



Relationship between Unemployment Rate and Economic Growth in Nepal: An Econometric Estimation

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ABSTRACT

Economic growth and employment are taken as the two major objectives of macroeconomic policy schema in both the developing as well as developed countries. This study aims to determine the relationship between the unemployment rate and GDP growth rate of Nepal using the time-series data from 1991-2020. Difference version approach, dynamic version approach and Granger causality test were used to study the relationship between the macroeconomic variables. The difference version and dynamic version approach showed non-significant results for the regression of unemployment rate on economic growth rate which implies that the unemployment rate is not significantly affected by the economic growth rate of Nepal. The Okun's coefficient in the difference version was -0.057 and in the dynamic version approach it was -0.058. Thus, the Okun's law doesn't seem to hold in case of Nepal's economy. The Granger causality test also revealed that the change in the unemployment rate is not a predictive variable of the GDP growth rate and vice versa. The non-significant relationship between the macroeconomic variables might thus be affected by other factors. Thus, it can be suggested to the government and policymakers to recuperate the ways of solving the unemployment by formulating economic policies that are more directed towards structural and labor market transformation. Tax reduction policy, increase in government spending, skill enhancement programs and youth employment subsidy can also be suggested.

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Introduction

Unemployment and poor economic growth rate are one of the burning issues in today's world among the major economic problems (Kori Yahia, 2010). The escalating number of unemployed people is a highly debated issue around the globe, even in the developed countries. Since they provide a clear image of a country's economic development, the two macroeconomic variables i.e., economic growth/ Gross Domestic Product (GDP) growth and unemployment are taken as the two major objectives of macroeconomic policy schema in both the developing as well as developed countries (Clement, 2018; Dahal and Rai, 2019).

Unemployment, with its economic and social effects is one of the most irresistible constraints faced by Nepalese policy makers (Sharma, 2019). The high rates of unemployment lead to a deficit in the labor market, intensifying the poverty incidence and poor standards of living (World Bank, 2012; Chowdhury and Hossain, 2014). Furthermore, the workers' remittance has been a customary phenomenon of Nepalese economy for almost

20 years. The accessible data show that the remittances inflows is about 30 percent of Nepal's gross domestic products (GDP), on average, with some variations (Paudel and Bhusal, 2021). Remarkably, the inflows of remittances have increased since 2002 and it has become an indispensable part of national economy revealing the fact that a large portion of youths are employed in foreign countries due to unemployment in Nepal (Paudel and Bhusal, 2021). To address the paucity of employment, the Government of Nepal has emphasized employment generation in its different plans, policies and programs viz Karnali One Family One Employment Program (2006), Youth Self-employment Program (2008) and Prime Minister Employment Program (2019), etc. Although huge investments have been made and such ambitious programs had been introduced, the current GDP growth rate and unemployment rate of Nepal are -2.088% and 4.44%, respectively (Figure 1). These figures reveal the significance of the unemployment problem in Nepal.

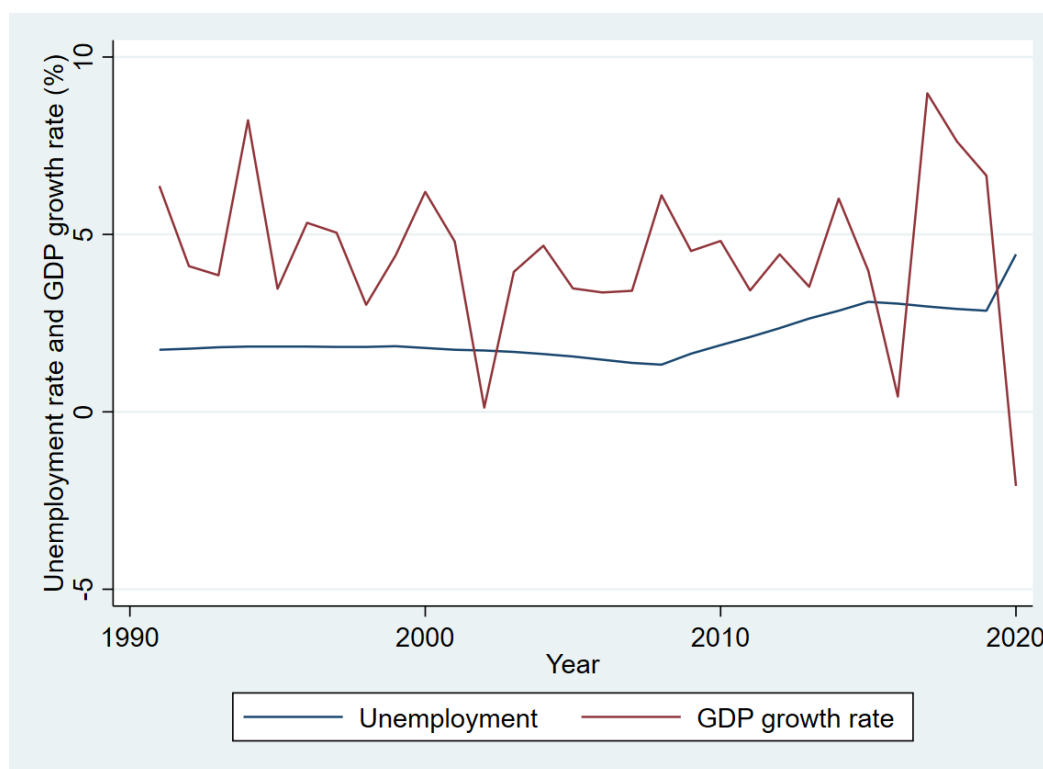


Figure 1. Unemployment and GDP growth rate in Nepal (1991-2020),
Source: Authors compilation from World Bank (2021)

Despite the social and economic impacts associated with the high unemployment rate, some additional concerns remain unsettled like -- Does the size of unemployment follow an autonomous route independent from other macroeconomic variables? It is a widely accepted view in economics that a higher GDP growth rate increases employment (Suleiman et al., 2017; Dahal and Rai, 2019). This theoretical proposal is popularly referred to as 'Okun's Law'. It is considered one of the pronounced relationships in the macroeconomics theory and has been found to be true in case of several countries and some regions, primarily developed countries (Thaba et al., 2020). Although Okun (1962) proposed that there exists a negative relationship between GDP growth rate and unemployment rate, the answer to these questions is related to the econometric estimation of the relationship between GDP growth rate and unemployment rate. Some studies in the past have determined the simple relationship using correlation and linear regression between the two macroeconomic variables, but our study goes beyond that with the assessment of short- and long-term relationship of the variables using difference and dynamic version approach along with the estimation of causality between the variables.

Thus, an econometric estimation of the relationship between the variables will permit analysts to conduct appropriate policies so as to curb the unemployment and ensure a sustainable growth in the country. Furthermore, the countries like Nepal have different economic environments than the advanced and emerging economies. Hence, the difference in logic of their labor market makes it important to determine whether or not the Okun's law applies in the context of Nepal.

Literature Review

Various studies have been done on the determination of relationship between economic growth and unemployment in different countries using diverse approaches and methods. Ozturk and Aktar (2009) used the Variance Decomposition and Impulse response function analysis and reported that GDP is not associated with unemployment rate in Turkey. However, Tunah (2010) used the ADF test followed by Granger causality test for determination of factors affecting unemployment and he reported a significant relationship between unemployment growth and GDP. Kreishan (2011) estimated the linkage between unemployment and economic growth in Jordan using Okun's law and reported that the Okun's law cannot be confirmed in the case of Jordan. Similarly, Mosikari (2013) reported a non-significant relationship between unemployment and GDP in South Africa. Phiri's (2014) study of Southern African countries economy, covering the 2000–2013 period, revealed a non-linear equilibrium between economic growth and unemployment. A momentum threshold autoregressive model was used for this purpose. Padder and Mathavan (2021) in their study on Indian economy from 1990-2020, reported a non-significant relation between GDP and unemployment growth along with absence of Granger causality between the variables. Thaba et al. (2020) also reported similar results in their studies of South Africa's economy.

Ting and Ling (2011) aimed to validate the Okun's relationship in the case of Malaysia's economy using the first difference and gap model and found a significant relationship between GDP and unemployment. Similarly, Anderton et al. (2014) determined the Okun relationship for various GDP components of 17 Eurozone countries.

The results of panel regression showed that unemployment is linked to GDP. Furthermore, Apap and Gravino (2014) used a regression analysis and found a significant negative relationship between output and unemployment. Based on the assessment of Banda (2016), a positive relationship between GDP and unemployment was observed in South Africa. Hjazeen et al. (2021), using the Autoregressive distributed lag approach, determined a significant relationship between the two macroeconomic variables in the economy of Jordan.

The evidence from multi-country studies by Pizzo (2019) revealed that there has been concerns in quantifying the relation between GDP and unemployment in the last years. The study reviewed the findings in developed and developing countries and revealed that the Okun's coefficient seems to be generally higher in developed economies, i.e., output would have a stronger effect on unemployment in developed economies with respect to developing ones. Moreover, Okun's coefficients are more precisely estimated for developed than developing countries (Pizzo, 2019). For example, according to Ball et al. (2016), the average Okun's coefficient of -0.2 was observed for the developing countries while the developed countries had the value of -0.4. The R^2 value usually ranges between 0.2 and 0.3 for the developing countries, being about a half of the developed economies (Ball et al., 2016).

Farole et al. (2017) and Bartolucci et al. (2018) distinguished different countries in terms of their GDP per capita and they reported that unemployment seems to be more responsive to GDP in rich economies. Similarly, An et al. (2017) consider the unemployment rate figures as unreliable in the developing countries. Furthermore, Lal et al. (2010), determined the Okun's coefficient, and checked the validity of Okun's law in some Asian countries using the time series data from 1980-2006 in which the empirical evidences revealed that Okun's law interpretation may not be applicable and valid in some Asian developing countries.

Ball et al. (2016) analyzes some explanatory variables, such as business and labor market adjustment, the contribution of services to GDP, the size of the shadow economy and a skill mismatch index as the elements of the unemployment rate. An et al. (2017) consider the poverty rate, the informality rate, as well as business regulation and the structural unemployment as the potential explanatory variables for unemployment rate.

Materials and Methods

Data Collection

In our study, we used the time-series data for GDP growth and unemployment rate from 1991 to 2020 (30 years data). The total number of observations is hence 30. The variables associated with the econometric estimation of the relationship between the economic growth rate and unemployment rate was obtained from the World Bank open data.

Analytical Model

As mentioned earlier, Okun's law (1962) was the first to address the relationship between the output/GDP growth rate and the unemployment rate. Okun proposed that to reduce 1% rate of unemployment, U.S. economy should increase GDP by nearly 3% (Okun, 1970; Elshamy, 2013), taking into account the period from 1947 to 1960. The

author developed two distinct models to study the relationship between the variables – the difference version and the dynamic version. In our study, we use both of these models to analyze Nepal's economy. For this purpose, the time-series data were made stationary by suitable differentiation with the help of Augmented Dicky Fuller (ADF) test for the purpose of using the analytical model.

The Difference Version Approach

The difference version model given by Okun (1962) was used to study the relation between unemployment rate and economic growth rate, which can be expressed empirically as:

$$\begin{aligned} (\text{UNEMP}_t - \text{UNEMP}_{t-1}) &= \alpha + \beta (\text{GDP}_t - \text{GDP}_{t-1}) + \varepsilon_t \\ \Delta \text{UNEMP}_t &= \alpha + \beta \Delta \text{GDP}_t + \varepsilon_t \end{aligned} \quad (1)$$

Where,

ΔUNEMP_t = unemployment rate in the t period

ΔGDP_t = GDP growth in the t period

ε_t = Error term in the t period

In simple words, this version refers to the regression of unemployment rate on GDP growth. The coefficient of regression, β refers to the 'Okun's coefficient'. The coefficient gives the rate of change in the unemployment rate due to the GDP growth rate i.e., the real output. Okun proposed the negative relation between the GDP growth and unemployment which implies that if β is not negative then it implies that the study opposes the Okun's rule or if the value is negative then there is a relationship between the GDP growth and unemployment as proposed by Okun. The estimated elasticity gives a measure of the relationship among the variables i.e., a low coefficient implies poor correlation between them while high estimate of the slope coefficient indicates an existence of the relationship in par with Okun's law.

The Dynamic Version Approach

Okun (1962) came with a new approach after he realized the shortcomings of the difference version as the model failed to address the past output levels, which plays a strong role in affecting the current unemployment rate i.e., the lags of the variables weren't addressed. In this light, the dynamic version was brought by him, which includes both the current and past GDP growth as the independent variable thus accounting for the variation in the current unemployment rate (Knotek, 2007). The empirical representation of the dynamic approach is shown below:

$$\begin{aligned} \Delta \text{UNEMP}_t &= \alpha + \beta_1 \Delta \text{GDP}_t + \beta_2 \Delta \text{GDP}_{t-1} + \beta_3 \\ \Delta \text{UNEMP}_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

Where,

ΔGDP_{t-1} = first lag of GDP growth

$\Delta \text{UNEMP}_{t-1}$ = first lag of unemployment rate

In this case, UNEMP_t and GDP_t denote the unemployment rate and GDP growth, respectively, and in the dynamic version, there are two lags one for the GDP growth and the other for the unemployment rate, which are the predictor variables for the variation brought in the current unemployment rate (Knotek, 2007).

Causality Test

A simple Granger causality model was used to further determine the relationship between the unemployment rate and economic growth of Nepal. However, it should be notable to state that the word ‘causality’ in the term ‘Granger Causality’ doesn’t necessarily refer to movement in one variable leads to a movement in the other, but rather the word implies a chronological ordering of movements of the series (Brooks, 2019).

$$UNEMP_t = \alpha_0 + \sum_{i=1}^n \alpha_i UNEMP_{t-i} + \sum_{j=1}^n \beta_j GDP_{t-j} + \mu_{1t} \quad (3)$$

$$GDP_t = \lambda_0 + \sum_{i=1}^n \lambda_i UNEMP_{t-i} + \sum_{j=1}^n \delta_j GDP_{t-j} + \mu_{2t} \quad (4)$$

It is assumed that the disturbances μ_{1t} and μ_{2t} are uncorrelated in the above equations. Equation (3) and (4) implies that the dependent variables $UNEMP_t$ and GDP_t are determined by the lagged variables of $UNEMP_t$ and GDP_t in both equations, respectively. It is assumed that GDP_t and $UNEMP_t$ are made stationary before running the causality test. The terms μ_{1t} , μ_{2t} are the disturbances which satisfy the regularity assumptions of linear regression, and ‘n’ represent the number of optimal lags. Furthermore, $UNEMP_t$ does not determine GDP_t if $\beta_j = 0$ in (3), for any $i = 1, 2, \dots, n$. In other words, the past values of $UNEMP_t$ do not provide any additional information on GDP_t performance (Thaba et al., 2020). The test provides the direction of the relationship among the variables i.e., bi-directional, unidirectional feedback or if there is no causation between the two variables (Suleiman et al., 2017). STATA Version 16.0 was used for the purpose of data analysis.

Results and Discussion

Descriptive Statistics

Table 1 below shows the descriptive statistics of the time series data. The average unemployment rate and output growth were 2.12% and 4.41%, respectively. The extreme values of both the variables are close to the mean, depicting very little spread i.e., low variation of data. It can be further confirmed by the low value of standard deviations. Thus, it can be asserted that there doesn’t exist any kind of high magnitude variations in the macroeconomic variables examined.

Unit Root Test and Test for Autocorrelation

Augmented Dicky Fuller (ADF) test was used to determine the stationarity property of the time series data. The null hypothesis of the ADF test is that the data is not stationary and if we are able to reject the null hypothesis i.e., the ADF test is significant, we conclude that the data is stationary.

In our study, the GDP growth rate was statistically significant at 1% for the test of stationarity (Figure 2) and thus there was no need for further differentiation while the unemployment rate showed non-significant results upon ADF test. Upon fourth differentiation, the unemployment rate was significant at 1% and hence showed stationarity (Table 2).

Ljung-Box test was used to determine the presence of autocorrelation in the time-series data. The results of the test (Q-statistic) for autocorrelation and partial autocorrelation of GDP growth rate and unemployment rate are shown in Table 3 and 4, respectively. The results

show the absence of autocorrelation and partial autocorrelation in the time-series data as the Q statistic shows non-significant results ($p > 0.05$) for any of the lags for both the variables.

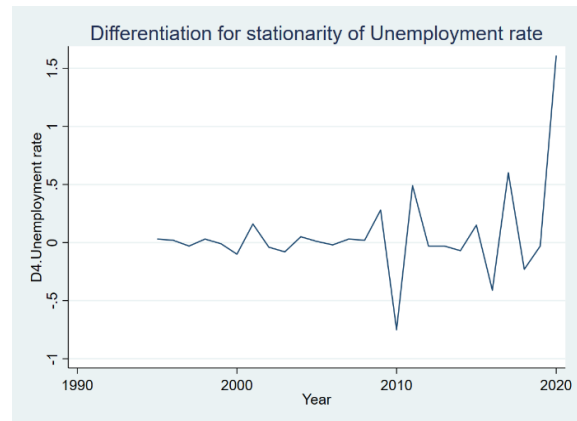
Our time series data are in conformity with ADF test for stationarity and Ljung-Box test for absence of autocorrelation or the presence of white-noise in the time series data making it liable for using the analytical models.

The Difference Version Approach

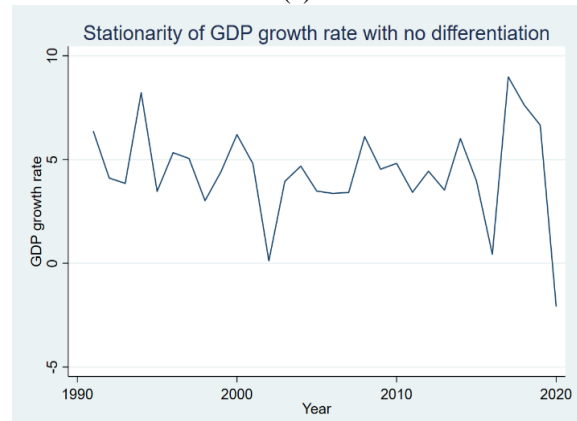
The econometric estimation from the difference version approach for studying the relationship of GDP growth and unemployment rate is presented in Table 5 below. From the perusal of table 5, it can be seen that the coefficient of regression is negative, in line with the Okun’s law. The coefficient, also known as Okun’s coefficient was observed to be -0.057 but it was statistically non-significant at 5%. This implies that the difference version showed no significant relationship between the variables. In other words, the Okun’s law is not applicable in case of Nepal’s economy.

Table 1. Descriptive statistics of the time-series data

Properties	Unemployment rate (Y)	Output/GDP (X)
Mean	2.12	4.41
Maximum	4.44	8.97
Minimum	1.33	-2.08
Standard Deviation	0.68	2.27



(a)



(b)

Figure 2. Stationarity of (a) Unemployment rate (4th differentiation) and (b) GDP growth rate (No differentiation)

Table 2. ADF test for GDP growth rate (no-differentiation) and unemployment rate after 4th differentiation

Variables	Test statistic Z(t)	1% Critical Value	5% Critical Value	10% Critical Value
Unemployment rate	-5.814***	-4.380	-3.600	-3.240
GDP growth rate	-5.209***	-3.723	-2.989	-2.625

MacKinnon approximate p-value for Z(t) = 0.0000

Note: ***,** and * represent significant at 1%, 5% and 10% level of significance, respectively and NS = non-significant, Source: Own elaboration

Table 3. Ljung-Box test for autocorrelation and partial autocorrelation in GDP growth rate

Lag	AC	PAC	Q	Prob>Q
1	-0.1189	-0.1637	0.46797	0.4939
2	-0.2827	-0.4202	3.2074	0.2012
3	-0.1328	-0.3267	3.8346	0.2799
4	0.220	0.1963	5.6222	0.2292
5	0.0482	0.2302	5.7113	0.3353
6	-0.1335	-0.0863	6.4246	0.3773
7	0.0219	0.0152	6.447	0.4889
8	-0.1432	-0.6227	7.3397	0.5005
9	0.1764	0.4105	8.762	0.4595
10	0.0295	-0.0413	8.8039	0.5508
11	-0.0741	0.0180	9.081	0.6144
12	-0.2096	-0.7373	11.423	0.4931
13	0.0194	-0.4009	11.44	0.5737

Table 4. Ljung-Box test for autocorrelation and partial autocorrelation in unemployment rate

Lag	AC	PAC	Q	Prob>Q
1	-0.2751	-0.7172	2.2036	0.1377
2	-0.0164	-0.9984	2.2117	0.3309
3	0.2156	0.4749	3.6832	0.2978
4	-0.1266	0.1038	4.2132	0.3779
5	-0.0343	-0.1925	4.2541	0.5134
6	0.1167	0.5213	4.7496	0.5763
7	-0.1682	-0.1779	5.8329	0.5594
8	0.0675	-0.0649	6.0174	0.6453
9	0.1330	2.1244	6.7749	0.6605
10	-0.2619	-4.3236	9.8951	0.4497
11	0.0841	-0.0166	10.238	0.5091

Table 5. Regression output of the difference version

Variables	Coefficient	Std. Error	t-statistic	P> t
Const.	0.3049	0.1623	1.88	0.073
GDP	-0.057	0.0339	-1.68 ^{NS}	0.105
Number of obs.	26			
R-squared	0.1056			
Adjusted R-squared	0.0684			
F-statistics	2.83			
Prob (F-statistic)	0.1052			
Durbin-Watson stat	2.21			

Note: ***,** and * represent significant at 1%, 5% and 10% level of significance, respectively and NS = non-significant, Source: Own elaboration

The Dynamic Version Approach

From the perusal of Table 6, it can be observed that the coefficients of GDP growth rate (GDP) and lagged GDP growth rate (DL1.GDP) are statistically non-significant at 5% while the lagged unemployment rate (DL1.Unemployment) is statistically significant at 5%. This implies that, 1 unit increase in the unemployment rate in time 't-1' decreases the economic growth rate in time 't' by 0.802 units. The dynamic model is able to explain only 34.3% of the variation in the unemployment rate due to the variation in the GDP growth rate and the lagged variables.

Causality Test

With the purpose to determine any possible causal links between the unemployment rate and GDP growth, the Granger causality test was used. The test is useful for statistical detection of the presence of any cause effect interaction between the variables considered. The results of the Granger causality test are shown in Table 7 below.

From the perusal of Table 6, it can be observed that both the null hypothesis couldn't be rejected at 5% level of significance. This means that there is no existence of feedback between the variables or there is absence of causality between the unemployment rate and the GDP

growth rate. So, the study concluded that the change in the unemployment rate is not a predictive variable of the GDP growth rate and vice versa.

Similar results have been reported by Ozturk and Akhtar (2009) in their study in Turkey where they found GDP is not associated with unemployment rate. However, Tunah (2010) used the ADF test followed by Granger causality test for determination of factors affecting unemployment and he reported a significant relationship between unemployment growth and GDP. Kreishan (2011) estimated the relationship between unemployment and output in Jordan and reported that the Okun's law doesn't hold in case of Jordan. Similarly, Mosikari (2013) reported a non-significant relationship between unemployment and GDP in South Africa. Phiri's (2014) study of Southern African countries economy, covering the 2000–2013 period, revealed a non-linear equilibrium between economic growth and unemployment. Padder and Mathavan (2021) in their study on Indian economy from 1990-2020, reported a non-significant relation between GDP and unemployment growth along with absence of causality between the variables. Thaba et al. (2020) also reported similar results in their studies of South Africa's economy. Farole et al. (2017) and Bartolucci et al. (2018) reported that unemployment seems to be more reactive to GDP in case of rich economies. Similarly, An et al. (2017) consider the unemployment rate statistics as unreliable in the developing countries. Furthermore, Lal et al. (2010) determined the validity of Okun's law in some Asian countries and reported that the Okun's law interpretation may not be germane in some Asian developing countries.

In contrast with our results, Ting and Ling (2011), in their study of Malaysia's economy using the first difference and gap model, found a significant relationship between GDP and unemployment. Similarly, Anderton et al. (2014) determined the Okun's law for various GDP components of 17 Eurozone countries and reported that unemployment is receptive to the GDP. Apap and Gravino (2014) also revealed that there was a significant negative relationship between output and unemployment. Hjazeen et al. (2021) also reported a significant linkage between

GDP and unemployment rate in the economy of Jordan. Furthermore, Banda (2016) estimated that the unemployment and economic growth in South Africa has a positive relationship. The evidence from multi-country studies by Pizzo (2019) revealed that the Okun's coefficient seems to be generally greater in economies of developed nations, i.e., GDP would have a higher impact on unemployment in developed economies with respect to developing ones. Moreover, Okun's coefficients are more precisely estimated for developed than developing countries (Pizzo, 2019). Furthermore, according to Ball et al. (2016), the average Okun's coefficient of -0.2 was observed for the developing countries while the developed countries had the value of -0.4. The R² value normally ranges between 0.2 and 0.3 for the developing countries, being about 0.5 times to that in the economies of developed nations (Ball et al., 2016).

The approaches used in our study showed that there is a non-significant relationship between the variables thus resisting any link between the GDP growth rate and unemployment rate of Nepal. Furthermore, the causality test validated the absence of any short-run causality connecting the GDP growth to the unemployment rate. This implies that the unemployment rate changes cannot be solely explained by the GDP growth variation, but rather other factors play a part in its determination. There might be some potential explanatory variables, such as business and labor market adjustment, the share of services in GDP, the size of the shadow economy, as well as a skill mismatch index that ascertain the unemployment rate (Ball et al., 2016). Furthermore, the poverty rate, the informality rate, as well as business regulation and the structural unemployment are also considered to be some impending explanatory variables for the unemployment rate (An et al., 2017). The relocation of people from rural to urban leading to increased labor force supply, social aspects like debasing social status, geographical fixity, population growth, and flawed education system, unexperienced, occupational unfit, and disease and disability might also be responsible factors for the unemployment rate (Chand et al., 2018).

Table 6. Regression output of the dynamic version

Variables	Coefficient	Std. Error	t-statistic	P> t
GDP	-0.058	0.031	-1.86 ^{NS}	0.077
DL1.GDP	0.035	0.039	0.91 ^{NS}	0.375
DL1.Unemployment	-0.802	0.293	-2.73 ^{**}	0.012
Const.	0.157	0.240	0.65	0.522
Number of obs.	25			
R-squared	0.3430			
Adjusted R-squared	0.2492			
F-statistics	3.66			
Prob (F-statistic)	0.0290			
Durbin-Watson stat	1.99			

Note: ****, ***, and ** represent significant at 1%, 5% and 10% level of significance, respectively and NS = non-significant, Source: Own elaboration

Table 7. Granger Causality test between unemployment rate and GDP growth rate

Null Hypothesis	Observations	Lags	F-statistic	Prob.
GDP doesn't impact UNEMP	30	2	1.791 ^{NS}	0.193
UNEMP doesn't impact GDP			0.969 ^{NS}	0.397

Note: ****, ***, and ** represent significant at 1%, 5% and 10% level of significance, respectively and NS = non-significant, Source: Own elaboration

Based on the results of our study, it can be suggested that the government and policymakers should devise economic policies that are more directed towards structural changes and labor market transformation to augment the existing policies. This is because unemployment is a major hindrance to the social development and results in wastage of the efficient manpower in which the government has financed. Other policies that the government can consider to reduce unemployment include a tax reduction. Furthermore, the government should invest in the educational sector as it creates employment in the long run and also developing the infrastructure in unison could be vital in solving the unemployment. Nepal also faces a major problem of structural unemployment. To increase the employment opportunities, the government should embark skill development programs to abolish structural unemployment. Other policies that could be adopted include employment subsidies and a reduction of trade union powers. Nonetheless, introducing youth employment subsidy can be a step in the right direction to help increase employment.

Conclusion

The study aimed to determine the empirical relation between the economic growth rate and the unemployment rate. We used the difference version and dynamic version approach, both of which showed non-significant results implying the inability of economic growth rate to define the change in unemployment rate. The Okun's coefficient in the difference version was -0.057 and in the dynamic version approach it was -0.058. Furthermore, Granger causality test also showed the absence of causal relationship between the variables. This implies that, there is not enough evidence from the study to provide a link between the variables and the unemployment rate is thus affected by other factors. It can be suggested to the government and policymakers to improve the ways of dealing with unemployment problems by employing economic policies that are more oriented towards structural changes and labor market transformation to supplement the existing policies. Furthermore, tax reduction policy, increase in government spending, skill development programs and youth employment subsidies can be suggested.

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