diagram. The data appeared to demonstrate an inverse and stable relationship between wage inflation and unemployment. Later, economists such as Friedman (1968), Akerlof et al., (2000) substituted price inflation for wage inflation and the Phillips curve was born. When economists from other countries, with the exception of Zimbabwe, undertook similar research, they also found very similar curves for their own economies. In fact, Phillips [5], analysed the annual wage inflation and unemployment rate.

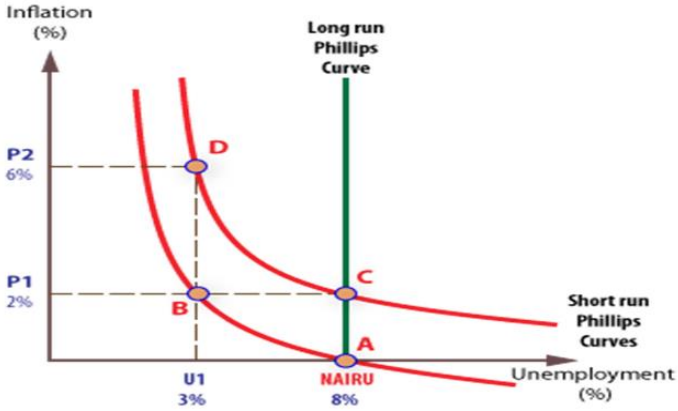

Figure 1.1. *Phillips Curve: (Adapted from Advanced Macro-Economics: Sanjay Rode, 2012).*

The curve suggests that changes in the level of unemployment have a direct and predictable effect on the level of price inflation in the short run. In fact, a fiscal stimulus, and increase in aggregated demand (AD), would trigger an increase in the demand for labour as government spending generates growth; this would lead in a decline in the fall of unemployment. The rightward shift of the AD would result in firms competing for fewer workers thereby raising nominal wages. This results in workers having greater bargaining power to seek out increases in nominal wages, thus wage costs surges. Faced with rising wage costs, firms pass on these cost increases in higher prices. It can, therefore, be concluded from this graph that whatever happens to inflation in the long run, no changes are experienced on the unemployment rate.

Statement of the problem

Unemployment and inflation are among the major problems not only in less developed and developing countries but also in developed countries. The two economic indicators have received a lot of attention among economic analysts, governments, and scholars in pursuit of better understanding of their occurrence as well as their relationship. Zimbabwe had a record high of both inflation and unemployment rates, with policies introduced to manage the two macro-economic indicators with little success. Phillip's (1958) conducted a study to determine the nature of relationship between the two macro-economic variables and an inverse relationship was found.

The objective of this study was to evaluate the Phillips Curve in the Zimbabwe economy, so that informed polices premised on inflation and unemployment may be recommended. The hypothesis that pinned this study is that unemployment is negatively related to inflation.

Review of related literature

The concept of inflation has been defined as a persistence in the general price level of broad spectrum of goods and services in a country over a long period of time. Inflation has been intrinsically linked to money, as captured by the often-said maxim '…inflation is too much money chasing too few goods…'. Inflation was described by Oliver (2010) as an economic situation when the increase in money supply is faster than the new production of goods and services in the same economy. Forder (2014) distinguish inflation from an economic phenomenon as a onetime increase in prices, or when there are price increases in a narrow group of economic goods or services. Balami (2006) also sees inflation as a situation of rising a general price of broad spectrum of goods and services over a long period of time. It is, measured as the rate of increase in the general price level over a specific period of time. The International Labour Organisation (ILO) defines unemployment as numbers of the economically active population who are without work, but available for and seeking work, including people who have lost their jobs and those who have voluntarily left work (World Bank, 1998). In Zimbabwe, unemployment measures the number of people actively looking for a job as a percentage of the labour force and is calculated by dividing the number of unemployed persons aged 15 years and above by the economically active population in that age range (Zivanomoyo & Mukoka, 2015).

Although there seems to be convergence on the inflation-unemployment concept, its application has been bedeviled with a series of problems across countries. First, most published unemployment rates are recorded open unemployment. People's attitude on this varies from country to country. While this may be high in developed countries and where government is committed to resolving unemployment problems, it is likely to be very low in countries with the opposite attributes. Okafor (2011) pointed out the problem arising from the concept of labour force. For instance, in Nigeria, people below the age of 15 years and those above the age of 55, who are actively engaged in economic activities, are excluded from labour statistics surveys. Contrary to the Zimbabwe economy, where people with at least 15 years are included in labour statistics surveys (ILO, 1998). These factors have the result in underestimation or overestimation of unemployment thereby making international comparison very difficult. Furthermore, factors such as the preponderance of full housewives (but who are willing to be engaged in paid job) and unpaid family workers also contribute significantly to the underestimation of unemployment.

Frictional unemployment may be regarded as a subset of structural unemployment, mainly reflecting temporary unemployment spells as a result of job search and matching difficulties in connection with quits, new entries to the labour market, and job separation because of employers' dissatisfaction with the individuals' workers (Lindbeck, 1999). Ordinarily, this kind of unemployment does not usually pose a threat to individuals' welfare, as it is temporary in nature. However, the situation in Zimbabwe is that frictional unemployment grows into long-term unemployment and thereby resulting into a stable state of unemployment.

Similarly, Abachi (1998) studied the trade-off between unemployment and inflation in Nigeria using a trade-off model. His studies revealed that there was no trade-off between inflation and unemployment. Rather, the estimates established a non-linear curve that slopes upwards. His findings showed that causality existed between inflation and unemployment, which implied that any attempt to control inflation resulted in an aggravation of unemployment and vice-versa.

In another study, Sanda (2006) used a sample of 360 firms in Kano and its environs to examine whether or not, in comparison to large firms, small firms are relatively better at creation of employment opportunities. The results were positive in that small firms were found to be relatively better, and the conclusion they derived was that a policy that gives special preference to small firms is justified. Unemployment is painful to those who have no source of income, but reducing it is not costless. In the short run, a reduction in unemployment may come at the expense of a higher rate of inflation, especially if the economy is close to full capacity, where resources are almost fully employed (Hargreaves-Heap, 1980).

In Zimbabwe, economic development is measured in terms of factors such as unemployment and inflation. These two variables are considered important economic indicators, with the unemployment rate considered as one of the macroeconomic factors that are used to measure the state of the economy. High inflation is coupled with increased price variability and at times can lead to the departures of investors. The reduction of the country's international competitiveness may be due to inflation which directly makes a country's exports relatively expensive. This study, therefore, evaluates the applicability of the Phillips Curve in the Zimbabwe context, with the theory stating that in the short-run there is an inverse relationship between inflation and unemployment rate, whilst in the long-run, the concepts of unemployment and inflation are not related.

Research Methodology

The study explored the econometric methodology applied to determine the relationship between inflation and unemployment in Zimbabwe. The study used secondary yearly data for only four variables, namely, inflation, unemployment, current account balance and gross domestic product. Twenty-eight observations were considered since the period under study covers from 1990 to 2017. The data was collected from International Monetary Fund (IMF) Data Base. In analysing the data Ordinary Least Squares (OLS) were used in which inflation was regressed against unemployment rate, current account balance, real GDP. The method is useful in developing quantitative relationship between variables, which can be used for prediction. This is the most appropriate technique in view of the test for fitness and simplicity in understanding. We assumed the assumptions of the OLS held to estimate the parameters in the model. This analysis helped us to determine the extent to which the exogenous or policy variables explained the endogenous variable. The test of the explanatory parameters was carried out using the student T-test which determines the strength of the relationship between the independent variables in the model. It ascertained if each estimated parameter is individually significantly different from zero. The co-efficient of determination (R-squared) was computed. R-squared was used to measure the goodness of fit. It was used to reinforce F-statistic. It considered, the degree of freedom and tests the significance of the explained variation in the regressend by the regressor. The Durbin-Watson (DW) value was also computed and used to determine the presence or absence of autocorrelation in the data collected.

Based on the theoretical framework, the model used on this study could be represented mathematically as:

$$INFL = f(UNEMP, CAB, GDP)$$

Where:

INFL = Inflation Rate, UNEMP = Unemployment Rate, CAB = Current Account Balance, GDP = Real Gross Domestic Product. The linear relationship of equation (1) could be stated as:

$$INFL_t = a^0 + a^1 UNEMP_t + a^2 CAB_t + a^3 GDP + U_t$$

Where a^1, a^2 and a^3 are the relevant elasticity, a^0 is the regression constant and U is the error term subject to the usual stochastic consumptions.

Results and Discussion

This section focused on the empirical estimation, presentation and economic interpretation of the regression results carried out using the methodology highlighted in the previous section.

- **Descriptive Statistic**

Table 1 shows descriptive statistics of the dependent and explanatory variables used in the study for the period 1990 to 2017. Maximum and minimum statistics rule out the possibility of outliers in the data used as the data were transformed logarithms to reduce its variability and enable direct estimation of the parameters. Classical linear regression requires that the residuals be normally distributed and judging by the probability values of the Jarque-Bera, three variables except for GDP residuals follows a normal distributed therefore, unit root tests can be conducted.

Table 1: Jarque-Bera Test Technique

	INFL	**UNEMP**	**GDP**	**CAB**
Mean	11.57143	22.76327	1.628571	-8.607143
Median	1.900000	16.02832	2.500000	-6.250000
Maximum	156.9000	87.80344	11.90000	4.100000
Minimum	-37.40000	-4.63257	-16.50000	-43.60000
Std. Dev	40.95992	21.17633	7.462144	9.255546
Skewness	2.229836	1.448543	-0.882641	-1.992995
Kurtosis	7.931191	4.778605	3.306033	8.384451
Jarque-Bera	51.57286	13.48263	3.744854	52.36051
Probability	0.000000	0.001181	0.153750	0.00000
Observations	28	28	28	28

- **Stationarity Test Results**

The stationarity and unit root tests of the data used in this study were conducted using Augmented Dickey-Fuller test and the results are shown in Table 2 below:

Table 2: Unit Root Test. Augmented Dickey Fuller Test

Variable	**t-ADF Statistic**	**Critical 1%**	**Critical 5%**	**Critical 10%**	**Conclusion**
INFL	-4.568668	-3.699871	-2.976263	-2.627420**	1(1)
UNEMP	-4.305603	-3.711457	-2.981038	-2.629906**	1(1)
GDP	-5.894354	-3.711457	-2.981038	-2.629906**	1(1)
CAB	-7.666563	-3.711457	-2.981038	-2.629906**	1(1)

**, ** indicate significance at 1% and 10% respectively*

The results from the ADF test became stationary after differencing. The next stage involves testing the existence of the cointegration relationship among the variable using Johansen Cointegration Test. Table 3 below presents the cointegration test results.

- **Cointegration Test**

Table 3: Johannsen Cointegration Test Results

**Denotes rejection of the hypothesis at the 5% (1%) significance level.*

Hypothesised No. of CE (s)	Eigen Value	5% Critical Value	Prob.
None*	0.753482	27.58434	0.0029
At most 1	0.395652	21.13162	0.4436
At most 2	0.246490	14.26460	0.4477

The hypothesis of no cointegration was rejected suggesting that there exists a long-run relationship amongst inflation and its determinants. This was because the statistical values of those tests were greater than their critical values. When the cointegration exists, it means INFL, UNEMP, GDP and CAB share a common trend and long-run equilibrium as suggested. However, the statement of cointegration of 'At most 3', was rejected. There being evidence of cointegration amongst the variables, the following Table 4 exhibits results for estimated Ordinary Least Squares (OLS).

- **Model Estimation Test**

Table 4: Ordinary Least Squares
Dependent Variable: (INFL)

Variable	Coefficient	Std. Error	t-Statistic
Unemp	-9.603003	13.46993	-0.712921
GDP	2.329862	1.138528	2.046381
CAB	-0.230333	0.926617	0.248574
C	58.23383	71.29286	0.816825

R Squared=0.16542
Adjusted R Squared=0.061099
F. Statistic=1.585676
Log Likelihood=-140,6422 Durbin Watson Stat= 1.779852

The result showed that unemployment rate in Zimbabwe has negative and significant relationship with the Inflation rate. The Current Account Balance (CAB) has a negative relationship with the Inflation rate. However, Gross Domestic Product (GDP) has a positive relationship with the Inflation rate. Given that this study was premised on the evaluation of the Phillips Curve in the Zimbabwe Economy context, discussion of the results was centred on Inflation rate and Unemployment rate. The results on Table 4 shows that a unit increase in unemployment will result in a decrease of inflation by 9.603 units. Therefore, Ordinary Least Squares (OLS) results shows that unemployment and inflation have a permanent (fixed) stable inverse relationship. These results, therefore, strongly supports the Phillips Curve. This, therefore, suggests that the Phillips Curve, will remain the primary framework in Zimbabwe for understanding and forecasting inflation.

Conclusion

The trade-off relationship between unemployment and inflation poses a dilemma for policy makers, since in order to reduce unemployment, the inflation rate in the economy tends to rise. Therefore, basing on the findings of this study, there is great need for constructive and well-specified policy recommendations that would help to ameliorate the situation of unemployment and inflation in Zimbabwe.

The following policy recommendations have potential of alleviating the current problems of unemployment and inflation in Zimbabwe.

- Government of Zimbabwe should strive to develop the agricultural sector, which has great potentials to increase the supply of farm products and other basic necessities of life. The

increased supply will reduce prices and increase in employment generation. To achieve this, various specific agricultural policy measures should be promoted and pursued vigorously. Thumbs up for the Command Agricultural model which the country is currently undertaking.

- Massive investments should be carried out in the real sector of the economy, through establishment of job-creating industries. This would help reduce the level of unemployment in the country, increase output, reduce prices of goods and services, and thus, reducing the level of inflation in the economy.
- The free flow of information between employers and employees should be enhanced, through the reduction in the cost of job or employee search by means of job data banks, thus resulting to increased efficiency in the labour market. Similarly, training and educational programmes should be increased and geared towards innovations and productivity, thereby, reducing the rate of unemployment in the economy.
- It is, also recommended strongly that special attention be given to policy implementation. In this regard, the government of Zimbabwe should set up a policy implementation body or committee in the office of the president for the purpose of monitoring government policies and ensuring that they are implemented according to prescriptions.
- A well thought model should be designed for the mining sector, especially in the Diamond mining. The model should clearly spell the procedures to be followed, from the extraction to the selling of the mineral, with the government taking a leading role from both the extraction and the selling, rather than leaving private industries to manage the most sought resource. This would enhance in the accountability of the mineral and the ultimate proceeds.
- Zimbabwe government should, therefore, work towards growing its economy through adopting a policy mix that embraces macro-economic indicators.

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