Output and Unemployment Dynamics: Okun’s Coefficient for Pakistan

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Abstract: The major aim of the paper is to trace out the evidence about the possible affiliation between level of unemployment and growth rate of output which was proposed empirically by Arthur Okun in early sixties. To perform this multivariate time series data has utilized ranges the period from 1972 to 2016 of Pakistan. To access the association and to quantify the magnitude of relationship ARDL, Bound test approach utilized. To check the order of integration Philips perron (PP) and ADF (Augmented Dicky Fuller) test applied. Paper confirmed the existence of inverse affiliation between level of unemployment and growth of output in Pakistan. The intensity of association is very low, suggests that the political unrests and lack of attention of policy makers toward factor markets hampers the employment creation effect of growth of output. To check the pattern of association Granger causality test uses that prescribed the existence of unidirectional affiliation through unemployment to growth rate of output in Pakistan.

Keywords: Growth rate of output, level of unemployment, Okun’s Law; ARDL

I. INTRODUCTION

Both Developed and developing countries are thirsted to attain economic growth and sustainable development with lower unemployment and inflation rates. As far as growth experiences are concerned Pakistan has faced numerous ups and downs in previous eras. Growth of output can be explained within ‘the increase in real output of goods and services produced within the boundary line of the country’. Growth rate of output attached with maximum utilization of country’s existing resources that depends upon the maximum employment of factors of production. Simply it is implied that hiring more labor with given capital cause to increase output over time ends with economic growth showing the favorable association between output and employment level of the country. By using this information policy makers can quantify the affiliation between unemployment and growth rate of output by taking different economies and group of countries with different type of data and method of estimation that first proposed by Arthur Okun in 1962. This proposed association between unemployment and output motivated the researcher to draw the inferences about proposed relationship in different countries and group of countries.

Theoretically the output and unemployment association is sound because initial theories were not pay attention toward unemployment while describing economic growth. As classical economists considered the ‘rigidities of labor market’ that cause unemployment while Keynesians pointed out the reason for unemployment that is ‘lack of effective demand for goods and services’. The idea of no long run association between unemployment and growth (Blanchard,1997) was provides the base for endogenous growth theory. Economic growth brings structural changes that caused structural unemployment in the economy (Romer, 1998; Hanif and Shao; 2018).

Changes in output associated negatively with the changes in unemployment. The affiliation first time proposed by Arthur Okun in (1962) namely known as Okun’s law. However, it is not necessary to hold this law true and valid for every country of the world, the results disagree from country to country. Okun proposed that “one percent change in output brings three percent change in level of unemployment”. Opposing to the findings of Arthur Okun Samuelson and Nordhaus (1995) observed by applying modern technique of estimation that “one percent change in output brings only two percent change in level of unemployment”.

1.1 Objective of the study

This paper design to check the direction and magnitude of association between unemployment and output in Pakistan that was proposed by Arthur Okun in sixties. As Arthur Okun suggested that growth of output affects negatively the level of unemployment.

II. REVIEW OF EMPIRICAL LITERATURE

At earlier study presented by Arthur Okun who proposed that three percent change in unemployment attached with one percent change in output. But in modern time most of empirical work done by a lot of researchers claimed that now Okun’s coefficient can assume value other than three it may be less or more than the magnitude proposed by Arthur Okun.
(1962). With applying different technique and method numerous empirical work has been done to find out the evidences in favor or against of Okun’s law for different countries of the world during different time.

Some studies designed to check the validity of Okun’s law by considering the single country of the world. These are Freeman, Lee (2000), Sogner (2001), Christopoulos (2004), MarkinKov and Geldonhuys, Turturean and Lonel, and Knotek (2007; Hanif and Irshad; 2018), Villaverde and Maza (2008), Mitchel and Pearce (2010) and Faridi et al. (2014). They confirmed the pattern of affiliation between unemployment rate and output growth that was proposed by Arthur Okun. Further, the empirical evidences regarding the intensity of affiliation could not support that was confirmed by A. Okun (1962). To account the structural changes that may cause to bring structural breaks in output and unemployment association. As Lee (2000) pointed out these structural breaks in Okun’s relationship accompanied with the increased women participation in labor force that may cause to reduce the level of wages and productivity. By constructing the cointegration framework for Greece Christopoulos (2004) and Hanif and Gul (2016) checked to provide the evidences in favor or against of Oku’s law. For these thirteen sections of Greece economy were selected to estimate the Okun’s relationship. Applicability of the law was proved for five selected areas by adopting panel cointegration analysis. By using quarterly data for the same economy Sogner (2001) estimated the magnitude of association between unemployment and growth rate of output. It was extracted that a percent change in unemployment brings 4.16 % change in level of output in the selected region.

Some empirical work done earlier account about the short comings of Okun’s relationship. This work has been done by Blinder and Altig et al. (1997) and Lee (2000). It was pointed out that the Okun’s law failed to show the trends in output with the passage of time. He was of the view that it was the inconsistency of the law related with the model predictions and recommendations about the direction of output. It is factor (labor) utilization that can alter the level of output of an economy. They further prescribed that usefulness of the law for forecasting purposes conditioned with the existence of stable relationship between Okun’s variables (Altig et al. 1997).

Some studies design to check the effect of trade cycles on the existence of Okun’s relationship. Knotek (2007) established the relationship between current unemployment and output with past level of output and rate of unemployment in different economic situation. He was of the view that economic status has no prominent effect of output and unemployment association in both short run and long run. In the same way Thirwal (1966), Hanif at al., (2016) and Martin (1997) attached the regional unemployment with trade cycles. It was tried to extract that how business cycles accounts for regional unemployment in the economy. By adopting simple regression analysis Mohlo (1995) and Hanif and Shao, (2018) established the affiliation between unemployment and regional disparities. By utilizing different proxies for measurement, it was observed that significant affiliation exists between industry variable and regional disparities. Further it was evaluated that which factors account for unemployment. He reported that institutions could play their vital role to reduce the level of unemployment. Using the same line Owyang and Sekhposyan (2012) found the linkage between business cycles and Okun’s coefficient for American economy. The strong affiliation of business cycles was observed on Okun’s relationship. It was extracted that in the time of recession rate of unemployment reported to be very high in the US economy.

time series data ranges from 1974-2014 for Pakistan economy Faridi et al. (2015) proposed an empirical study to account the evidences in favor or against of what was presented by Arthur Okun in early sixties. Results of Autoregressive Distributed Lag (ARDL) Bound testing approach confirmed the existence of indirect affiliation between unemployment and level of output. Khalig et al. (2014) adopted the group of nine Arab countries to estimate the Okun’s coefficient for these nations. The results of Engel Granger least square reported the evidences in favor of Okun’s law. But the low intensity was observed among Okun’s variables, reason was reported by them that it was less attention towards professional education that depress the employment strategies.

Some studies provided the contradictory results in relation with Okun’s affiliation (Bankole and Fetai (2013), Pierdzioch et al. (2009) among others). By constructing the Engel Granger cointegration test for Nigerian economy Bankole and Fetai (2013) extracted the affiliation between Okun’s parameters and to find out the intensity of affiliation. Results for the period from 1980 to 2008 reports against the Okun’s law. Similarly, by taking the G7 countries including the Nigerian economyPierdzioch et al. (2009) check the validity of Okun’s law for selected nations. Results of the study reported that the existence of inverse affiliation between structural changes and level of unemployment. Further they tried to account for the failure of Okun’s law in Nigerian economy. They confirmed the existence of contradictory results of Okun’s law for Nigerian economy.Moreover, by pointed out that growth of output has very little influence on the level of employment Mitchel and Pearce (2010) established the affiliation between growth of output and unemployment. Results contradicts the strength of association that was first point out by Arthur Okun in early sixties.

Two-way affiliation was observed between rate of unemployment and growth rate of output (Irfan et al. (2010) and Turturean and Lonel (2007) among many). By using error correction and Granger causality test for Asian countries Irfan et al. (2010) estimated affiliation between unemployment and output over the period from 1980 to 2006. By taking the Romanian economy Turturean and Lonel (2007) checked the possible affiliation between Okun’s variables for the period of 1993 to 2004. Results of both studies not only account the
evidence in favor of Okun’s law but also prescribed the existence of bidirectional affiliation between these two.

To sum up the above empirical work done unemployment and output can be noted that the main variables under consideration in these studies. So, for different sample period concept of Okun’s law (Versions of law) can be utilized to check the applicability of Okun’s law and to quantify the intensity of affiliation to the empirical data of the country or the group of countries.

III. RESEARCH METHODOLOGY

In order to establish the relationship between output and unemployment or to check the applicability of Okun’s law annual multivariate data of unemployment and gross domestic product (GDP) have selected for the period from 1972 to 2016. The data for unemployment and GDP were extracted from “economic survey of Pakistan” and “Labor Force survey of Pakistan”.

3.1 The Model

Following the earlier empirical work done the main and prominent variables of the model are gross domestic product and level of unemployment. To improve the efficiency of results variables are taken in the form of logarithm so that they could be interpreted as growth rate after taking their first difference. The unit of measurement of the variables is in millions. Following equation establish the relationship between the level of output and unemployment.

\[ l_{GDP} = \beta_1 + \beta_2 l_{UNEMP} + \epsilon \]

Here \( l_{GDP} \) and \( l_{UNEMP} \) represents the ‘natural logarithm of gross domestic product’ and level of unemployment respectively. Both are measure in millions. While \( \epsilon \) is random stochastic term.

IV. RESULTS AND DISCUSSION

To check the order and stationarity of the multivariate annual data series PP (Philsps Perron) and ADF (Augmented Dicky Fuller) tests are utilized. Results of the test are given in the following table.

Table 1: Stationary properties of the variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>UNIT ROOT TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AUGMENTED DICKY FULLER (ADF)</td>
</tr>
<tr>
<td></td>
<td>T-statistics</td>
</tr>
<tr>
<td>( l_{GDP} )</td>
<td>-5.24</td>
</tr>
<tr>
<td>( l_{UNEMP} )</td>
<td>-3.73</td>
</tr>
</tbody>
</table>

Results of both the tests (ADF and PP) reported that gross domestic product is non-stationary at their level including the both intercept only’ and trend and intercept, it becomes stationary after taking the difference (I (1)). While the level of unemployment is stationary provided by both test at their level (I (0)) when intercept is included along with intercept.

As both the variables are integrated of different order so to trace out the applicability of Okun’s law for Pakistan we can further proceed by applying the ARDL (Autoregressive Distributed Lag), Bound testing procedure.

Before proceeding towards ARDL procedure first it is important here to trace out the existence of long run affiliation between unemployment and level of output by using Bound test. The results of Bound test are reported in following table.

Table 2: Bound test for output unemployment relationship

<table>
<thead>
<tr>
<th>F-Statistic</th>
<th>1% critical value Bound</th>
<th>2.5% critical value Bound</th>
<th>5% critical value Bound</th>
<th>10% critical value Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>I (0) I (1) I (0) I (1) I (0) I (1) I (0) I (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.34</td>
<td>3.25 4.63 2.65 3.09 2.25 3.91 2.35 3.93</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The computed value of F-test is reported as 5.34 that is observed to be more than the upper bound critical value confirmed the existence of long run affiliation between unemployment and output for Pakistan. Results confirmed that by further proceeding significant runup impact of unemployment on GDP can be obtain.

The next step of ARDL approach entails the approximation of the long run and short run coefficient of Okun’s relationship and interpreting about the applicability of the law. Results are reported in following table.

Table 3: ARDL Approximation

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Standard Errors</th>
<th>T-statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long run Results (ARDL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( l_{UNEMP} )</td>
<td>-0.71</td>
<td>0.1352</td>
<td>-2.3527</td>
<td>0.0000</td>
</tr>
<tr>
<td>Constant</td>
<td>12.3720</td>
<td>0.5272</td>
<td>21.3820</td>
<td>0.0000</td>
</tr>
<tr>
<td>Short run Results (ARDL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( d_{l_{UNEMP}} )</td>
<td>-0.47</td>
<td>0.17</td>
<td>-0.9275</td>
<td>0.2760</td>
</tr>
<tr>
<td>Dc</td>
<td>0.26</td>
<td>0.28</td>
<td>1.4388</td>
<td>0.1022</td>
</tr>
<tr>
<td>Ect (-1)</td>
<td>-0.62</td>
<td>-1.89</td>
<td>0.2331</td>
<td>0.0341</td>
</tr>
<tr>
<td>R-Square</td>
<td>0.41</td>
<td>Adj R-Square</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>DW statistics</td>
<td>1.78</td>
<td>F-statistics</td>
<td>6.23</td>
<td></td>
</tr>
</tbody>
</table>

The results pointed out that a percent change in output brings 0.71 percent change in level of unemployment in long run while 0.47 percent in short run. The sign and magnitude of error correction term and its significance property provided that the 62% adjustment towards long run equilibrium. The value of R-square indicated that the 41% variations in unemployment explained by gross domestic product indicated that other 59% variations are associated with other factors variations. The value of Durbin D-statistics confirmed that there is no problem of autocorrelation in the model. Further to address this problem the graphs of recursive estimates are drawn.
To check the pattern of association between unemployment level and growth of output Granger Causality test is applied on this stage. Results of Granger Causality test are reported in following table.

Table 4: Granger Causality representation

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>F-Statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Unemployment does not cause growth of output</td>
<td>3.4145</td>
<td>0.0436</td>
</tr>
<tr>
<td>Growth of output does not cause level of unemployment</td>
<td>0.0398</td>
<td>0.1610</td>
</tr>
</tbody>
</table>

Results of granger causality test pointed out the existence of one-way affiliation between level of unemployment and growth rate of output.

(a) Plot of CUSUM

The straight lines represent critical bound at 5% significant level

![Figure 1: Plots of CUSUM and CUSUMSQ of recursive residual](image)

(b) Plot of CUSUMSQ

![Figure 2: The straight lines represent critical bound at 5% significant level](image)

The plots of recursive estimates indicate that within the given bound all the coefficients of the model are stable confirmed that there is no problem of autocorrelation.

V. CONCLUSION

The major emphasis of the paper has on to check the applicability of Okun’s law and to estimate the coefficient describing the relationship between growth of output and unemployment both in short run and long run in Pakistan. By applying ARDL procedure it is found that inverse relationship exists between unemployment and level of output. The Okun’s coefficient reported the value of 0.71 percent which interpret that one percent change in output brings 0.71% change in level of unemployment while the 12.37 intercept term indicated that the level of unemployment attached with zero level of output’. Lower intensity of association varied with professional training and economic systems of the country. To reduce the level of unemployment a market based economy is needed, So, the results implied that the policy maker should take steps to enhance the investment opportunities in the country. One-way causality runs from unemployment to GDP observe by adopting Granger Causality test.

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