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THE NEXUS BETWEEN GROWTH AND UNEMPLOYMENT RATE IN PAKISTAN: DOES OKUN'S LAW EXIST?

Muhammad Salahuddin Ayyubi[1], Humna Ahsan[2], Ayesha Anwar[3], Asad Elahi Khan[4], Muhammad Ghulam Shabeer[*5]

[1]Assistant Professor at Forman Christian College (A Chartered University), Lahore, Pakistan;
[2,3]Assistant Professor Department of Economics Forman Christian College (A Chartered University);
[4]Department of Economics, Forman Christian College (A Chartered University), Lahore, Pakistan;
[*5]Department of Economics, University of Management and Technology, Lahore Pakistan

[1]salahuddinayyubi@fccollege.edu.pk; [2]humnaahsan@fccollege.edu.pk; [3]ayeshaanwar@fccollege.edu.pk;
[*5]imgshabeer@gmail.com `

Corresponding Author: *

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ABSTRACT

This research is an in-depth examination of the link between the unemployment rate and output growth in Pakistan. The study begins with a background discussion of Okun's law, the Gross Domestic Product (GDP), unemployment, and the situation in the three main sectors of Pakistan. A comprehensive literature review is then presented, which includes authors' interpretations of studies related to Okun's law in Pakistan and other developed nations. The literature review is followed by a discussion of the methods used to determine the Okun coefficient, including the use of the Autoregressive Distributed Lag (ARDL) model to examine the link between unemployment and output growth. Additionally, to understand the impact of the growth rate of the three main sectors on the unemployment gap, the Ordinary Least Squares (OLS) technique was used as all the variables were found to be stationary at the level. The study provides promising results, revealing a negative relationship between the output growth gap and the unemployment gap. The findings of this study contribute to a better understanding of the dynamics of unemployment and output growth in Pakistan and provide valuable insights for policymakers and economists.

Keywords: Okun's Law, Unemployment, Economic growth, Econometric Modelling, ARDL
JEL Classification: E24, J6, C5, C52.

1. INTRODUCTION

Arthur Okun died at the early age of 52. His major book "Prices & Quantities: A Macroeconomic Analysis" was published after his death in 1982. A widespread misunderstanding about Okun's law is that it merely represents a correlation between aggregate demand and unemployment. It may be correct that Okun (1962) tested the connection between unemployment and output. However, it wouldn't be incorrect to call this statement an oversimplification of the whole concept.

Various definitions can be used to express Okun's concept, for instance, it can be defined as the connection between variation in unemployment and the variation in output, or perhaps as the deviation in the unemployment gap due to deviation in the total output gap. The theory states that in an ideal situation when the potential GDP and actual GDP are equal, the unemployment and (NRU) are equal as well. There is a negative relationship, such that whenever there is a positive difference between the output gap, there is going to be a negative difference in the unemployment gap.

Okun's law has experienced fluctuations in terms of its popularity and usage over time. At certain points, it was widely adopted and applied, while at others it was largely disregarded or dismissed. This can be due to various factors such as changes in economic theory, shifts in policy priorities, and advancements in data analysis. There were times when it was completely disregarded even as a rule of thumb according to Meyer and Tasci (2012) and there were times when it was used to project the state of

unemployment after major world economic events like the great crisis of 2008 or even more recently post COVID-19. The controversy surrounding Okun's law stems from the fact that its appeal varies across different countries. The appeal of this law is contingent on the accuracy and precision of the data used and the estimation methods employed. This research proposes to investigate the connection between the shifts and movements in the aggregate demand and unemployment in Pakistan. It aims to evaluate how fluctuations in the economy, both positive and negative, affect unemployment rates in the country. Additionally, the study seeks to quantify the impact of sector-specific growth, such as sectoral growth in services, agriculture, and manufacturing, on the unemployment rates by analyzing the interplay between changes in output and unemployment. Furthermore, to foster economic growth and stability, it is essential to have a better understanding of the variables that lead to unemployment in Pakistan. The findings of this research can inform policymakers to make decisions aimed at reducing unemployment and promoting economic growth, particularly in the services, agriculture, and manufacturing sectors.

Countries like Pakistan and other developing nations face this issue of unemployment and dealing with it is very crucial. Unemployment is one of the primary issues that have a huge list of consequences on individuals and the nations themselves, this makes these issues essential for policymakers. According to the 2021 Economic Survey of Pakistan, Pakistan is home to the fifth-biggest population in the world and one of the ten countries with the greatest workforce. This underscores the crucial role that the country's labor force plays in driving economic growth and development. Having a large and active labor force presents a unique opportunity for Pakistan to tap into its human capital to drive economic growth and development. With the right policies and investments in education, training, and infrastructure, the country's labor force can be harnessed to fuel economic growth and provide new job opportunities for its citizens. In conclusion, the large size of Pakistan's population and labor force highlights the country's significant economic potential and underscores the importance of effectively utilizing its human capital to achieve sustainable economic growth and development. With such a large population and workforce, it is essential for Pakistan to create favorable conditions for employment and economic expansion, for the purpose of making the best use of its human resources and advancing its general prosperity. Approximately 1.3 million individuals enter the workforce each year according to the Economic Survey of Pakistan (2021). This indicates that the amount of people without jobs in the labor force is increasing at a very intense rate obviously due to the fact that Pakistan has a very large population and with a large and growing pool of available labor, Pakistan has the chance to utilize this human capital to drive economic growth and development. Given the magnitude of Pakistan's workforce, it is extremely difficult to provide employment possibilities for this vast of a labor force.

According to World Bank data, Pakistan faced an unemployment rate of 4.35% in the fiscal year 2021. However, the country is facing serious challenges in terms of unemployment due to the effects of climate change, droughts followed by severe monsoon rains and widespread flooding have contributed to a challenging employment environment. The poverty and unemployment rates in Pakistan are estimated to be between 21.9% and over 36%, as of 2022, highlighting the severity of the problem. These statistics indicate the requirement for effectual policies and programs to address the unemployment challenges faced by the country.

Any economy should strive for sustainable growth as one of its main objectives. Maximizing an economy's growth by efficiently utilizing all of its resources is desirable in order for it to operate at its best. Pakistan's GDP expanded by 6% in the fiscal year 2021–2022 and Pakistan's population makes up 2.83% of the world's population, while its GDP makes up 0.26% of the global economy. This suggests that Pakistan needs to see higher economic growth in order to maintain its expanding population and labor force.

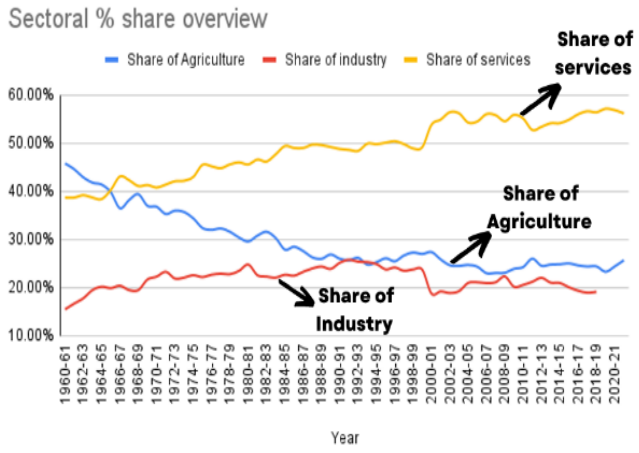
What drives Pakistan's economy? In terms of how the process should work, Pakistan's economy was first dependent on the primary sector, just like every other business. Despite not yet being classified as a developed nation, Pakistan has successfully shifted the generation of over half of its yearly GDP to the services sector. Given that it still employs over half of Pakistan's workforce and continues to provide a large contribution to the GDP, the primary sector continues to have a big impact on the country. Given that Pakistan has a lot of land that is fertile, it makes sense that the majority of its people reside in rural

areas where crops like cotton, rice, wheat, sugarcane,, and others are grown and exported. (Statista, 2023).

Although 6.0% growth is anticipated for FY2022, the Asian Development Bank (ADB) predicted in a review that due to devastating floods, tighter policy, and the necessity of addressing significant external and fiscal disparities, Pakistan's economy will only grow by 3.5% in FY2023 (ending 30 June 2023) instead of 6.0%.

Starting with the primary sector yet one of the largest sectors in Pakistan, about sixty percent of Pakistan's population is dependent on rain-fed agriculture, which depends on dependable weather patterns. Pakistan's natural resource foundation is rich and extensive, spanning many different ecological and climatic zones. It also boasts one of the biggest systems in the world for canal water irrigation. This gives the nation the ability to produce a range of food products. 22.45 million hectares altogether, 16.5 million of which are in the province called Punjab, are already under production. Dairy, fishing, livestock and poultry, crops, and cotton are subsets of this industry.

The following figure shows how the percentage share of agriculture, industry, and service sectors has changed over the years.



Sectoral Percentage Share Overview
Figure 1.1
Data source: State Bank of Pakistan

As seen in Figure 1.1., Pakistan's agriculture sector contributed around 45% of the country's GDP in the early 1960s, which was the biggest percentage of any of the three sectors at that time. In the middle of the 1960s, the share of the services sector surpassed that of agriculture, and as can be seen in the graph, the services sector has been growing ever since. It has been Pakistan's largest sector since the middle of the 1960s. However, from 1960 to 2021, the industrial sector's contribution stayed between the 10% to 30% range or close to 20%.

The Pakistan Bureau of Statistics reports that the ag riculture industry grew by 7.19% in 2021. In the manufacturing sector, the main industries that contribute to the manufacturing sector of Pakistan are automobile, oil and gas, cement, and textile. Approximately 25% of Pakistan's labor force is employed in the industry sector, which is a crucial part of the country's economy. It is important to monitor how fluctuations in the growth rates of the sectors affect employment overall. variation in the growth of these sectors can have a significant impact on the employment rate, and understanding this relationship is crucial for understanding the overall health of the economy.

Growth and lack of sufficient unemployment are the biggest challenges Pakistan faces. This study gives us a better insight into how we can use these indicators to improve our economic situation. There was no research that looked at the impact of growth in different sectors of the economy on the unemployment gap through the lens of Okun's rule in Pakistan. This research will enable readers to see how unemployment has been affected through different sectors of the economy. The following are the study's main research questions; a) Does Okun's law hold in Pakistan? What are the sizes of its empirical estimates? b) How is the unemployment gap affected by growth in different sectors of the economy?

There is a considerable research gap when we discuss Okun’s law specifically related to Pakistan, most of the studies indicate that the connection is either too weak or is not present in Pakistan, so this research attempted to test the theory in Pakistan in the Okun's tradition of estimation. Okun's law of the world is used to forecast the impact of output on employment, even though controversial but still empirically significant. It would be insightful because of the fact that a similar type of relationship can be used to forecast unemployment and growth in Pakistan. The association between growth and joblessness is crucial. Problem confronts when this relationship does not hold in developing countries as the literature also suggests. Pakistan is a developing country and this relationship in most of the studies was not valid

in the case of Pakistan. From an economic perspective, the desired study enhances the literature for future researchers through which new scholars can work on other study dimensions such as the author's attempt to measure the Okun's coefficient and the connection between the unemployment gap with respect to the growth in the different sectors of the economy.

2. Literature Review

The objective of this section is to establish what the studies over the years tell us about Okun's relationship specifically in the case of Pakistan and how different researchers have carried out their research to analyze this relationship. This section gives us an insight into how valid or invalid the relationship is in Pakistan. First, we have discussed all the studies not in favor and they are followed up with studies that are in favor of Okun's law specifically for Pakistan.

Lal, Muhammad, Jalil, and Hussain, (2010) carried out research on nations that are in Asia such as "Pakistan, Bangladesh, India, Sri Lanka, and China", in an attempt to estimate Okun's Law by cointegration approach to these countries and found out Okun's law was not applicable specifically to India and Pakistan. Therefore, they concluded that it may not be valid in the case of developing nations due to problems of asymmetry. Ahmed, Khali, and Saeed, (2011) used the "GAP " and "difference" versions to analyze Okun's relationship from the period 1974 to 2009 but could not find the existence of Okun type link in Pakistan. Hanif, Ahmed, and Çevik, (2021) tested Okun's law in SAARC nations and could not find a connection between output and unemployment in "Bhutan, Maldives, Nepal, and Pakistan" and implied that the output growth does not have an impact in providing employment in the long term in the mentioned nations. The reasons why Okun's rule was not well-founded in Pakistan were explained by Arif (2020). The study explained that the economy of Pakistan was dominated by the informal sector and a huge share of the labor force was employed in the agriculture sector. Hence, lower investment can be among many reasons why Okun's law does not have a strong connection in Pakistan, the observed research established that Okun's law holds true for Pakistan but unemployment has less impact on the GDP of Pakistan when compared with Okun's benchmark. Hussain and Hina (2016) examined Okun's law in Pakistan and the outcome established and observed a stable long-run connection and suggested that Okun's law existed. Latif et al., (2021) Argued that Okun's law was valid in Pakistan and noticed that a 1% change in GDP had a 0.52% impact on unemployment.

Freeman (2000) found that there was no significant interregional difference between output shifts and unemployment when regional data were compared with national data in the US. Daly and Hobijn (2010) concluded that there was strong output growth and employers laid off workers while output stayed steady and Okun's rule didn't hold in this period during the 2009 economic crisis in the US. Louail and Riache (2019) considered Okun's rule in the Saudi-Arabia economy and the results revealed that Okun's Law exists. Ball, Leigh, and Loungani (2013) found a strong and stable Okun's relationship in OECD countries.

Lim, Dixon, and Ours (2019) augmented Okun's coefficient to display greater asymmetry in the declining period of the economy, and the flow between unemployment and employment responds differently when growth is negative or positive.

Manna, Riadh, and Touiotou (2020) examined the asymmetrical result amongst the change in output growth & unemployment rates and the outcome showed Okun's rule did not hold true in the short run and there was an absence of an equilibrium relationship in the long run. An, Ghazi, and Prieto (2017) analyzed Okun's rule in lower-middle and lower-income nations, the outcome implied that traditional Okun's rule was not maintained in lower-income nations however, with employment as an alternate way the estimated association between the labor market and GDP was intense.

Leballo and Mello (2014) investigated Okun's law in South Africa and the empirical results showed that there was an Okun relationship in South Africa but it was insignificant.

Bankole and Fatai (2013) analyzed the real GDP and unemployment for Nigeria and the results showed that Okun's law did not hold in Nigeria. Ayinde, Adekunle, and Muritala (2018) tested Okun's law to study the economic growth patterns in Nigeria and the results confirmed Okun's propositions between growth rate and level of unemployment with 0.317 elasticities. Adeyeye, Odeleye, and Aluko (2017) employed the dynamic model of Okun's law in Nigeria and the econometric techniques that they used were the Toda- Yamamoto Granger non-causality test and GMM in their research. Huang, et

al (2019) took a very interesting approach in their investigation as the variables employed in this research were "output growth", "unemployment", and "oil price stocks" and "the distinction between male and female unemployment", they utilized panel data with a large number of observation, the exact count of 66 countries were included in the investigation. Al-husband and Edienat (2017) provided substantial to their investigation using descriptive graphical analysis such as "trends, patterns, and plots" Also an "OLS" was used as an approach to model the relationship and cointegration test to check the long-term correlation.

3. Methodology

Okun (1962) discussed the empirical relationship between GDP and unemployment in the USA. It makes common sense that as an economy grows, there will be more jobs available and vice versa, thereby affecting the unemployment rate. A stable link between output and unemployment can offer exciting possibilities for policymakers, but evidence suggests that macroeconomic theory produces a comparatively handful of models linking output and change in unemployment. Okun's law has been in and out of fashion in the field of macroeconomics and since Okun's original article was published it has arched the debate on how much output can be produced if full employment is achieved, meaning how can the gap between unemployment and NRU, minimize the gap between the actual GDP and potential GDP, and textbooks of economics have reported it as an empirical regularity. It has been cherished as an important tool to capture demand driven fluctuations and it has been criticized by scholars as well, Some scholars even went forward to call it a rule of thumb instead of a law. Meyer & Tasci (2012) expressed their doubts since jobless recoveries were observed, in their study "Unstable Okun's law, not the best rule of thumb".

Post-world economic crisis of 2008-09, many serious reconsiderations were triggered because of the deviations in the predicted unemployment and the actual outcome. Thus, there was a widely shared belief that the relationship broke down after the 2008-09 recession, IMF (2012). In order to cater to all these debates Ball et al (2014) came forward with a set of rules to carry out Okun's law estimations to point out some common mistakes and errors that researchers make and set the assumptions for Okun's law estimation. With a fundamental principle that when output reaches a long-term level, unemployment is also regarded as reaching a long-term level. Ball et al (2014), also assumed that whenever there is a shift in the aggregate demand or output it tends to prompt the firms to hire or fire people, thereby affecting the unemployment rate.

This relationship can be described alternatively in the form of the following two equations:

$$Et - Et* = \lambda\,(Yt - Yt*) + \eta t \qquad \lambda > 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

$$Ut - Ut* = \delta\,(Et - Et*) + \mu t \qquad \delta < 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.2)$$

where

It is the log of actual employment in the time period "t"

$_{It}$ is the actual output in the time period "t"

U_t is the actual unemployment rate in the period "t"

(*) is the long-run value of variables in the time period "t"

Equation 3.1 states that the coefficient of this equation will always be positive because if the output increases, beyond its long-run level, it will contribute positively ($\lambda > 0$) by increasing employment greater than the long-run level. On the other hand, equation 3.2 states that an increase in employment beyond its long-run level would contribute to a decline ($\delta < 0$) in employment from its long-run.

Substituting eq 3.1 into eq 3.2 we get:

$$Ut - Ut* = \beta\,(Yt - Yt*) + \epsilon t \qquad \beta < 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

where $\beta = \lambda\delta$ and $\epsilon t = \eta t + \mu t$ .The coefficient β in Okun's Law depends on the coefficients in the two relationships that underlie the relationship.

Equation 3.3 is the Gap version of Okun's Law that we used in this study to check the connection between output and unemployment in Pakistan for the time 1979 to 2021.

To evaluate the gap variant of Okun's law the data for GDP in USD was gathered from WDI and the unemployment data was gathered from various issues of the economic survey of Pakistan. We took the natural log of the GDP in USD and applied the HP filter on it to extract the trend series, furthermore to calculate the NRU we have used the moving averages of the 8 years.

Moreover, the data on the growth rate of the agriculture, manufacturing, and services sectors was gathered from the Pakistan Bureau of Statistics.

3.1 Long-Run Unemployment and Output

Hodrick Prescott (1997) is a data smoothing technique and it is commonly used to eliminate short-term fluctuations in the time series. By removing these short-term fluctuations we can have a better understanding of the long-term trends in the data, It is wise to use the HP filter for these estimations because it is widely used by researchers and is backed by literature, The value of the lambda that we have used is 100 as this is suggested for yearly data Ball et al (2014)

The output gap is estimated by subtracting the series generated by the HP filter "trend" series from the log of GDP in USD or it is the difference between the growth rate series and potential growth rate series.

By subtracting the NRU from the total unemployment, the unemployment gap is calculated. The moving average method was used to get the NRU, with 8 years of moving averages to optimize the results.

Table 3.1 Methods Used in Pakistan: Overview of Okun's Coefficients

Authors	Coefficient	T-Value	P- Value	Model fitted
Lal et al. (2010)	-0.03	2.08	0.02	FMOLS
Batavia and Salam (2012)	-0.002	-0.57	0.57	Cointegration
Masoor, Khan & Khan (2018)	-0.179	-1.81	0.008	ARDL
Hanif, Ahmed, Acet & Çevik, (2020)	0.09	not reported	0	ARDL

The Purpose of this compilation is to give the reader an overview of how these studies have been carried out in Pakistan with regard to Okun's law. We will examine Okun's coefficients which have been estimated by these scholars.

In their study of South Asian nations, Lal et al. (2010) used a gap version of Okun's law, with the unemployment gap acting as the independent variable and the output gap acting as the dependent variable. For the estimation, the FMOLS, a fully modified version of OLS often used in panel data, was used. Even though the predicted coefficient was statistically significant at the 5% level, the value of the coefficient was too low.

Batavia and Salam (2012) used the cointegration technique in their study, the response variable in their research was the output gap and the independent variable in this study was the unemployment gap interestingly they used the log of unemployment gap. The coefficient they extracted from their endeavor was -0.002 which is again too low and the P-value is also above the 5% level of significance.

Mansoor, Khan, and Khan, (2018) used the ARDL model to estimate their results and the Okun's coefficient that they computed was -0.179 and the level of significance was above the 5% level.

Hanif, Ahmed, Acet, and Çevik, (2020) used the ARDL model to conduct their estimation, the Okun's coefficient that they estimated was interestingly positive and too low, the coefficient was statistically significant as it was below a 5% level of significance.

In this study, we first carried out estimation using the OLS regression, as the resulting series of the HP filter of both the unemployment gap and output gap was stationary at level. However, the overall model was not significant. The P-value of the overall model was 0.3060 and the values of R squared and adjusted R squared were 0.0223 and 0.0015 respectively. Even Though, the coefficient was negative -0.0341732 its P value was not significant as well.

These results led us to use another method of calculating the natural rate of unemployment, by means of the moving averages.

However, we got similar results when we used the moving averages of 3 and 4 years, and the same OLS technique was used as the series remained stationary at level. To optimize the results we used the 8-year moving averages. However, this time the series didn't remain stationary at level and this led us to use the ARDL model. After using the 8-year moving averages as NRU and then subtracting it from the original unemployment series gave us a resulting series that was not stationary at level but stationary at first difference. As the unemployment gap is our dependent variable and the independent variable is the output growth gap it was decided to move forward with the ARDL model for the estimation.

This study has used the ARDL model. One of the reasons to have chosen the ARDL model for our estimation in this research is that it is efficient in small sample sizes when compared to its counterparts. Moreover, by applying the ARDL model unbiased long-run estimates are obtained.

The ARDL model specification is as follows

$U_t - U_t^* = \gamma_{io} + \sum_{i=1}^{p} \delta i(U - U^*)_{t-i} + \sum_{i=0}^{q} \beta_i (Y - Y^*)_{t-i} + \epsilon_{it}$ (3.4)

Where $U_t - U_t^*$ is a vector and the variable $(Y - Y^*)$ are purely allowed to be I(0) or I(1) or cointegrated

The δ and β are the coefficients of unemployment and output respectively.

γ is the constant

p and q are the optimal lag orders

ϵ_{it} is the vector for error terms

Our second model has four variables, The unemployment gap is the dependent variable and the growth rate of agriculture, industry, and service sector are the three independent variables.

the model can be specified as

$U_t - U_t^* = \beta o + \beta 1 Growthofagriculture_t + \beta 2 Growthofindustry_t + \beta 3 Growthofservice_t + \epsilon t$ (3.5)

where

U_t is the unemployment rate

U_t^* is the natural rate of unemployment or long-run unemployment

$U_t - U_t^*$ is the unemployment gap

βo is the intercept

$\beta 1$ is the coefficient of the Growth rate of the agriculture sector

$\beta 2$ is the coefficient of the Growth rate of the industry sector

$\beta 3$ is the coefficient of the Growth rate of the services sector

4. Results

This section is dedicated to the assessment of stationarity, which is a critical step in time series analysis. Stationarity is assessed using tests such as the Augmented Dickey-Fuller (ADF) test and the Phillip-Perron test. The results of the stationarity tests are discussed and the implications for the analysis are highlighted.

In order to examine the correlations between variables in a time series setting, the ARDL regression model is lastly utilized. The ARDL regression findings are provided and explained, including coefficients, standard errors, t-values, and p-values.

Table 4.1 Descriptive statistics for model 1

Variable	Obs	Mean	Std. Dev.	Min	Max
U_t	51	4.94549	1.76717	1.69	8.27
$U_t - U_t^*$	44	.3144602	.9475468	-1.945	2.62625
GDPinUSD	51	1.08e+11	1.07e+11	6.38e+09	3.56e+11
Y_t	51	24.8661	1.116367	22.57697	26.5982
$Y_t - Y_t^*$	51	-3.74e-08	.102365	-.4080887	.3066654

The results for the descriptive statistics show five variables: U_t, $U_t - U_t^*$, GDPinUSD, Y_t, and $Y_t - Y_t^*$. For each variable, the table provides the number of observations (Obs), the mean, standard deviation (Std. Dev.), minimum value (Min), and maximum value (Max).

U_t is the unemployment rate that we used, and it has 51 observations. The mean is 4.94 and the standard deviation is 1.76, the minimum value in this series is 1.69 and the maximum value is 8.27. The second variable is $U_t - U_t^*$, which is the unemployment gap, and this is the variable that has been used in the regression.

4.1. Stationarity of the Variables

We have employed the Argumented Dicky-fuller test to check the stationarity of the variables. The results are in Table 4.2

Table 4.2 Agumented Dicky-Fuller (ADF) Test Results

Variable	T-Statistics	1% Critical Value	5% Critical Value	10% Critical Value	P- Value for z(t)
U_t	-1.754	-3.580	-2.930	-2.600	0.4038
U_t at I(1)	-6.672	-3.587	-2.933	-2.601	0.0000
U_t -U_t* at I(O)	-2.631	-4.214	-3.528	-3.197	0.2658
U_t -U_t* at I(1)	-5.931	-3.634	-2.952	-2.610	0.0000
GDPinUSD at I(O)	2.128	-3.580	-2.930	-2.600	0.9988
GDPinUSD at I(1)	-6.672	-3.587	-2.933	-2.601	0.0000
Y_t at I(O)	-0.495	-3.580	-2.930	-2.600	0.8931
Y_t at I(1)	-6.389	-3.587	-2.933	-2.601	0.0000
Y_t -Y_t * at I(O)	-5.348	-4.150	-3.500	-3.180	0.0000

Based on this finding, we accept the null hypothesis that our variable U_t is non-stationary at level I(O) and has a unit root problem, as well as the alternative hypothesis that our variable U_t is stationary and has no unit root at first difference I(1). Additionally, the results indicate that series U_t-U_t* has unit root problems at the level I(O) but not at first difference I(1).

A sample of 43 observations from the years 1979 to 2021 were used for this ARDL (Autoregressive Distributed Lag) regression analysis. Both the response variable (U_t - U_t*) and the predictor variable (Y_t - Y_t*) have one lag in the model. The model's significance is demonstrated by the results, which have a Fstatistic of 16.62 and a probability of less than 0.0000. The results suggested that the projected Okun's coefficient in this situation is -2.90, indicating that a 1% departure from the trend in real GDP would be accompanied by a negative 2.90% change in the unemployment rate. On the other hand, to check the cointegration in the long run, we carried out the bound test for ARDL. Cointegration analysis showed that there is a long-term cointegration of the output and unemployment gaps. We accepted the null hypothesis at the 1%, 5%, and 10% significance level.

The second model in which the relationship between sectoral growth rates and the total unemployment gap has been estimated. Like the first model, it starts with descriptive statistics, followed up by stationarity tests, diagnostics tests, and finally the OLS regression followed up with robust regression as a remedial measure.

4.3 Descriptive Statistics for Model 2

Variable	Obs	Mean	Std. Dev	Min	Max
$U_t – U_t$*	51	2.06e-09	.6527084	-1.229134	1.756167
Growthofagriculture	51	3.318235	3.135735	-5.29	11.72
GrowthofIndustry	51	5.856275	4.441646	-7.8	16.38
Growthofservices	51	5.741765	3.150426	-1.21	21.45

4.4. Augmented Dicky-Fuller ADF test Results for model 2

	T-Statistics	1% CV	5% CV	10% CV	P-Value z(t)
U_t-U_t*	-3.923	-4.150	-3.500	-3.180	0.0113
Growthofagriculture at I(O)	-3.580	-3.580	-2.930	-2.600	0.000
Growthofindustry at I(O)	-4.920	-3.580	-2.930	-2.600	0.000
Growthofservicesat I(O)	-5.841	-3.580	-2.930	-2.600	0.000

After considering the ADF test results we conclude that the variables U_t-U_t* Growthofagriculture, Growthofindustry, and Growthofservicesat are stationary at level.

The results of VECM showed that the growth has a positive coefficient and the P-value is statistically significant which means that as the growth of the Industry sector increases the unemployment gap also increases, ultimately having a positive influence upon particularly unemployment rate, this relationship can be interpreted by the dynamics of the Industry sector. When there is a growth in the Industry sector the producers tend to buy more capital goods in order to increase productivity or cut cost.

5. Conclusion

Okun's Law makes a very logical argument that each time there is a rise in aggregate demand or total output, there should be an increase in employment, thus affecting the unemployment level negatively. Similarly, whenever there is a decline in the total output there should be a reduction in the employment rate affecting the unemployment rate positively.

The coefficient of the second lag of the variable output gap in our research is -2.9 which is very close to the original Okun(1962) coefficient. Moreover, the growth rates of the three major sectors don't have a substantial impact on the total unemployment rate according to our statistical analysis.

In compliance with the results of this study, the Okun relationship weakly exists within Pakistan.

There is significant proof suggesting that Okun's law is effective in developed nations but it's not valid in Pakistan as it is a developing country and the reason why it might be the case is as follows.

1) Issues With The Data.

While collecting the historical data on unemployment the authors had to go through a historical collection of economic surveys of Pakistan which are not easily available on the internet.

The data available for recent years are gaps in the data as the data for 2015, 2016, and 2019 were not even available, which might have affected the results. Furthermore, the data is only available on a yearly basis, not a quarterly basis, for all of the variables used in this research. Okun (1962) used quarterly data in his findings. We point this out because the value of lambda in the HP filter is based on the type of data, whether quarterly or yearly.

Finally, we would like to point to the authenticity of the data that is available. For instance, the unemployment rate of Pakistan has never been more than 8.27%, no matter what the economic situation throughout its history.

Considering all the above-mentioned points on our suspicion of the authenticity of the data, we believe it could be one of the main driving factors why Okun's relationship might not be valid or weak in Pakistan.

2) Informal Sector

The informal sector in Pakistan plays a significant role in the country's economy, yet it is often overlooked in economic analysis and policymaking. According to the Economic Survey of Pakistan 2021, a significant percentage of the labor force in Pakistan is employed in the informal sector. However, the income generated from this sector is often low and those employed in it are subjected to poor working conditions and high income instability. Arif (2020) has also highlighted this issue in her research, emphasizing the need to pay more attention to the informal sector in economic analysis and policy-making. The informal sector is a vital source of livelihood for a large number of people in Pakistan and addressing the issues faced by those employed in it is crucial for the overall economic growth of the country. The government must take measures to support the informal sector and provide better working conditions and increased income stability to those employed in it. This can be achieved through initiatives such as providing training and support to improve the productivity and competitiveness of informal sector workers, as well as providing access to financial services and resources. By addressing the challenges faced by the informal sector, the government can contribute to more inclusive and sustainable economic growth in Pakistan.

3) The Economic Structure

The economy of Pakistan is a multifaceted entity that is influenced by a range of internal and external factors. One of the most notable features of the Pakistani economy is the changing composition of its Gross Domestic Product (GDP), which is largely contributed by three primary sectors: Agriculture, Industry, and Service. While the Agriculture sector has traditionally been a dominant player in the Pakistani economy, its share of the total GDP has declined significantly in recent years. In the past, the Agriculture sector contributed about 45% to the GDP but now, it only contributes about 20%. Despite the decline, the Agriculture sector still employs a large number of workers, accounting for approximately 35% of the total labor force in the country.

This trend of declining contribution to the GDP by the Agriculture sector is an indicator of structural changes in the economy of Pakistan. It also highlights the fact that there has been a failure in successfully transferring new skills to the labor force in the sector. As the Industry and Service sectors require more skilled labor, this could have led to a decline in the Agriculture sector's contribution to the GDP. To maintain sustainable economic growth and development, it is essential to invest in human capital and provide workers with the necessary skills to transition to other sectors.

4) Legal

The inclusion of children aged 10 in the labor force in Pakistan is a serious issue that goes against the provisions of the constitution. According to Article 13(3) of the Constitution of Pakistan, the legal age for an individual to be counted as part of the labor force is 14 years. However, in reality, children as young as 10 years old are often included in the labor force, as highlighted in various economic surveys of the country. This is a clear indication that child labor continues to be a widespread problem in Pakistan, and the use of child labor is often used to manipulate the numbers and obscure the true extent of the issue. Child labor is a violation of the rights of children and has a serious impact on their physical, mental, and emotional development. The exploitation of children in the workforce also undermines the dignity of labor and contributes to the perpetuation of poverty. To address this issue, the government of Pakistan must take concrete steps to enforce the provisions of the constitution and ensure that children are protected from exploitation in the workplace. This will require a concerted effort by all stakeholders, including the government, employers, and civil society, to promote the rights of children and ensure that they are not subjected to labor that is harmful to their well-being. Okun's law is a macroeconomic relationship that states that there is a negative correlation between the unemployment rate and the rate of economic growth. The law has been observed to be more applicable in developed countries, such as the United States, due to several reasons. Firstly, developed countries have better institutions and more robust data collection and reporting systems, which enable accurate and comprehensive measurement of economic variables. This data availability is crucial in applying and testing the validity of Okun's law.

Secondly, the availability of education and the efficient transfer of new skills to the labor force are also factors that contribute to the applicability of Okun's law in developed countries. In these countries, the population has better access to quality education and training, which allows them to adapt to the changing demands of the labor market. This leads to a more efficient use of labor resources and a higher level of productivity, which is reflected in the relationship between unemployment and economic growth.

In contrast, the situation in Pakistan is quite different, as the population is deprived of basic facilities such as health and education. This lack of access to education and training, along with a weaker institutional framework, leads to a less efficient use of labor resources and a lower level of productivity. These factors make it more difficult to apply Okun's law in Pakistan and to accurately measure the relationship between unemployment and economic growth. Therefore, to improve the applicability of Okun's law in Pakistan and to achieve sustained economic growth, it is crucial to address these underlying issues and to provide access to quality education and training for all citizen

6. Policy Recommendation

The results of this study have important implications for policymakers in Pakistan. The findings suggest that by increasing the positive gap in GDP growth, the unemployment gap can be reduced. This information can be used by policymakers to design and implement effective economic policies that aim to reduce unemployment and increase output growth. It is recommended that policymakers ensure the availability of accurate and transparent data on unemployment and GDP growth. This is crucial in making informed decisions and evaluating the effectiveness of economic policies. The absence of reliable data can result in incorrect conclusions and ineffective policies. Hence, it is important for the government to ensure that the data collected is not fabricated or hidden from the public and is easily accessible for analysis and evaluation. By providing accurate and transparent data, policymakers can make informed decisions that will have a positive impact on the economy and the well-being of the citizens of Pakistan.

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