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IMPACT OF ECONOMIC GROWTH ON UNEMPLOYMENT: EVIDENCE ON OKUN'S LAW FROM PAKISTAN

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ABSTRACT

This research aims at analyzing the impact of changes in GDP and its expenditure components on unemployment in order to validate Okun's Law in Pakistan. The responsiveness of unemployment rate with respect to changes in gross domestic product and its expenditure on changes was examined for Pakistan by using aggregate and disaggregated annual data from 1971 to 2023. The first difference version of Okun's Law was applied on both approaches i.e. aggregate and disaggregated approach to validate the law. For both versions of the law, we apply ordinary least squares method (OLS). The estimated results from both approaches confirm the validity of Okun's law for Pakistan in the sample period. The main finding from the disaggregated approach is that the consumption component of GDP has the largest impact on unemployment in Pakistan. The Okun's coefficient for consumption is -2.32 which is significant at 10 percent level. The government expenditure has the second highest impact on the unemployment rate after consumption. Based on results from both aggregate and disaggregated approaches, it is suggested that policy makers in Pakistan must give especial attention to sustainable economic growth to reduce unemployment rate in Pakistan. Specifically, they must focus consumption and government expenditures to enhance levels of employment for the youth of the country.

Keywords: Okun's Law, Unemployment, Ordinary Least Square, GDP and its expenditure components, JEL Classification Code: E2, E21, E24, C22.

INTRODUCTION

Macroeconomic theory suggests an inverse relationship between unemployment and economic growth. An increase in economic growth creates employment opportunities which in turn result in decrease in unemployment and vice versa. This inverse relationship between unemployment and GDP growth is embodied into a famous macroeconomic law called Okun's law named after Arthur M. Okun (1962) - its founder.

Unemployment is a major economic problem for almost every country of the world. Joblessness has a staunch punishing impact on society because the life of the most people starts regressing once they get unemployed. This in turn translates into emotional agony and mental misery. This is why unemployment is a popular slogan in political campaigning (Mankiw, 2012). The effect of joblessness is distributed disproportionately which turns it into a hot administrative issue and equally critical economic headache (Parkin, 2011).

Unemployment is considered as a key macroeconomic issue in every economy because increased rate of unemployment means that labor resources – an abundant factor of production in the most developing and under-developed countries, are not utilized optimally which result in reduced levels of output (Mavikela, 2019; Khalid et al., 2021; Vang, 2021; Hjazeen et al., 2021; and Shah et al., 2022). Mavikela (2019) considers slow economic growth rates and increasing unemployment rates as main challenges facing developing countries. The study argues that increase in unemployment translates into inefficient use of human capital making it a key macroeconomic problem. Mavikela (2019) not only considers unemployment as a macroeconomic problem facing many economies in the world but it also argues the persistent rate of unemployment translates not only into discouragement of potential workers but it also affects skills of the workers inversely. The study further suggests unemployment also causes physical and mental illness to labor force which is one of the biggest challenges to health and welfare systems of the countries facing high levels of unemployment. Ultimately, the joint effect of all these negative repercussions of unemployment is manifested on economic growth.

Economic Growth defined as an annual percentage growth rate of GDP is a major determinant of unemployment. Economic theory

and empirical evidence worldwide show an inverse relationship between unemployment and economic growth. As an economy reports positive GDP growth, employment also increases which in turn causes unemployment to fall. In other words, a decrease in unemployment rate means more workers work now and contribute to economic growth. Because more people work in an economy, they definitely produce more goods and services. Conversely an increase in unemployment rate means less people are employed for production of goods and services which consequently translates into lower GDP growth. This inverse relationship between unemployment and GDP growth or positive relationship between employment and economic growth was first evaluated by Arthur M. Okun (1962), a prominent American Economist.

The inverse association between GNP/GDP and unemployment has become a major economic regulation and named as "Okun's Law" to honor its founder. Blinder (1997) terms it as a "truly sturdy empirical regularity" that constitutes part of "the core of practical macroeconomics that we should all believe". Dornbusch, et al. (2011), Romer (2012) and Mankiw (2012) incorporate Okun's Law as "an empirical regularity" in their renowned textbooks.

Okun (1962) observed that the unemployment rate declined in the years when the real growth rate was high, whereas the unemployment rate increased in the years when the real growth rate remained low or even negative. This point offers the academic foundation of the link between unemployment and growth: the lesser number of unemployed people means that more are working in an economy and producing more of goods and services resulting into higher economic growth (Knotek II, 2007). Higher economic growth in an economy implies higher rates of employment and thus reducing the number of unemployed people (Higgins, 2011)

The simple equations presented by Okun (1962) showing statistical association between the degree of joblessness and GDP have been applied as rules of thumb since that time (Knotek II, 2007). In addition to showing negative link between output and unemployment theoretically, Okun (1962) made empirical estimations in order to quantify the very size or magnitude of this causal relation. The estimated results of Okun (1962) reveal a ratio of 1:3 showing that

number of unemployed people will reduce at the rate of one percent when output grows at the rate of three percent.

LITERATURE REVIEW

There is handsome pool of literature on Okun's Law investigating its validity through time series as well as cross section data around the globe. Studies around the world present mixed evidence on whether this law holds relevant in different times and over different geographical regions. Some studies validate its significance and relevance across different cross sections and time periods and many other researches refute it. However, in this article we present the relevant literature on Okun's law in Pakistan. We turn to a brief review of the literature that focuses on testing whether Okun's Law stands valid in Pakistan. Javeid (2005) checked validity of Okun's Law in Pakistan by estimating first difference version of the Law. He applied Engle-Granger and ECM techniques on yearly time series of 25 observations (i.e. 1981-2005). The study confirms that Okun's Law holds in Pakistan by the reporting long run negative link between output and unemployment. The value of Okun's coefficient is -0.028 which is, however, statistically insignificant.

Whereas Hussain, et al. (2010) estimated the production function version of the Okun's Law to analyze coherent relationship between economic growth and unemployment in Pakistan. Using Johansen co-integration method and VECM on annual (1972-2006) data, the study finds that the growth and unemployment are positively correlated. The coefficient of unemployment is 0.182 which indicates that a one percent increase in unemployment causes output growth to increase by 0.182 implying a positive relationship which contradicts the validity of Okun's law.

Ahmad, et al. (2011) also examines whether Okun's law holds in Pakistan. Like Hussain, et al. (2010), the findings of Ahmad, et al. (2011) also bears no testimony to prove the validation of this law in for Pakistan. They estimated first difference and gap versions by using ordinary least squares method. The Okun's Coefficient from the difference version is -0.467. Though correctly signed this value is much lower than the expected Okun's coefficient ranging between 2 and 3. Thus the main conclusion of this study is that validity of Okun's law is refuted in Pakistan. Another study on Pakistan testing the

validity of Okun's law is Batavia and Salam (2012). The gap version of the law was estimated on annual data from 1985 to 2010. The estimated Okun's Coefficient from the ARDL -0.002 which is insignificant at all levels. This implies that there is no postulated Okun's relationship between unemployment and output. Khan, et al. (2013) also used the Gap Version to estimate the Okun's coefficient for Pakistan. Applying the ordinary least square method and the gap version on annual data (1976-2010), they however revealed that Okun's law holds in case of Pakistan albeit with coefficient of -0.36.

Akram, et al. (2014) however, adopted a relatively more comprehensive approach by estimating Okun's law through three different versions i.e. gap, difference and dynamic versions. The study applies ordinary least squares methods on the gap, difference and dynamic versions of the law. GDP was used as a dependent variable and regressed on unemployment as an independent variable. The estimated Okun's coefficients from the three versions are -6.44E-12, -0.247 and -0.185. According to Akram, et al. (2014) the estimated coefficient values are much less than the expected values of Okun's coefficient i.e. 2 to 3 refuting any substantial evidence in favor of the law.

Faridi et al. (2015) examined the impact of GDP on levels of unemployment with a view to validate Okun's Law in Pakistan. Though this study also used first difference version but unlike other studies on Pakistan i.e. (Akram, et al., 2014 Khan, et al., 2013; Batavia and Salam, 2012; Ahmad, et al., 2011; and Hussain, et al. (2010), it uses unemployment rate as a dependent variable and regresses on changes in GDP. The estimated coefficients from Faridi et al. (2015) are -0.63 and -0.032 in the long run and short run respectively. These findings were obtained by estimating of change model/first difference version and use of auto-regressive distributed lag model on annual data (2074 -2014). The results reconfirm findings of Khan, et al. (2013). Shah et al. (2022) studies the impact of unemployment on economic growth using annual data from 1974 to 2020 and ARDL estimation technique. The studies finds that there is a significant inverse relationship between unemployment and economic growth.

RESEARCH GAP AND MOTIVATION

Many countries, despite recording impressive and robust economic growth post Great Recession of 2007-2009, have not shown expected decrease in unemployment rates (Pehlivanoglu and Tanga,

2016) as suggested by Okun's law. Hence there is a need to validate Okun's Law. We limit our study to Pakistan and evaluate whether postulated inverse relation between unemployment rate and GDP growth exists in Pakistan. As discussed in the review of literature above, there are a few studies on Pakistan. The empirical findings of these studies present mixed evidence on validity, relevance and significance of Okun's Law in Pakistan. Javeid (2005); Hussain, et al. (2010); Khan et al. (2013) and; Faridi et al. (2015) reveal that the direction of the impact of economic growth on unemployment is the same as expected (negative) but the magnitude of the Okun's coefficient is far lower than 3. Conversely Ahmad et al. (2011) and Batavia and Salam (2012) report no validity of Okun's law in Pakistan.

Another research gap on which this paper is based is the size of the sample. Annual data from 1971 to 2023 is used for analysis. This is the largest sample ever used in the case of Pakistan. However, the most important gap that this study is going to fill or adding value to the existence literature on Okun's law is use of a disaggregated approach. Following Anderton et al. (2014); Andonova and Petrovska (2018) and Hashmi, et al., (2021) this study uses not only aggregated approach to estimate changes in unemployment caused by changes in overall level of output i.e. GDP but also uses a disaggregated approach to capture the differential impact of individual expenditure components of GDP. In other words, this study will also examine how unemployment changes with changes in household consumption expenditure, investment expenditure, government expenditure, exports and imports. No study in Pakistan has ever used this approach to validate Okun's law. The disaggregated approach not only increases the explanatory power of each model but it also helps in estimating individual effect of different components of GDP. This latter prospect of this approach has great policy implications at macroeconomic levels. It helps the policy makers and the governments to find the target component of GDP that has relatively larger impact on unemployment.

METHODS AND MATERIALS

We check validity of Okun's law in Pakistan by using two approaches to the law. The first difference version of the Okun's law has been empirically applied on aggregate and disaggregated approaches to determine Okun's Law Coefficient (OLC) for Pakistan.

Model Specification

Specific models/versions of Okun's law that will be estimated for Pakistan are discussed below. The equation 4.1.1 presents the aggregated approach to the law in the differenced version.

$$Un_t - Un_{t-1} = \alpha + \beta(Y_t - Y_{t-1}) + \varepsilon_t \quad 4.1.1$$

Where e and Un_{t-1} stand for unemployment rate at one time prior to time t or the first lag of the unemployment rate. Similarly Y_t and Y_{t-1} represent economic growth rate in the present period and one time prior to it, respectively. The equation 4.1.1 presented above can also be written in difference notation as in 4.1.2

$$\Delta U_t = \alpha + \beta \Delta Y_t + \varepsilon_t \quad 4.1.2$$

Where: $\Delta =$ Difference operator

Delta sign i.e. Δ refers to change or difference in a variable between two time periods. The coefficient of economic growth (Y_t) i.e. β is Okun's coefficient or Okun's Law Coefficient (OLC) which measures the direction and size of the effect of growth of real GDP on rate of joblessness. This OLC has primary importance in estimating version of the law as the decision to accept validation of Okun's law is based on the value of the estimate.

However, equations (4.1.1) and (4.1.2 do not estimate the disaggregated or decomposed effect of individual constituents of the national product on the joblessness. In order to check the individual effects of variations in parts of aggregate demand on the joblessness, equation 4.1.3 is estimated. Following Anderton, et al. (2014); Andonova and Petrovska (2018) and; Hashmi, et al., (2021) we augment Okun's differenced equation given in 4.1.2 above to decompose changes in aggregate GDP into its expenditure components i.e. consumption (C), government expenditures (G), investment (I), exports (X), and imports (M) and present it as equation 4.1.3 below:

$$\Delta Y_t = \Delta \sum GDP_t \approx \sum_g \left[\frac{GDP_{gt}}{\sum_g GDP_{gt}} \right]$$

(4.1.3)

$$\Delta GDP_{gt} = \sum_g \lambda_{gt} \Delta GDP_{gt}$$

Where λ_g represents relative percent share of each expenditure component of aggregate demand (GDP) i.e. consumption, investment and government expenditure, export and imports. Substituting 4.1.3 into 4.1.2 we obtain the equation 4.1.4.

$$\Delta U_{it} = \alpha + \sum_g \beta_{gt} \lambda_g \Delta GDP_{g,t} + \omega_t$$

(4.1.4)

However, in equation 4.1.4 we cannot estimate differential impact of GDP components as β calculates a single Okun Coefficient. Therefore, we need to estimate a separate β*g* for each of the components. We can do this by augmenting the model (4.1.4) by substituting the components of GDP as equation (4.1.5) below:

$$\Delta U_t = \alpha + \beta_1 \lambda \Delta C_t + \beta_2 \lambda \Delta I_t + \beta_3 \lambda \Delta G_t + \beta_4 \lambda \Delta X_t + \beta_5 \lambda \Delta M_t + \omega_t$$

(4.1.5)

Each β measures differential impact of GDP components. That is each component has a different coefficient. $\beta_1, \beta_2, \beta_3, \beta_4$ and β_5 are coefficients of consumption, investment, government expenditure, export and import respectively. First four βs are expected to be negative while the coefficient of imports (β_5) is supposed to have a positive sign.

Data Type, Sources and Definition of Variables

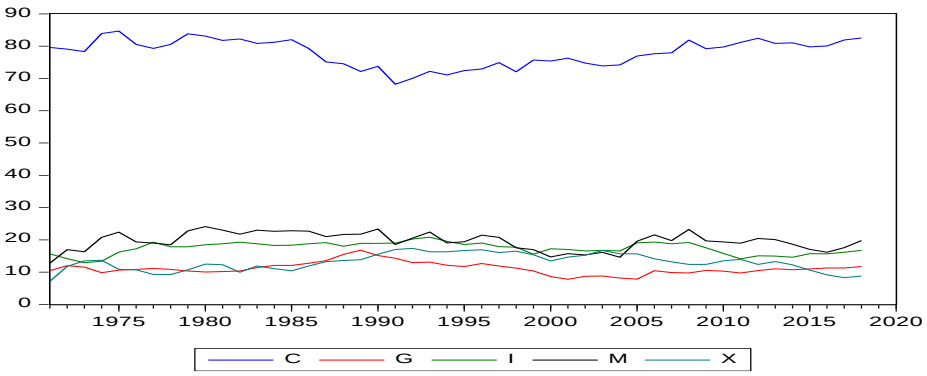
Seven variables have been used in this study that include unemployment rate, GDP, and five of its decomposed constituents (i.e. consumption, investment, government expenditure, exports and imports). The data on all the variables have been taken from World Bank World Development Indicators. For output, gross domestic product at current US$ has been used in the analysis.

Unemployment rate is the main variable in this research article as it has been used as a dependent variable in all equations. Households

and final consumption expenditure (current US$) has been used as an indicator of consumption (c_t). Gross fixed capital formation has been used an indicator of investment (i_t) in the analysis. Whereas General government final consumption expenditure has been used as an indicator of government expenditure (g_t). Exports of goods and services is used as an indicator for exports (x_t). Similarly, the indicator of imports variable (m_t) is imports of goods and services retrieved from WDI.

The expenditure components of GDP have been used as a percentage of GDP in the analysis. The figure 4.1.1 shows the share of each component in GDP of Pakistan since 1971. It can easily be seen that consumption is the largest component of Pakistan's GDP. Its average percentage share in total output is around 78 percent. Whereas it's minimum and maximum values for the 53 years are 68.21 and 84.66 respectively. The average percentage shares of other components in GDP of Pakistan in study periods are 17.40, 11.16, 13.07 and 19.61 respectively for investment, government expenditure, exports and imports respectively.

FIGURE 4.2.1
PERCENTAGE SHARE OF EXPENDITURE COMPONENTS OF GDP FOR PAKISTAN



Note: *C, G, I, M and X stand for consumption, government expenditure, investment, imports and exports respectively. The numbers on the vertical axis are in percentage showing the share of each component in total GDP of Pakistan.*

Econometric Analysis Techniques

In paper, we estimate the first difference version of Okun's law to examine the impact of GDP and its expenditure components on unemployment. For both approaches to the law, we apply ordinary least squares method. Applying OLS on the first difference version is very common as many major studies have applied this technique for analysis [Smith (2010), Akram, et al. (2014), Soylu (2018) and Vang (2021)]. But many economists have also used OLS to estimate the relationship between unemployment and GDP growth. Major studies in applying OLS include Akram (2014); Canarella and Miller (2017); Parenparaj and Gnanachandran (2021) and; Vang (2021). Further, Augmented Dickey-Fuller (ADF) and Phillips and Perron tests are used to check for stationarity in the variables.

RESULTS AND DISCUSSIONS

The results and discussions are divided into two subsections i.e. descriptive analysis and regression analysis.

Descriptive Analysis

The descriptive analysis of all variables used in the analysis including gross domestic product, unemployment rate, consumption, investment, government expenditure, exports and imports is presented based on a graph showing the growth of the variable over time, mean, median, maximum, minimum values and standard deviation of each variable. The table 5.1.1 gives mean, median, maximum, minimum and standard deviation values for all the variables used in this research.

TABLE-5.1.1

DESCRIPTIVE ANALYSIS OF ALL VARIABLES

Variable	Mean	Median	Maximum	Minimum	SD	JB
Unemployment Rate	4	4	8	0.40	2	1
GDP	97,100	6,520	315,000	6,320	91,900	9
Consumption	87,859.84	51,430.42	296,396.80	5682.68	85913.88	10
Investment	14,782.45	9,629.33	47,625.85	723.26	13,107.84	8
Government Exp:	10,591.01	6,515.99	36,847.25	730.645	10,137.79	11
Exports	11,825.14	9,804.44	30,699.24	757.23	9,652.00	5
Imports	18,614.73	10,881.34	62,128.84	1,031.19	17,291.83	8

Note: *Data on GDP of Pakistan are taken from World Bank's World Development Indicators (WDI). The values are in the millions of US $. SD and JB stand for Standard Deviations and Jarque-Bera respectively. The unemployment rate is the percentage of unemployed people from the total labor force.*

However, table 5.1.2 offers a more important descriptive analysis. Instead of showing the absolute values of the expenditure components in US $, this table offers analysis of the variables as percentage of GDP of Pakistan. The variables used in the estimated models in the current research are used as percentage of GDP.

TABLE-5.1.2
DESCRIPTIVE ANALYSIS OF EXPENDITURE COMPONENTS AS % OF GDP

Variable	Mean	Median	Maximum	Minimum	SD	JB
Consumption as % of GDP	77.97	79.22	84.67	68.22	4.14	2.95
Investment as % of GDP	11.17	10.92	16.78	7.78	1.86	6.87
Government Expenditure as % of GDP	17.41	17.87	20.82	12.93	1.86	2.94
Exports as % of GDP	13.07	13.26	17.36	7.14	2.62	1.62
Imports as % of GDP	19.62	19.71	24.10	12.79	2.72	2.23

Note: *The percentage share is obtained by dividing the component value in USD by GDP in USD. SD and JB stand for Standard Deviations and Jarque-Bera respectively.*

It can easily be seen from table 5.1.2 that consumption is the largest component of GDP of Pakistan over the study period. The mean value of consumption for the fifty years is around 78 percent of GDP. It implies that it contributes 78 percent to the GDP of Pakistan. The maximum value that the consumption has assumed from 1971 to 202**2** is 84.67 percent while its minimum value for the same sample period is 68.22 percent. The standard deviation of consumption remained 4.14 during this period.

Imports of goods and services remain the second largest component of GDP with 19.62% contribution to GDP of Pakistan. Its value is markedly greater than imports of goods and services over the study period implying the huge trade deficits for Pakistan. After consumption and imports, investment remains the largest component of GDP of Pakistan followed by exports and government expenditure in that order. The mean values of imports, exports and government expenditure over the sampling period are 17.41, 13.07 and 11.17 respectively**.**

Time Series Properties

Augmented Dicky Fuller has been widely used in empirical time series literature for testing non-stationarity of the data. It is based on the following equation:

$$: \Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_1 \Delta Y_{t-i} + \varepsilon_t \qquad (5.2.1)$$

Where Y_t and ε_t refer to stochastic time series process and white noise error term respectively. The test in equation 5.2.1 follows a random walk with drift (β_1) and a deterministic trend (t). Null of Unit root test implies that $\delta = 0$. The null of unit root is not rejected if calculated *t*-values are greater than the critical ones. In other words, if calculated *t*-values are greater than the critical ones, the null hypothesis that the data is not stationary is accepted. On the other hand, if calculated *t*-values are lower than the critical ones, null of unit root is rejected.

ADF test is applied in this study on all the variables used in the estimation to check whether they are stationary (or non-stationary). As we have used annual data, automatic lag length has been used based on Schwarz Information Criterion (SIC) for estimation of ADF test. The ADF tests results in log levels are presented in table 5.2.1. It appears from the results; we cannot reject the null hypothesis of unit root for all variables used in the analysis of the present research. This implies, in other words, no variable of the interest is stationary at levels. Further, figure 5.2.1 portrays the data in log levels and confirms the ADF results in table 5.2.1. The trend line in the graph of each variable in the figure shows the presence of non-stationarity in each of the variables.

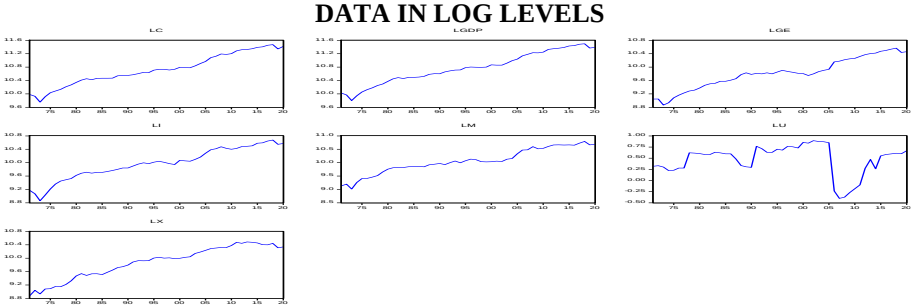
TABLE-5.2.1
ADF TEST IN LOG LEVELS

Variable	Constant	Constant and Trend
gdp_t	-0.912165	-2.019185
u_t	-2.508987	-2.489574
c_t	-0.610939	-2.328794
i_t	-1.155424	-3.274553
g_t	-0.932759	-1.803481
x_t	-2.234227	-0.923002
m_t	-1.592216	-2.367542
5% critical values	-2.922449	-3.504330

Note: *In estimation of ADF tests, automatic lag length has been used based on Schwarz Information Criterion (SIC). And 5% one sided critical values are taken from McKinnon (1996). Annual da**ta for the period 1971 to 2023 is** used. Variables used are gdp_t u_t, c_t, i_t, g_t, x_t and m_t which represent gross domestic product, unemployment rate, consumption, investment, government expenditure, exports and imports respectively.*

Because of the presence of non-stationarity in the data, we took the first difference of all variables and ran the ADF test again. The results from the differenced data are shown in Table 5.2.2. The ADF test results for the differenced data show that hypothesis of presence of non-stationarity cannot be accepted for all variables except exports of goods and services (x_t). This variable is non-stationary in both specifications. The estimated values for all variables except exports (x_t) are significantly greater in absolute values than the critical values at five percent level of significance. Therefore, it can be concluded that all variables of interest, except exports, are stationary at first difference. Alternatively, it can be stated that all variables, except exports, are stationary and are of integrated order one that is *I* (1).

FIGURE-5.2.1
DATA IN LOG LEVELS



Note: *The graphs in figure 1, represent data in log levels for* gdp_t u_t, c_t, i_t, g_t, x_t *and* m_t *which represent gross domestic product, unemployment rate, consumption, investment, government expenditure, exports and imports.*

TABLE-5.2.2
RESULTS OF ADF TEST IN FIRST DIFFERENCE

Variable	Constant	Constant and Trend
Δgdp_t	-6.123340 [a]	-6.182737 [a]
Δu_t	-6.087988 [a]	-6.021653 [a]
Δc_t	-6.582417 [a]	-6.558803 [a]
Δi_t	-5.484161 [a]	-5.578184 [a]
Δg_t	-6.070452 [a]	-6.050866 [a]
Δx_t	1.707913	-2.872310
Δm_t	-7.342137 [a]	-7.411689 [a]
5% critical values	-2.923780	-3.506374

Note: *Superscript a indicates the significance of the variable at 5 percent significance level. In estimation of ADF tests, automatic lag length has been used based on Schwarz Information Criterion (SIC). And 5% one sided critical values are taken from McKinnon (1996). Annual data for the period 1971 to 2023 is used.*

FIGURE-5.2.2
DATA IN FIRST DIFFERENCE

Note: *The graphs in figure 1, represent data in log for* gdp_t u_t, c_t, i_t, g_t, x_t *and* m_t *which represent gross domestic product, unemployment rate, consumption, investment, government expenditure, exports and imports respectively.* Δ *is the first difference operator.*

As export variable was non-stationary at both specifications from the ADF test, we applied the Phillips and Perron test for checking stationarity/non-stationarity of the variables. The estimated results at levels from Phillips and Perron unit root tests are given in table 4.2.3. Results from this test show that all variables are non-stationary at levels. Thus results from this test at levels are similar to those from ADF. However, unlike ADF, the Phillips and Perron test results at first difference show that all variables including exports of goods and services are stationary at first difference. Therefore, we conclude that variables used in the analysis of this dissertation are stationary at first difference.

Estimated Results from Regression Analysis

We apply two different approaches/equations to validate Okun's law in Pakistan. First, we use the aggregate approach to examine overall impact of GDP growth on unemployment in Pakistan. Secondly, we use disaggregated approach to study individual effects of each component of GDP on unemployment. The first difference version of the Okun's law as given in equation number (4.1.2) in methods and materials section is used for both approaches. The first difference version of Okun's Law measures the effects of current or

contemporaneous changes in gross domestic product on the rate of unemployment rate.

The estimated results from the aggregate approach from first difference version of Okun's law are given in table 5.3.1 below:

TABLE-5.3.1
OKUN'S COEFFICIENT FOR PAKISTAN
FROM FIRST DIFFERENCE VERSION: AGGREGATE APPROACH

Sample		1971-2023
Variable	Okun's Coefficient	T-Statistics
Δgdp_t	-1.829	-0.517344
	(3.537)	
Constant	0.101	0.493551
	(0.205)	
Observations		53
R^2		0.11
F-Statistics		0.276

Note: Standard error values are given in parenthesis. Our dependent variable is changes in the unemployment rate i.e. Δu_t . Δ represents the first difference operator.

The value of Okun's coefficient from the first difference version is -1.829. The sign of the coefficient is as expected showing the inverse relationship between unemployment rate and gross domestic product. The magnitude of the coefficient i.e. -1.829 shows that a one percent increase/decrease in gross domestic product decreases/ increases unemployment rate by -1.829 percent. However, the value of the Okun's coefficient from the first difference version for the aggregate approach is insignificant at all levels. The overall significance of model shown by F-statistic i.e. 0.276 is also insignificant. Further, the value of r-squared is 0.11 which is also very small. This implies that gross domestic product explains only 11 percent variation in unemployment rate in the case of Pakistan.

Moreover, another important finding from the results of aggregate approach to the first difference version of Okun's law is the

ratio ($-\frac{\beta_0}{\beta_1}$) which finds outs the rate of output growth or changes consistent with a stable unemployment rate. In other words, this ratio tells us how quickly the economy would typically need to grow to maintain a given level of unemployment (Knotek II, 2007). Our findings show that value of this ratio i.e. $-\frac{\beta_0}{\beta_1}$ is -0.05. This means that gross domestic product gdp_t must grow at the rate of at least five percent in order to make the unemployment rate unchanged. Alternatively, this implies that if the policy makers do not want unemployment to decrease from a given rate they must ensure that the economy grows at least by 5 percent. This in other words could be interpreted as the required level of economic growth by holding the unemployment rate constant through time (Sadiku-et al., 2015).

As we have seen from the results of the first difference version to aggregate approach in table 5.3.1 that despite correct sign and reasonable magnitude, the Okun's coefficient as well overall model are insignificant as seen from small t-Statistic and F-statistic values at all levels. The explanatory power of the model (seen from r-squared value) is also small. Therefore, we cannot rely on the findings of results from the aggregate approach. Therefore, we used the disaggregated approach of the first difference version (Anderton, et al., 2014).

The disaggregated approach allows us to estimate Okun's coefficient for each expenditure component of GDP instead of calculating a single Okun coefficient for GDP. The disaggregated model shown as equation 4.1.5 was estimated using ordinary least squares following Smith, 2010; Akram, et al., 2014; Soylu, et al., 2018; and Vang, 2021. The estimated results are presented in table 5.3.2. The estimated results of the first difference version of Okun's law through disaggregated approach are given in table 5.3.2. The results from the aggregated approach are robust compared to the aggregated approach. The coefficients of all variables are significant and mostly with expected signs. The explanatory of the model has increased from 0.11 in the aggregated approach to 0.94 in this approach.

TABLE-5.3.2
OKUN'S COEFFICIENT FOR PAKISTAN FROM FIRST DIFFERENCE VERSION: DISAGGREGATED APPROACH

Variable	*Okun's Coefficient*	*T-Statistics*
Δc_t	-2.320^{***}	-2.537
	(0.914)	
Δi_t	-0.846	-1.696
	(0.498)	
Δg_t	-1.789^{***}	-2.142
	(0.835)	
Δx_t	1.615^{**}	3.949
	(0.409)	
Δm_t	1.160^{***}	2.149
	(0.540)	
Constant	20.594^{***}	3.717
	(5.539)	
Observations	53	
R^2	0.94	
F-statistics	6.41	

Note: Standard error values are given in parenthesis. Our dependent variable changes in the unemployment rate. Δ represents the first difference operator. Furthermore, c_t, i_t, g_t, x_t, and m_t stand for private/household consumption, total investment, government expenditures, exports, and imports respectively at time t. Superscripts **and *** show significance of estimated parameters at, 5%, and 10% level respectively.

The Okun's coefficient for the individual expenditure components from the disaggregated approach denote the differential impact of the components of aggregate demand/expenditure on unemployment, which varies considerably depending on which expenditure component is driving GDP – the absolute values range from over 2.32 for consumption to around 0.84 for investment. The

Okun's coefficient for consumption is the largest of all and significant at 10 percent level. This implies that unemployment is relatively more sensitive or elastic with respect to the consumption component of GDP. This seems intuitively correct because consumption expenditure of the people is labor intensive in nature than other components (Anderton, et al., 2014). The unemployment in Pakistan seems to be the least responsive to changes in investment with the parameter estimate of -0.846 for the Okun's coefficient. This implies that investment in Pakistan is going to adopt relatively more capital intensive technology.

The other estimates for individual Okun's coefficients are -1.789, 1.615, 1.16 respectively for government expenditure, exports and imports. The Okun's coefficient for exports is against its hypothesized sign. Instead of having a negative sign, it has a positive sign. This means unemployment in Pakistan increases with respect to increase in exports and vice versa. In other words, this means that exports from Pakistan are relatively capital intensive in nature. Our results from the disaggregated approach are mostly in line with those from other studies using the same approach i.e. Anderton, et al. (2014); Andonova and Petrovska (2018) and; Hashmi, et al., (2021).

CONCLUSION

In this paper, we studied the effects of changes in gross domestic product and its expenditure on changes in unemployment in Pakistan from 1971 to 2023. Thus, the major objective of the study was to estimate Okun's coefficient for Pakistan with a view to examine validity of Okun's law. However, in order to validate Okun's law in Pakistan, we adopted a different approach. In addition to predicting changes in unemployment rate with overall changes in gross domestic product, we estimated differential effects of changes in expenditure components of GDP on changes in unemployment rate in Pakistan. In other words, a separate Okun's coefficient was estimated for overall GDP through conventional aggregate approach; and for individual GDP components including consumption, investment, government expenditure, exports and imports using a disaggregated approach.

The first difference version of Okun's law was used for both approaches i.e. aggregate as well as disaggregated approach. First, we estimated the first difference version of Okun's law using the

aggregate approach by applying the least square methods on annual data from 1971 to 2023. The value of Okun's coefficient from the first difference version is -1.829. This shows the overall impact of GDP on unemployment in Pakistan from 1971 to 2020. The magnitude of the coefficient i.e. -1.829 shows that a one percent increase/decrease in gross domestic product decreases/increases unemployment rate by -1.829 percent.

Further, our findings show that Pakistan's economy needs to grow at a rate of five percent to maintain a given level of unemployment. In other words, this implies that gross domestic product (gdp_t) must grow at the rate of at least five percent in order to make the unemployment rate unchanged. Alternatively, this implies that if the policy makers do not want unemployment to decrease from a given rate they must ensure that the economy grows at least by 5 percent.

However, the value of the Okun's coefficient from the first difference version for the aggregate approach is insignificant at all levels. The overall significance of the model shown by F-statistic i.e. 0.276 is also insignificant. Further, the value of r-squared is 0.11 which is also very small. This implies that gross domestic product explains only 11 percent variation in the unemployment rate in the case of Pakistan. After estimating the first difference version of Okun's law using the aggregate approach, we estimated the same version using the disaggregated approach. Nevertheless, the results from the disaggregated approach are significant and more promising compared to the aggregate approach. The main finding from this approach is that the consumption component of GDP has the largest impact on unemployment in Pakistan. The Okun's coefficient for consumption is -2.32 which is significant at 10 percent level. This means that unemployment responds more strongly to the changes in consumption in Pakistan. Our results from the disaggregated approach are mostly in line with those from other studies using the same approach i.e. Anderton, et al. (2014); Andonova and Petrovska (2018) and; Hashmi, et al., (2021).

The other important finding from the disaggregated approach is that government expenditure has the second highest impact on the unemployment rate after consumption. The estimated Okun's coefficient for the government expenditure is -1.789 which is also

significant at 10 percent level. This implies that a one percent increase in government expenditure decreases unemployment by -1.789. Further, our results show that the investment component exerts the lowest effect on the unemployment rate in Pakistan as its parameter estimate for this variable -0.84 is the lowest of all coefficients from the disaggregated approach. The estimated Okun's coefficient for exports component offers another insight on determinants of unemployment rate. The Okun's coefficient for this trade component is 1.615. Though significant at five percent level, it shows a positive sign, unexpectedly, showing that unemployment rate in Pakistan is positively related with changes in exports of goods and services. This shows that Pakistan exports those goods and services which are capital intensive in nature unlike goods and services consumed by Pakistani nationals at home. However, the value for the coefficient of imports component of GDP is as per theoretical expectations and significant at 10 percent level.

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