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Structural Stability of Okun's Law in Pakistan: An Econometric Analysis

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Abstract
This research study reveals about the structural stability and application of the Okun's law in Pakistan. The law postulates a negative relationship between unemployment rate and GDP growth. It has been originally presented empirically by Arthur Okun in early 1960s. Various studies have been conducted in the past as well on the applicability of the Okun's law in Pakistan and also around the world. This particular analysis is based on the difference version of the Okun's law. For this purpose time series data has been taken from 1985 to 2015. ARDL model has been used to find the long-run relationship between the unemployment and real national income. The stability of the model has been checked by applying the dummy variable approach. For this purpose the data period has been segregated into two sections i.e., 1985-2001 and 2002-2015. The dummy results confirm the structural instability in the Okun's coefficient in Pakistan during the study period. This research also uses the Chow test for the investigation of structural stability of the Okun's Law in Pakistan. The Chow test also confirmed that there is structural instability. The ARDL results verify the negative long-run relationship between the unemployment rate and GDP growth rate. This research concludes that there is a negative correlation between the two variables but structurally unstable.
Keywords GDP, Unemployment, Okun's Law, Structural stability, Dummy variable approach, Chow test.

1. Introduction

The negative functional relationship between unemployment and GDP was first introduced by Arthur Okun in early 1960s. According to this law, there is an inverse relationship between the unemployment and the GDP of a country. The original version says that when the unemployment in the economy increases by 3 percent, the GDP growth reduces by 1 percent.

The population of Pakistan in 2014-15 is 191.75 million people with the growth rate of 1.9 percent per annum (Pakistan Economic Survey 2014-15). It stands 137th on HDI Index. (HDI report 2013). Pakistan's estimated population in 2011 was over 184.5 million (Demographic and Health survey of Pakistani, 2012-13).Pakistan's urban population expanded seven times during the period 1950-2011, whereas the overall population expanded by four times. Pakistan is now the sixth most populated country in the world (Economic survey of Pakistan 2014-15, Govt. of Pakistan). According to Federal Ministry of Education, the literacy rate in 2013 was 58 percent. In this 70 percent is for male and 47 percent for females (Pakistan Economic Survey 2013-14).

There have been many fluctuations in the growth rate of Pakistan economic history. It has been 68 years since the creation of Pakistan and in this long time span Pakistan has seen three military dictatorships and many democratic governments. Both democratic and military governmentshave been in power in Pakistan's political history but there has been economic improvement under the military rulers; on the other hand the under the umbrella of democracy, there has been corruption, unfair privatization, mismanagement and huge spending on non-development expenditure (Khan, 2012).

Pakistan's economic development started from 1958 to 1968. Gross fixed investment over the ten years military rule increased nearly three folds in real term rising from 4.5 percent of GDP in 1958-59 to 14percent in 1968-1969. During this period growth rates of services, agriculture and industrial sector were 6.27 percent, 4.1 percent and 9.14 percent respectively (Shah,2014).

Under the military rule from 1977 to 1988, Pakistan GDP showed increasing trend by 154 percent while average GDP growth rate was 6.5 percent and the average unemployment rate during late 70s and 80s was 1.4 percent. In 1984 Pakistan GDP growth rate was 4.5 percent while unemployment rate was 3.9 percent. In 1985 the GDP growth increases from 4.5 percent to 7.9 percent while unemployment decreased from 3.97 percent to 3.6 percent (Pervez, 1997).

Third military era began from 1999 to2008; in 2003-04 GDP growth rate was 7.5 percent while unemployment rate was 8.3 percent, in the year 2004 GDP growth increased to 9 percent while unemployment decreased to 7.7 percent. (EconomicSurvey of Pakistan 2004-5)

Analyzing the unemployment tendency in Pakistan from the year 1985-2012, it can be found that there is an upward trend in this period. It can also be observed that in 1989 the unemployment rate abruptly raised to 6.3 percent. During the Military rule since 1977 to 1988, the unemployment remained very low due to the liberal

economic policies of the said government. The international political scenario at that time including the Soviet adventurism in Afghanistan, as a consequence of that invasion, the excessive economic support from the western countries to Pakistan helped to sustained growth rate in the country.

Unemployment in Pakistan is one of the major problem. It shows increasing trend in last decade. During last few years, terrorism contributed to low level of productivity and investment while unemployment is increasing with every passing year. The growth rate shows a fluctuating trend in the last few decades of Pakistan's history. It can be observed that the growth rate in 1980s was 6.5 percent on average. There was sharp increase in 1992. The years starting from 2000 also exhibits sharper increase in the growth rate which peaks in the year 2005.

The direction or tendency of the growth rate in Pakistan has generally remained negative. The political situations in Pakistan have also been responsible for the decreasing real GDP growth rate. Pakistan has many political parties but only two of them remained in the lime light or power. The PPP and PMLN have been in government alternatively during the last one and half decade excluding the Gen. Musharaf era. Both these political parties have been blamed for corruption, mismanagement and money laundering. Besides that, no democratically elected government in Pakistan has completed its five years tenure except the Pakistan People's Party tenure of 2008-2013. All this turmoil at the political scene led to economic deterioration and inconsistency in the policies (Pervez, 2011). All such ups and downs in the political history of Pakistan brought various fluctuations in its socio –economic history as well.

Irfan et al. (2010) tested the Okun's law for some countries in Asia with data from 1980-2006. Long term relation was checked through co integration and ECM was employed for short run analysis. Three countries in Asia including Malaysia, Korea and Singapore were noted for the inapplicability of the Okun's law. It was also found that there were frequent ups and downs in the inflation rate in countries like India and Pakistan and hence the natural rate of unemployment was difficult to predict due to these fluctuations.

Jalil et al, (2010) analyzed the relationship put forward in Okun's law in few countries. In order to do this analysis, data from 1980 to 2006 was taken. Engle Granger and ECM were applied to do the short run and long run interpretation. It was observed that the Okun's law might not apply in few Asian economies and hence was invalid.

The economic growth and unemployment rate in Pakistan may or may not have the relationship put forward by Arthur Okun, but there is also an important aspect of this relationship that needs to be addressed whether this relationship has been stable, if exists, in the long term in Pakistan. This research addresses both these questions. In other words the study wants to confirm whether the economic growth in Pakistan helps out in the reduction of the unemployment. Besides this, it is also intended to know whether this inverse relationship between the unemployment and economic growth has structural stability in the long run. This is being confirmed through the dummy variable approach.

This study focuses on Pakistan's economy showing that high unemployment level coincides with low level of productivity in the country. Consequently, consumer's purchasing power goes down as prices increases. This will further result in low level of production and there will further be rise in unemployment level in the country. But Okun's law will help in understanding the relationship between both the variables in implementation for adequate policies to continue with reduction of unemployment.

The importance and value of Okun's law is not only for the interest of economist but empirical relationship is important to frame policies and macroeconomic stabilization. It is rule of thumb for estimation to know the impact of changes in unemployment on GDP. The inverse relationship between the output and unemployment under Okun's law is very important in any economic model because, it forms the basis of aggregate supply curve. It also bears a great importance at the policy level. The economists and policy makers would always be interested to understand the strength of relationship between unemployment and output or economic growth. The reduction in disinflation policy is also dependent on the response of the unemployment to changes in the output. In Pakistan, which is one of the developing countries, there is high level of unemployment and to reduce it, all the determinants of unemployment need to be analyzed.

The previous studies conducted on the validity of Okun's law have reached the conclusion that Okun's law has failed in Pakistan. It was intended in this study to recheck the claim of failure of Okun's law in Pakistan. The study also desire to check if the relationship is stable in the long run. For this purpose the dummy variable test and chow tests have been applied. It's the first time in Pakistan that both dummy variable approach and chow tests have been used for the Okun's law in Pakistan.

2. Methodology

Generally in economic theory, the quantitative analyses with modern statistical technique are used for such analysis. The research techniques consist of quantitative as well as analytical technique and focuses on estimation of the data. In this study application of secondary source of data from period 1985-2015 has been used and analyzed.

2.1. Theoretical framework

For the analysis of the long run relationship between the variables, the Error correction model is often used. For this purpose the difference version of the Okun's law was taken under consideration. On the other hand the dummy variable model was used to assess the model's stability over time. The total time period of study was divided into sub periods and then dummies are introduced to check for the structural breaks. The regression process then was involved for the rolling of time period which can be called as rolling regression (Owyang, 2012).

The negative functional relationship between unemployment and real GDP was first introduced by Arthur Okun in early 1960s. Okun's law has different versions, that is, the Difference version, and the gap version. Each technique has its own advantages and disadvantages. Only the difference version has purely statistical and simple calculations made through SPSSx, which can be directly calculated from the available empirical data without making any assumptions. Therefore only the difference version of the law has been applied in the study. The difference version approach simply regress GDP growth over changes in unemployment rate.

2.2. Difference version of Okun's law

The difference version of Okun's law can be empirically expressed as follows:

$$U_t - U_{t-1} = \alpha + \beta (Y_t - Y_{t-1}) + \eta_t \quad (1)$$

Where;

U_t = Unemployment rate in period t (percentage)

Y_t = GDP growth in time period "t".

η_t= Error term in time period "t".

2.3. Gap version of Okun's law:

In the gap version there can be a complication to calculate the natural rate of unemployment and the potential output level. The gap version can be showed empirically as follows:

$$(U_t - U^*) = \beta (Y_t - Y^*) + \epsilon_t \quad (2)$$

Where;

U^* = Natural rate of unemployment.

Y^* = Potential output.

η_t= Error term in time period "t".

The initial estimates of Okun's analyzes was that one percent increase in unemployment rate would decrease the output by 3 percent. Later on the estimation was made through comparative modern econometric methods, with one to two percent relationship between the two variables. (Samuelson and Nordau's, 1995)

2.4. The data

As mentioned earlier, the method for collecting the data is based on secondary source of data. Therefore evaluation of population is not required. The time series data from 1985 to 2015 has been used for study purposes, which will further be attained from different resources. These will include Pakistan economic survey, World Bank indicators (WDI), and statistical bulletins of Pakistan Bureau of statistics.The main source of collecting the data is secondary source which has been taken for the period 1985 to 2015 from World Bank as well.

2.5. Models specification

2.5.1. Augmented-Dickey Fuller Test

Non-stationary is a problem generally found in the time series data. A data being non stationary is because of the unit root in the data. If not removed, it can produce spurious results. These results might not be good enough for the analysis or forecasting. Unit root is a chain of processes which forms through a time and it basically can create problems in the statistical inference of the time series data. A linear stochastic process has a unit root if one is a base or root in the characteristic equation of the process. As a consequence such a process would be non-stationary. On the other hand if the other base or root of the equation sets in the other equation which is inside the circle, then the first difference of the model will be stationary.

The stationary or for that matter non stationary of a time series can greatly affect the behavior and attributes of the time series. For a non-stationary series, persistent and continuous shocks shall be infinite. It can result in spurious regression as mentioned earlier, that might lead to a higher value of R_2. This would be at the expense of even no relationship between the variables at all. For this reason, the time series data should be free of unit root problem for the regression to be run successfully through SPSSx.

Dickey and Fuller (1979, 1981) developed a method for tracing the unit root and that method is known as is Augmented-Dickey Fuller test. For this purpose consider the following random walk model:

$$U_t = U_{t-1} + u_t \quad (3)$$

This model means that all past information is available in this case. The unit root process of Dickey and Fuller can be illustrated by the help of an Autoregressive process AR(1):

$$U_t = \delta U_{t-1} + u_t \quad (4)$$

2.5.2. Auto regressive distributive lag model (ARDL)

Autoregressive Distributed Lag (ARDL) Model is used to check a long-run relation in the variables. The main advantage of ARDL modeling lies in its flexibility that it can be applied when the variables are of different order of integration (Pesaran and Pesaran, 1997). Another advantage of this approach is that the model takes sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson and Chai, 2003). Moreover, a dynamic error correction model (ECM) can be derived from ARDL through a simple linear transformation (Banerjee et al., 1993). The ECM integrates the short-run dynamics with the long-run equilibrium without losing long-run information. It is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data (Laurenceson and Chai, 2003).

The test involves asymptotic critical value bounds, depending whether the variables are I (0) or I (1) or a mixture of both. Two sets of critical values are generated which one set refers to I (1) series and the other for I (0) series. Critical values for the I (1) series are referred to as *upper* bound critical values, while the critical values for I (0) series are referred to as the *lower* bound critical values.

If the *F* test statistic exceeds their respective upper critical values, we can conclude that there is evidence of a long-run relationship between the variables regardless of the order of integration of the variables. If the test statistic is below the upper critical value, we cannot reject the null hypothesis of no cointegration and if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressions.

The bounds test is mainly based on the joint F-statistic which its asymptotic distribution is non-standard under the null hypothesis of no cointegration.The null hypothesis of no cointegration is rejected when the value of the test statistic exceeds the upper critical bounds value, while it is accepted if the F-statistic is lower than the lower bounds value. Other ways, the cointegration test is inconclusive.

As mentioned earlier, the variables considered in this study are a mix of I (0) and I (1) series. The cointegration test methods based on Johansen (1991; 1995) and they require that all the variables be of equal degree of integration, i.e., I (1). Therefore, these methods of cointegration are not appropriate and cannot be employed. Hence, we adopt the ARDL modeling approach for cointegration analysis in this study.

The ARDL model helps us understand and confirm or otherwise the validity of the Okun's law in Pakistan. It will tell us first if there is a negative relationship between the unemployment rate and GDP growth rate in Pakistan. The ARDL model will also reaffirm this relationship in the short run as well as long run in Pakistan.

Assume a very simple dynamic ARDL model explaining the response of Y in terms of X given as follows:

$$Y_t = \alpha_0 + \alpha_1 Y_t - 1 + \gamma_0 X_t + \gamma_1 X_t - 1 + \mu_t \quad (5)$$

Where Y_t and X_t are stationary variables and μ_t is a white noise

and residual $\mu \sim (0, \sigma_2)$

$$Y_t^* = \alpha_0 + \alpha_1 Y_t^* + \gamma_0 X_t^* + \gamma_1 X_t^* + \mu_t \quad (6)$$

$$Y_t^* = (1 - \alpha_0) + \alpha_0 + X_t^*(\gamma_0 + \gamma_1) + \mu_t \quad (7)$$

$$Y_t^* = (1 - \alpha_1) = \alpha_0 + X_t^*(\gamma_0 + \gamma_1) + \mu_t \quad (8)$$

$$Y_t^* = \frac{\alpha_0}{1} - \alpha_1 + X_t^* \gamma_0 + \frac{\gamma_1}{1} - \alpha_1 + \mu_t \quad (9)$$

$$Y_t^* = \beta_0 + \beta_1 X_t^* + \mu_t \quad (10)$$

$$\beta_1 = \frac{\gamma_1}{1} - \alpha_1 \quad (11)$$

So the long run elasticity between Y_t and X_t is captured by

$\beta_1 = \gamma_0 + \frac{\gamma_1}{1} - \alpha_1$(Pesaran, 1999)

But in in the current study, the following model shall be used for ARDL:

$$\Delta U = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta U_i + \sum_{j=0}^{m} \beta_{1j} \Delta GDP_j + \gamma_1 \Delta U_{t-1} + \gamma_2 \Delta GDP_{T-1} + e_1 \quad (12)$$

Where;

U= unemployment rate (percent)

GDP= gross domestic product (percent)

2.5.3. Structural stability: The dummy variable approach

In this section, the structural stability of Okun's law has been examined through the dummy variable approach. Dummy variable is a very important and significant statistical technique that is used in econometrics as well as statistics. It is particularly used in regression analysis. It is also known as binary variable or qualitative variable. It takes the value of 0 and or 1 to signify or point to the presence and absence of some event or attribute that is

otherwise not quantifiable. In the regression analysis the dependent variable may not just be effected by quantitative elements but non quantitative as well. For this purpose the dummy variable is the best option along with the other statistical techniques available these days. When the dummy takes the value of 0, it shall cause the coefficient of the variable to have no role or part in affecting the dependent variable. If on the other hand it takes the value of 1, the coefficient acts in the alteration of the intercept value.

This study examines the relationship between unemployment and national income of Pakistan over the period 1985-2015.Structural breaks can occur in time series data or cross sectional data, when there is a sudden change in the relationship being examined.

Examples include sudden policy changes such as a change in government or sudden move in asset prices (1987) or serious international disaster such as a civil war. We then need to decide whether two separate regression lines are more efficient than a single regression.This period is divided into two parts i.e.,1985-2001 and 2002-2015.The reason for taking 2001 as break year is due to the significant events prior to 2001. It includes the transfer of government from democracy to dictatorship. It also includes the September 11 terrorist attack on the USA.

The onset of 9/11 War disrupted Pakistan's normal trading activities, as the cost of trading increased substantially because of higher insurance cover. Consequently, economic growth slowed demands for imports reduced with consequential decline in tax collection and inflows of foreign investment were naturally adversely affected, accentuated by the travel bans issued by western governments to its entrepreneurs. All these factors consequently led to the decision of taking 2001 as break year in this study. (Economic survey of Pakistan 2010-11)

The following dummy variable regression model is used to examine the structural stability of Okun's law(Gujrati & Porter, 2009)

$$UE_t = \alpha_1 + \alpha_2 D_t + \beta_1 GDP_t + \beta_2 (D_t * GDP_t) + \varepsilon_t \quad (13)$$

Where;

UE = unemployment rate.

GDP= Gross Domestic Product(percentage).

t= time

D=1 for the period 2002-2015

=0 otherwise (i.e., for the period1985-2001)

From the above model, the following regression can be obtained:

2.5.3.1. Mean unemployment function for the period 1985-2001 (D_i=0)

$$E(UE_t|D=0) = \alpha_1 + \beta_1 GDP_t + e_t \quad (14)$$

2.5.3.2. Mean unemployment function for the period 2002-2015

$$E(U_t|D=1) = (\alpha_1 + \alpha_2) + (\beta_1 + \beta_2) GDP_t + e_t \quad (15)$$

Just as we called B_2 the differential intercept coefficient, we can now call α_2 the differential slope coefficient (also called the slope drifter), for it tells by how much the slope coefficient of the GDP differs between the two categories.Just as $(\beta_1 + (\beta_2)$ gives the mean value of *U*for the category that receives the dummy value of 1 when GDP is zero, $((\beta_1 + (\beta_2)$ gives the slope coefficient of GDP for the category that receives the dummy value of 1. Notice how the introduction of the dummy variable in the additive form enables us to distinguish between the intercept coefficients of the two groups and how the introduction of the dummy variable in the interactive, or multiplicative, form (D multiplied by GDP) enables us to differentiate between slope coefficients of the two groups.

Depending on the statistical significance of the differential intercept coefficient β_1 and the differential slope coefficientβ_1, we can tell whether the two categories differ in their intercept values or their slope values, or both. Four types of possibilities are in figure I.

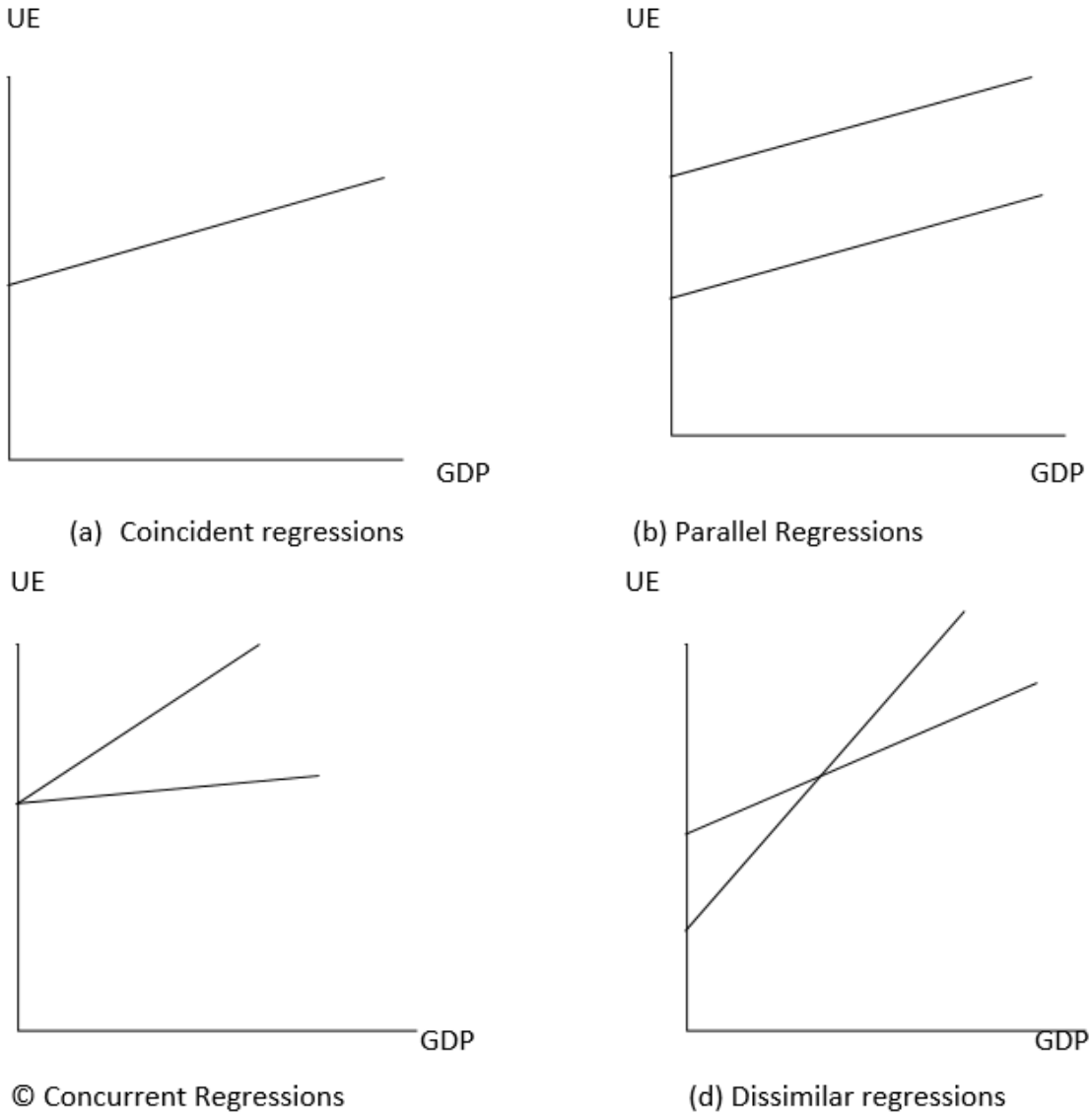

Figure I: Various expected outcomes of test for structural stability between unemployment and GDP

Figure I(a) shows thatthere is no difference in the intercept or the slope coefficients of the two categories regressions. That is, the two regressions are identical. This is the case of coincident regressions.

Figure I(b)shows that the two slope coefficients are the same, but the intercepts are different. This is the case of parallel regressions.

Figure I (c) shows that the two regressions have the same intercepts, but different slopes. This is the case of concurrent regressions.

Figure I (d) shows that both the intercept and slope coefficients are different; that is, the two regressions are different. This is the case of dissimilar regressions.

The following null and alternative hypothesis is formulated:

$H_0: \alpha_2 = 0$
$H_1: \alpha_2 \neq 0$
$H_0: \beta_2 = 0$
$H_1: \beta_2 \neq 0$

This is decided on the basis of t-statistic and its respective p-value to accept the null or alternative hypothesis.

2.5.4. Chow test

The Chow test is a statistical and econometric test of whether the coefficients in two linear regressions on different data sets are equal. The Chow test was invented by economist Gregory Chow in 1960. In econometrics, the Chow test is most commonly used in time series analysis to test for the presence of a structural break.

The process involves running the regression using all the observations, before and after the structural break, collects the RSS. Then Run 2 separate regressions, one before, RSS(1) and one after, RSS(2) the structural break.

Calculate the test statistic using the following formulae:

$$F - \frac{RSS_c - (RSS_1 + RSS_2)/k}{RSS_1 + RSS_2 / n - 2k}$$

$$RSS_c - combined\_RSS$$

$$RSS_1 - pre - break\_RSS$$

$$RSS_2 - post - break\_RSS$$

The final stage of the Chow Test is to compare the test statistic with the critical value from the F-Tables. The null hypothesis in this case is structural stability, if we reject the null hypothesis; it means we have a structural break in the data.The plus point that is there in the chow test is that there is no need for the introduction of dummy variable for the analysis in the chow test.

3. Results and discussion

3.1. Augmented Dickey Fuller test results

The ADF test has been used to test for the Stationary in the data for both the variables i.e. unemployment rate and GDP growth rate. The ADF test results show that unemployment rate is non-stationary at level. This is being confirmed from theprob. value which is greater than 0.05 i.e. at 5percent,but it becomes stationary at first difference. On the other hand GDP growth rate is stationary at level.

TableI. Augmented Dickey Fuller test results

Variable	t-critical (at 5% level)	t-statistics (prob.)	Conclusion
U	-2.967767	-1.889336 (0.3324)	
ΔU	-2.971853	-6.625837 (0.0000)	$\Delta U \sim I(1)$
GDP	-2.967767	-3.726422 (0.0089)	$GDP \sim I(0)$

Our test resulted in unemployment statistic of -6.625 which is less than the critical value at first difference with significant p value. The value for GDP t-statistic is -3.72, which is less than the critical value at level.

3.2. Results of autoregressive distributive lag model (ARDL)

ARDL model used in our research can be expressed as:

$$d(U) = \alpha + \beta_1 d\big(U(-1)\big) + \beta_2 d(GDP) + \beta_3 U(-1) + \beta_4 GDP(-1) + \varepsilon \qquad (16)$$

In the above equation the term $\beta_1 \mathrm{d}\big(\mathrm{U}(-1)\big) + \beta_2 \mathrm{d}(\mathrm{GDP})$ represents short run relationship between variables whilethe long run relationship is represented by $\beta_3 \mathrm{U}(-1) + \beta_4 \mathrm{GDP}(-1)$.

The results of ARDL model according to table 4.2 are according to our hypothesis and shows that there is negative relationship between unemployment rate and GDP growth rate in long run. For log-run relationship we have used Wald test to investigate the overall significance of both $\mathrm{U}(-1)$and $\mathrm{GDP}(-1)$. This confirms our first objective of the study in which we wanted to see the validity of Okun's law in Pakistan. The ARDL model confirms this research question about the validity of the Okun's law and reaffirms the presence of negative Okun's law in Pakistan.

Table II.Results of ARDL model

Variable	Coefficient	Std. Error	t-state(Prob.)
C	2.266	0.811	2.79(0.01)
D(U(-1))	-0.258	0.191	-1.352 (0.188)
D(GDP)	-0.067	0.088	-1.352 (0.188)
U(-1)	-0.226	0.110	-2.041 (0.052)
GDP(-1)	-0.179	0.099	-1.810 (0.082)

The ARDL model has been used since both the variables of GDP rate and unemployment rate are not stationary at level. One of the variables is stationary at level while the other is stationary at first difference. When this situation occurs then we cannot apply the ECM. Only ARDL model can be used. Besides this we were also interested to know the short run and long run relationship between the variables. That is why the ARDL model has been applied. From the results of Wald test we concluded that a strong long-run negative relationship exists between unemployment rate and GDP growth rate, which is according to our hypothesis. The probability value shows that in long run the unemployment and GDP growth has a significant relationship.

Table III.Results of wald test

Test Statistic	Value	Df	Probability
t-statistic	-2.608273	23	0.0157
F-statistic	7.233	(1, 24)	0.012

Chi-square	6.803087	1	0.0091

The Wald test has been used to see the overall impact of the two variables. Wald test uses the F-statistic and it shows a long run relationship with the F value greater than zero and significant. The lower bound and upper bound critical value at 1 percent level of significance are 3.06 and 4.15 respectively. Since the value of F-statistic is 7.23, which is greater than the upper bound, so it can be concluded that there is cointegration between the two variables in the long run.

3.3. Results of dummy variable approach

We have availed the dummy variable approach to check for the structural stability of the Okun's law in Pakistan. It was observed that coefficient of GDP*D_1 is negative and significant while coefficient of $D_1$is non-significant.So the dummy variable approach shows structural instability of concurrent shape among the various possible shapes as discussed earlier in the methodology of dummy variable approach.

Table IV.Results of Structural Stability

Variable	Co-efficient	St. Error	t-stat.	Prob.
C	5.611	.733	7.647	0.0000
GDP	.201	.148	1.353	.187
D_1	1.581	1.059	1.492	.147
GDP*D_1	-.635	.208	-3.047	.005

Chow test has been applied to check for the presence of structural break in the data. In our research we have used 2001 as break year. The reason for selecting 2001 as break year is because there was a global economic shift due to World Trade Centre terrorist attack in USA. This had economic and political repercussions on Pakistan as well. Pakistan got some economic benefits from 9/11 in the form of increase in Forex reserves and loans right offs. But at the same time the war against terrorism started in Pakistan which had a negative economic impact on Pakistan (Rabbi, 2012). The Chow test is the variation of F-test.Structural breaks can occur in time series data or cross sectional data, when there is a sudden change in the relationship being examined. Examples include sudden policy changes such as a change in government or sudden move in asset prices (1987) or serious international disaster such as a civil war. In the present study the Chow test showed structural break.So the results of chow test are according to our hypothesis.

Table V.Results of ChowTest

F-statistic	10.602	Prob. F(2,27)	0.0004
Log likelihood ratio	17.968	Prob. Chi-Square(2)	0.0001
Wald Statistic	21.205	Prob. Chi-Square(2)	0.0000

4. Conclusion

This study was conducted to apprehend two core objectives i.e., to check the validly of Okun's law in Pakistan and also examine the stability of the Okun's law in Pakistan's economy. It also explores the short-run and long-run relationship between real national income and unemployment in Pakistan. Augmented Dickey-Fuller test was used to examine the data for stationary. The unemployment rate became stationary at first difference whereas the national income was found to be stationary at level.

ARDL test was used to see the short-run and long-run relationship between the variables and the test results confirm hypothesis of negative relationship between unemployment and GDP in the long run. The model is also in equilibrium in the long-run. Dummy variable approach was applied to check for the structural stability of the Okun's law in Pakistan. The results show there is structural instability of concurrent form, which means that it has the same intercept but different slopes for the two periods. The Chow test also confirms the structural break in the data.

It is concluded that there is long-run relationship between the unemployment and GDP growth rate in Pakistan and this relationship is negative and significant. Besides that there is structural instability of Okun's law in Pakistan. The reason was understands is the post and pre 2001 period economic situation. After 2001, there was a shift in the economic paradigm of Pakistan's economic and political situation. Before 2001, there was political and hence economic instability in Pakistan. This interpretation may be one of the reasons for the structural instability of Okun's law in Pakistan.

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