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Inflation–Unemployment Dynamics in Nepal: A Phillips Curve Perspective (1991–2024)

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ABSTRACT

The knowledge on inflation and unemployment is crucial for macroeconomic analysis for the policymakers. Various studies have assimilated the inverse relationship between inflation and unemployment by using the original Phillips Curve. This study adopted data from 1991-2024 to test the existence of Phillips Curve in Nepal. The unemployment rate in Nepal have been high and stagnant compared to a more volatile inflation rate. The study used the Augmented Dickey-Fuller (ADF) test to check the stationarity of the data. After the data points were proved stationary, the Ordinary Least Squares (OLS) method was used for the regression analysis. The empirical evidence from the model suggested that there was no direct relationship between inflation and unemployment. Even through a negative coefficient of unemployment suggested an inverse relationship, it was not significant enough. Therefore, Nepal needs to adopt policies that counter each of these macroeconomic issues separately. It is recommended to use supply-side policies for reducing unemployment rates while continuing with monetary policies to fight inflation.

Keywords: Inflation, Unemployment, Phillips Curve, Augmented Dickey-Fuller (ADF), Ordinary Least Squares (OLS)

1. Introduction

Unemployment and Inflation are among the most essential macroeconomic indicators of an economy. Unemployment is a condition when a person from the labor force is actively seeking for a job but doesn't have a job. Inflation is defined as the persistent increase in average price levels of an economy. Inflation is calculated through the changes in price of goods and services of the Consumer Price Index (CPI). The following equations calculate unemployment rate and inflation respectively:

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$$Unemployment\ rate\ = \frac{Unemployed\ people}{Total\ labor\ force} \times\ 100$$

$$Inflation\ = \frac{CPI_{new} -\ CPI_{old}}{CPI_{old}} \times 100$$

In 1958, A.W. Phillips hypothesized an inverse relationship between unemployment and inflation. After looking into the data from the British economy, he postulated that high unemployment was associated with low inflation and low unemployment was associated with high inflation. In other words, there was a trade-off and governments would have an opportunity cost if policies were targeted to solve either one of them. However, during the 1970s, countries like the USA experienced both high inflation and high unemployment rate, a period known as stagflation. Following this, economists Milton Friedman and Edmund Phelps refurbished the idea of the original Phillips Curve. They postulated that its application is limited to short-run and that in the long-run, this inverse proportionality ceases to exist. At present too, real world data often contradict the effectiveness of the original Phillips Curve in the long run. It is with no doubt that successful economies like Norway or Switzerland have achieved low levels of unemployment and a stable rate of inflation. In contrast, many countries have grappled with stagflation in recent decades.

The rework of the Phillips curve from Friedman and Phelps formulated the Expectations Augmented Phillips Curve. It suggests that when the market expects high inflation, the labors demand higher nominal wages to keep their purchasing power. Once nominal wages are increased, the firms immediately set higher prices to keep their markups high. This, in the long run, leads to an increase in inflation at a constant rate of unemployment or the Natural Rate of Unemployment (NRU). (The CORE Econ Team, 2024)

With a GDP per capita (constant US$) of 1179.8 USD in 2024 (World Bank Group, 2025), Nepal is one of the poorest countries in the world. Since 1990, Nepal's GDP has become ten times larger. Despite this, unemployment rates have been stagnant at around 10% for decades. Youths are forced to flee the country for employment opportunities. In fact, the youth unemployment rate (fraction of unemployed youths aged 15 to 24 in the labor force) in Nepal was a staggering 20.82% in 2024. Figure 1 shows the trend of unemployment and inflation in Nepal since 1991. The data of unemployment is extracted from the World Bank's Open Data and is only available since 1991. The annual inflation rates are sourced from Nepal Rastra Bank's website.

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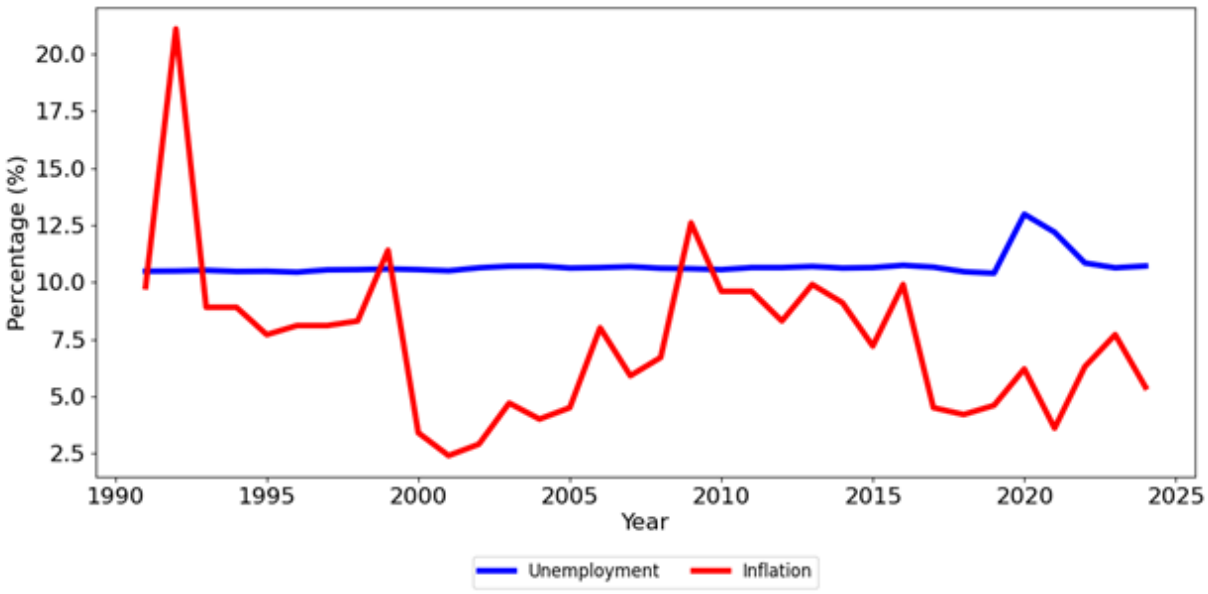
Fig. 1. Time series of inflation and unemployment rate in Nepal (1991-2024)



From the trend shown in figure 1, it can be clearly seen that for the most part, the fluctuation in inflation seems to have no correlation to unemployment. However, during 2020/21, the Covid-19 recession and closure of businesses led to supply shocks and cyclical unemployment. It is in the same period when the unemployment rate peaked at 12.98%. Meanwhile, the inflation is decreasing, providing some evidence for the existence of the original Phillips Curve during the years following the pandemic. Yet, the historical trend refutes this relationship's existence in other times, such as the 2008 financial crisis. Moreover, inflation rose to 9.9% while unemployment rates were still comparatively static during the 2015/16 fiscal year. That year consisted of several institutional changes following the 7.8 magnitude earthquake, petroleum blockade and the amendment of the constitution.

We can observe two distinct problems in Nepal's economy from the above time series. First, the unemployment rate has been consistently around 10%. High unemployment rates come with reduced economic growth, decrease in tax revenue, accumulation of government debt and costs of unemployment benefits. Second, the rate of inflation is extremely volatile which impacts business confidence, limits investment and decreases the real wage of labors with less bargaining power.

2. Literature Review

This literature review section consists of past research conducted on examining the Phillips curve's existence in various countries. The existing literature reveals inconsistent results. While

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some studies have contradicted the validity of the original Phillips Curve, others have provided evidence in its support. The studies have also employed varied econometric models. Among them, OLS models, VAR models and Granger causality tests are more prevalent.

(Daniel, Israel, Chidubem, & Quansah, 2021) explored the Phillips curve hypothesis and the trade-off between inflation and unemployment in Nigeria. The analysis included Vector Autoregressive (VAR) and Error Correction Methods. The study found no major causality nor a long-run relationship between inflation and unemployment in Nigeria. The study also involved recommending respective fiscal and monetary policies in Nigeria, as unemployment's cause was attributed to government inefficiencies while inflation was linked with the depreciation of the Naira.

(Wondimu, Mwakabungu, & Tolesa, 2025) concluded that the Phillips Curve hypothesis does not hold in the long run. They utilized a Vector Error Correction Model (VECM) and Granger causality tests on annual time series data for Ethiopia (1991/92 to 2020/21). The VECM results indicated a positive and statistically significant long-run impact of unemployment on the inflation rate, suggesting structural stagflationary dynamics, though a negative relationship was observed in the short run. Furthermore, Granger causality tests confirmed the absence of a causal link running between the inflation rate and the unemployment rate.

(Alper, 2017) investigated the validity of the Phillips Curve for the Turkish economy (1987-2016). The study employed the Autoregressive Distributed Lag (ARDL) bound testing approach, preceded by Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. In the short run, when inflation was the dependent variable, the inverse Phillips Curve relationship was valid: a 1% increase in the unemployment rate was found to reduce the inflation rate by 0.32%. However, the long-run analysis revealed an asymmetrical cointegration relationship. A long-run relationship among the variables was determined only when the unemployment rate was taken as the dependent variable. Using the Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) methods to estimate coefficients, the study still found a long-run inverse relationship: a 1% increase in the inflation rate reduced the unemployment rate by 0.03%.

(Mangnejo, Mahar, and Ahmed, 2020) conducted an empirical investigation into the Phillips curve in Pakistan using annual time series data from 1991 to 2015. The authors concluded that a Phillips curve exists in Pakistan during the period studied. Employing econometric tools such as the Augmented Dickey-Fuller (ADF) unit root test, Engle-Granger co-integration, and Granger causality within the EViews 9 software, the study examined both the stationarity of variables and the causal direction between inflation and unemployment. The Granger causality tests revealed that unemployment significantly caused inflation, but inflation did not Granger-cause

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unemployment. The descriptive trend analysis further supported a negative relationship between inflation and unemployment, consistent with the Phillips curve hypothesis.

(Elliot, 2015) explored the relationship between inflation and unemployment in Ghana. The study tested the existence of the new Keynesian Philips curve model on annual time series data sampled from 1970 to 2013. This study too, rejects the evidence of the Phillips Curve. The study used the ADF unit root test for stationarity examination. The regression analysis revealed that the estimated coefficients were insignificant (particularly that of the output gap) and the relationship between inflation and unemployment hence, was trivial.

3. Research Methodology

3.1. Methodology

This study adopts the Augmented Dickey-Fuller (ADF) test to check for unit roots and stationarity of inflation and unemployment series. After conducting the ADF test, the appropriate econometric model is selected based on the stationarity of the variables. If both inflation and unemployment are stationary, an Ordinary Least Squares (OLS) regression can be applied to estimate the Phillips curve. However, if the variables are non-stationary but become stationary after first differencing, it is necessary to test for cointegration. In the presence of cointegration, a Vector Error Correction Model (VECM) is adopted to capture both short-run dynamics and the long-run equilibrium relationship. If cointegration is absent, a Vector Autoregressive (VAR) model in first differences is more suitable. Additionally, Granger causality tests can be applied within the VAR/VECM framework to examine the direction of causality between inflation and unemployment.

3.2. Model Estimation

According to Phillips (1958), there is an inverse relationship between unemployment and price inflation. This relationship is specified using the following linear regression model that has been utilized in various studies:

$$\pi_t = \alpha + \beta u_t + \varepsilon_t$$

Where,

π_t= rate of inflation at time t

u_t= rate of unemployment at time t

α = baseline inflation when unemployment is zero

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β = coefficient of unemployment

ε_t= error term

According to this model, inflation is the dependent variable and unemployment is the independent variable. The expected signs include $\beta < 0$, since this is the slope coefficient and a negative slope implies an inverse relationship between inflation and unemployment. Furthermore, $\alpha > 0$ ensures that there is a positive baseline inflation (not deflation) even when unemployment is zero.

3.3. Descriptive Statistics

Descriptive Statistics involves summarizing the basic characteristics of a data set and providing insightful information. It involves using measures of central tendency and spread. Statistics employed in most high-school mathematics courses are used and summarized in table 1.

Table 1: Descriptive Statistics of Inflation and Unemployment

Statistical Measure	Inflation	Unemployment
Mean	7.45588	10.7135
Median	7.7	10.62
Maximum	21.1	12.98
Minimum	2.4	10.39
Standard Deviation	3.51604	0.493901
Variance	12.36253	0.243939
Sum	253.6	364.26
Skewness	1.61039	3.75517
Ex. Kurtosis	4.74155	13.3577

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4. Results

4.1. Unit root test results

An Augmented Dickey-Fuller (ADF) unit root test was conducted to examine the stationarity of the inflation and unemployment rate series from 1991 to 2024. According to (Dickey and Fuller 1979), the Augmented Dickey-Fuller (ADF) test extends the original Dickey-Fuller (DF) test by examining whether a time series has a unit root (i.e., is non-stationary) while accounting for higher-order autocorrelation through the inclusion of lagged differences. The null hypothesis of the ADF test is that the series contains a unit root, whereas the alternative hypothesis is that the series is stationary.

The study utilized Gretl software for the ADF test. The test was applied with both a constant-only model and a constant-plus-trend model, and the results are summarized in Table 2.

For inflation,

H_0 = Inflation has a unit root

H_1 = Inflation has no unit root

The ADF test results indicate that the inflation series is stationary. For the constant-only model, the test statistic is -3.6712 with a p-value of 0.0046, which is below the 1% significance level, providing strong evidence to reject the null hypothesis of a unit root. For the constant-plus-trend model, the test statistic is -3.8698 with a p-value of 0.0133, which is below the 5% significance level, also allowing rejection of the null hypothesis.

Table 2: Augmented Dickey-Fuller (ADF) Unit Root Test Results for Inflation

Variable	Constant only Model	Constant + Trend Model
Estimated (a-1)	-0.604421	-0.665656
Test statistic (τ)	-3.67121	-3.86984
p-value	0.004561	0.01325
Lag(s) included	0	0
1st order Autocorrelation	-0.131	-0.061

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For unemployment,

H_0 = Unemployment has a unit root

H_1 = Unemployment has no unit root

The ADF test results for unemployment reveal that this series is also stationary. For the constant-only model, the test statistic is -3.58738 with a p-value of 0.006037, which is below the 1% significance level, providing strong evidence to reject the null hypothesis of a unit root. For the constant-plus-trend model, the test statistic is -4.62407 with a p-value of 0.0008928, which is also below the 1% significance level, allowing rejection of the null hypothesis.

Table 3: Augmented Dickey-Fuller (ADF) Unit Root Test Results for Unemployment

Variable	Constant only Model	Constant + Trend Model
Estimated (a-1)	-0.5832	-0.991727
Test statistic (τ)	-3.58738	-4.62407
p-value	0.006037	0.0008928
Lag(s) included	0	1
1st order Autocorrelation	0.096	-0.030

4.2. Regression Analysis

Since both inflation and unemployment time series are stationary, we will use the Ordinary Least Squares (OLS) regression method to find the coefficients. OLS is a common method used in econometrics to estimate the parameters of a linear regression model. It minimizes the sum of the squared differences between observed values and the values predicted by the model. By doing such, it can provide efficient estimations under assumptions like linearity. The study uses the Gretl software for the regression analysis.

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Table 4: Regression results of the Phillips curve model

Variables	Coefficient	Std. Error	t-ratio	p-value
α	22.2934	13.2386	1.684	0.1019
u_t	-1.38494	1.23441	-1.122	0.2702
R^2	0.037847			
Adjusted R^2	0.007780			
Durbin-Watson	1.308017			
Std. error of regression	3.502337			

5. Discussion

The OLS regression results are displayed in table 4. It consists of variables α and β of our model, along with other important parameters. The coefficients, standard error, t-ratio (t-statistic) and p-value of α and u_t are given. Coefficient refers to the estimated value of the parameters of our regression model. Standard error is the uncertainty of the estimation of the coefficient. The t-ratio measures how many standard errors the coefficient is away from zero. Lastly, the p-value gives the probability of observing t-ratio if the true coefficient were zero.

Firstly, it can be observed that the value of coefficient of unemployment (β) is negative (β = -1.385), which aligns with the inverse relationship that the Phillips curve mentions about. This means that a 1% increase in unemployment reduces the inflation by 1.385%. However, the p-value is 0.2702 and is not statistically significant and the model explains only a very small portion of variation in inflation (R^2 = 0.038). The low explanatory power suggests that unemployment alone is insufficient to capture inflation dynamics in Nepal for the period 1991–2024. Additionally, the Durbin-Watson statistic of 1.31 indicates some positive autocorrelation in the residuals, implying that past inflationary shocks or trends may influence current inflation, which the simple linear model does not account for.

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Beyond unemployment, inflation is likely affected by multiple other factors, including supply shocks, fluctuations in food and energy prices, exchange rate movements, monetary policy, and structural changes in the economy. The presence of these omitted factors can weaken the observed relationship between unemployment and inflation. Furthermore, the expectations-augmented Phillips curve suggests that when agents anticipate inflation, wage and price adjustments reduce the trade-off between inflation and unemployment, leading to the concept of the Natural Rate of Unemployment (NRU). This may help explain why the regression slope is negative but statistically insignificant—Nepal may have been operating near its NRU during the sample period, or inflation expectations may have dampened the short-run effect of unemployment on inflation.

6. Conclusion

The analysis indicates that the empirical evidence for the existence of the original Phillips curve in Nepal from 1991-2024 is weak. It was an expected result given the stagnant unemployment rates throughout the decades despite volatile inflation rates. The low explanatory power of unemployment in determining inflation suggests that policymakers cannot use demand-side policies to counter unemployment. Factors including supply-shocks, expectations of inflation in labors and other structural changes must be studied to understand why unemployment has been high for decades.

It is also important to be aware of the limitations while collecting unemployment data. It can be difficult to distinguish if a person is in the labor force or not. Moreover, people who are seasonally employed or underemployed may express themselves as fully employed, leading to an underestimation of true unemployment levels. Informal employment, common in developing economies like Nepal, further complicates measurement, as many workers are not captured in official surveys. These limitations can affect the accuracy of analyses such as the Phillips curve, where precise measurement of unemployment is critical to understanding its relationship with inflation. Similarly, the basket of goods of the CPI might change year after year, making analysts unsure of the kind of inflation and the group of people who suffer the most.

Concluding, the tools of monetary policies are recommended to stabilize inflation and inflation expectations through credible policies from the Central Bank of Nepal (Nepal Rastra Bank). Moreover, supply-side interventionist and free market policies could be beneficial in reducing the natural rate of unemployment. From the empirical evidence it could be argued that the high rate of persistent unemployment is not because of cyclical (Keynesian) unemployment but due to lack of skills of the manpower, as well as supply-side constraints. This includes structural employment and frictional employment. Nepal should focus on increasing its potential output by investing in tourism, agriculture and hydropower to develop a comparative advantage. The

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nation will also be benefitted from foreign direct investment (FDI). Incentive based policies like providing subsidies to private firms, privatizing and restarting defunct industries will also be helpful. Finally, by improving the quality of education and mobilizing the transition of graduates into the labor market, Nepal has the potential to lower its unemployment rate.

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