Relationship between Unemployment and Gross Domestic Product: Evidence from Pakistan using Okun's Law

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Abstract

Today unemployment is a problem faced by many countries. It aggravated further when recession hit the globe in 2008-2009. Many countries are still unable to bring unemployment level to normal levels and struggling hard to bring economy back on track. The output - unemployment relationship was postulated by Arthur Okun in 1962 which led to famous Okun's Law. The research is aimed at finding Okun Co-efficient and to verify the findings of this Law for the case of Pakistan economy. Annual Time series from 1985 to 2010 on unemployment and GDP was used for data analysis. Data was examined for CLRM conditions and Hodrick Prescot filter approach is used in gap model to examine direction and long run relationship between unemployment and GDP. This paper will be helpful for stakeholders in policy making and can be used for further analysis for cross country comparison(s) using panel data.

Keywords: Unemployment, Co-integration, output gap.

1. Introduction

1.1 Background of Study

Recently due to global turmoil that recession brought to the world; unemployment is increasing gradually impacting output levels. Many economies output have not yet touched the pre-recession levels which lead to workers lay off.

Pakistan also suffered from global recession and in the last 3 years many organizations ceased their operations and large number of organizations' output reduced significantly which resulted in loss of jobs. Due to slowdown in economic activity fresh graduates are also facing difficulty in securing jobs resulting in an increase in unemployment rate. Okun Law is an instrument which plays a pivotal role in measuring association between unemployment and GDP. Unemployment is a broader issue and there are many factors that contribute to it. In this paper, our main objective is to find relationship between unemployment and GDP.

Okun's Law proposes inverse relationship between the variables under study. Okun's Law states that "for every 3 percentage increase in output, unemployment will decrease by 1 percentage."

This law has gained significant importance for decades and many research findings validate this law. Cross-country studies on Okun's Law are also conducted which also reveal action points for policy makers in managing output to reduce unemployment.

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Over the period of time, different models emerge to measure this relationship and studies suggest that relationship is not the same as it was given in 1962. Difference in Okun's co-efficient is due to use of model specification as well as it varies from country to country due to differences in economic structures.

This paper estimate Okun's Coefficient which will serve as guidance as to what level of optimum output can minimize unemployment. This relationship is determined through gap model.

1.2 Problem Statement

Unemployment is a major macro-economic issue, especially in developing countries like Pakistan. The research problem behind this study was to statistically analyze the relationship between unemployment and output.

1.3 Research Objectives

The objective of this research is to validate the findings of Okun law i.e. to test if relationship given by Okun Law holds true for the case of Pakistan and to identify if long run relationship exists between GDP and unemployment which will assist in policy making.

1.4 Significance of the Study

Pakistan is facing unemployment problem and this study will help in analyzing relationship of unemployment with output which will assist in predicting output levels. The study is significant in a manner that very few attempts are made so far to estimate Okun Law for the case of Pakistan. Study will assist as a baseline for future researchers who can work on cross country comparison of Okun's co-efficient.

1.5 Scope of the Study

This study is conducted on macroeconomic variables for a period of 1985-2010 and can be generalized to the national level.

2. Literature Review

Okun's Law was given by Mr. Arthur Okun in 1962 in his paper "Potential GNP: Its Measurement and Significance". In this paper, inverse association between output and unemployment was established. It provided arithmetic connection between GDP and unemployment which is still very famous in the field of economics and many economists validate the findings of this Law over the period of time (Okun, 1962). According to Okun, there exist a specific relationship between unemployment and GDP. Quarterly observations from 1948 to 1960 were used to quantify the relationship (Knotek, 2007).

2.1 What Is Unemployment?

According to Bureau of Labor Statistics:

"The unemployment rate represents the number unemployed as a per cent of the labor force."

2.2 Types of Unemployment

The New World Encyclopedia (2006) defines four major types of unemployment as follows:

2.2.1 Frictional Unemployment

Frictional unemployment is a type which will be present always as it covers only those who are temporarily unemployed.

2.2.2 Structural Unemployment

This is a type of unemployment which occurs when enough jobs are not available to match person skills.

2.2.3 Cyclical Unemployment

This type of unemployment varies with economic conditions. Like when economy contracts organizations lay off workers resulting in high unemployment.

2.2.4 Seasonal Unemployment

There are many businesses which are seasonal and which impact unemployment. In peak season companies hires more people while in off season many workers are laid off which creates seasonal unemployment.

Findings from Okun paper gave new dimension to relationship between unemployment and GDP. Okun's estimated that unemployment can be reduced by 1 per cent if output is increased by 3 percentage point (Okun, 1962). Weber (1995) agreed with this theory but found that co-efficient vary due to difference in specifications.

Huanga, and Lin (2006) also confirm validity of Okun Law and found contrary relationship between cyclical output and cyclical unemployment. Blinder (1997) strongly supports Okun Law in explaining association among output growth and changes in unemployment. According to Prachowny (1993) Okun's law is not sufficient to estimate production efficiency. There are labor inputs as well as other set of factors of production like weekly hours and capacity utilization which also impact output.

There is also difference in results when test was conducted over different time periods. Coefficient values were found higher in post 1972 period (Weber, 1995). Economists are of unanimous opinion that oil shock of 1973 and 1979 changed relationship between variables (Moosa, 1997).

Moreover, different studies confirms structural break in this relation. According to Lee (2000), there were structural changes due to rising female participation in labor force, productivity and wage slowdown and corporate restructuring. Many studies support structural break but Weber (1995) applied structural break on US economy to check if relationship changed in 1973 and found that no structural break occurred.

When different studies were conducted over a period of time and over different countries, Lee (2000) came to conclusion that co-efficient varies from country to country due to difference in type of unemployment and output growth. Many studies are conducted on cross-country comparison and results support this finding.

Recently, economist started taking into account asymmetry in the Okun's Law. Asymmetry means "relationship of unemployment to output is different when economy is expanding from the time when there is a contraction in economy". Conventionally, this was not taken into account and assumption was there is no change in effect on unemployment when economy expands and contract.

Silvapulle et al., (2004) also validate asymmetric linkage between output and unemployment for the Okun Law. Dynamic model take into account asymmetry which explains better relationship between unemployment and GDP.

Weber (1995) found that difference in estimate is due to method adopted. Co-efficients vary depend upon the method used. Dynamic estimation result in lower co-efficient values while static estimate support original Okun's findings.

According to Freeman (2000), Okun law provides rough guideline in policy making in estimating effect of unemployment on output as over the period of time there has been decline in relationship. Initially 3 percentage point increase in GDP leads to 1 per cent change in unemployment which is now reduced to 2 - 2.5.

Knotek (2007) mentioned 3 different ways of finding Okun's Law. The first difference approach captures difference over the period of time. Second, the gap model takes into account gap between potential, and actual output and third is dynamic model; which relies on past, and current output and past unemployment to measure effect of unemployment on GDP.

Petkov (2008) used method combining statistical and economic technique by applying HODRICK-PRESCOTT (HP) filter with autoregressive Distributed Lag (ARDL). HP is used to find dynamics of business cycle and it is also used by Lee (2000) in his research. This was further analyzed using Error Correction Mechanism and final result concluded that although co-efficients vary over time, but strong relationship exist between variables. These findings supports dynamic version suggested by Knotek.

In conclusion, Okun's Law which was a simple equation between unemployment and output growth has now transformed into a dynamic model and serves as a tool for taking decision in policy making. Although there are few limitations associated with this law but it provides a building block in estimating cost of unemployment.

3. Conceptual Framework

Changes in output are determined by changes in demand. Increase (decrease) in demand will increase (decrease) output which in turn increase (decrease) labor demand which leads to change in unemployment.

$$D\downarrow \quad O\downarrow \quad LD\downarrow \quad U\uparrow$$

D - Demand
O - Output
LD - Labor demand
U - Unemployment

4. Research Methodology

Research is quantitative in nature and secondary data is used. Annual data for the period of 1985 to 2010 was collected from SBP Handbook. Data was analyzed for CLRM conditions i.e. Normality, Hetroscedasticity, Autocorrelation. In order to check co-integration ECM, and Engle and Granger test are used. HP filter approach is used to calculate output gap and unemployment. E-views are used as software for data analysis. Based on data analysis, conclusion and recommendations are presented.

4.1 Model and Data Specification

Commonly used methods for estimating Okun Law are 'difference method' and 'gap model'. In first difference method growth rates are used, while in gap model cyclical unemployment is regressed on cyclical output using static and dynamic regression. Hodrick Prescott (1997) is applied to calculate cyclical output and cyclical unemployment, which decompose series into cycle and trend. Gap model is used in this paper and following is the model specification.

$$LOGGDPGAP = \alpha + \beta\ UNGAP + \mu \quad (1)$$

Where:

LOGGDPGAP – natural log of output 'gap'

UNGAP – unemployment 'gap'

α – is intercept

β – Okun co-efficient

μ – Error term

In equation 1 GDP and unemployment gap are extracted through Hodrcik Prescott filter (HP filter) approach. In HP filter data series are smoothened and low frequency values are separated from high frequencies. Time series through HP filter is static when trend is used (Cogley & Nason, 1995).

There is an issue with sample size as there are only 26 observations which may impact co-efficient. As unemployment is calculated in percentage and GDP is measured at actual, the difference between fitted series and actual trend is taken as cyclical component for unemployment whereas for output percentage deviation from fitted trend is measured as cyclical output.

5. Empirical Results

Data was analyzed for CLRM conditions to check for hetoscedasticity, autocorrelation and Ramsey test.

White hetroscedasticity test with cross terms was conducted to test null hypothesis of no hetroscedasticity. According to test result we fail to reject null hypotheses confirming that there is no hetroscedasticity.

Ho: No Hetroscedasticity			
Hetroscedasticity	NxR2	Chi Sq Value at 0.05	P-Value
	11.71	36.415	0.24

For model specification Ramsey test was conducted with null hypotheses that there is no model mis-specification and results obtained (given in appendix) confirm that model is correctly specified.

Ho: Model is correctly specified		
Ramsey Test	F Stat	P-Value
	11.71	0.229

From regression output Durbin Watson value is 2.09 which confirms that there is no autocorrelation but according to Gujrati and Sangeetha (2007) Durbin Watson value is biased when lagged variables are included in regression. In order to check for true autocorrelation in model, we applied Breusch Godfrey LM test which follows chi-square distribution with null hypotheses that there is no autocorrelation. As nxR2 does not exceed critical value of chi-square and hence we fail to reject null hypotheses of no autocorrelation.

Ho: No Autocorrelation			
LM Test	nxR2	Chi Sq Value at 0.05	P-Value
	0.91	36.415	0.7

Inverse relationship is found between log of GDP gap and gap unemployment as expected. Correlation analysis confirms negative relationship between output and unemployment.

Variable	GDP_Gaplog	UE_Gap
GDP_Gaplog	1	-0.41
UE_Gap	-0.41	1

Model presented assumes that variables are stationary and in order to check this, unit root test are conducted.

5.1 Unit Root Test

Unit root test is conducted to check stationary of variables as non-stationary time series gives spurious result. Augmented Dickey Fuller (1979) test is used to check unit root on individual time series (i.e. log GDP gap series and Unemployment gap series unit root) are tested.

ADF test result shows that both the variables are stationary at level or I(0). As both the variables are stationary at level we cannot proceed with 2 step Engle Granger and ECM as it can be concluded that there is no long-term relationship between output gap and unemployment gap.

Variable	ADF at Level		
	Co-efficient (t-value)	P-value	Decision
GDP_Gaplog	-3.169	0.0346	Integrated at level
UE_Gap	-3.12	0.0379	Integrated at level

ARDL model is used to estimate co-efficient and in order to select appropriate econometric model specification, Akaike Information criteria (1974) and Schwarz Criterion are used. Order of lag is determined by computing regression over different lags and appropriate order is the one at which AIC and SC are minimum. For the data analyzed, second order is most appropriate.

Lag	AIC	SC
0	-5.07	-4.97
1	-5.29	-5.15
2	-5.41	-5.22
3	-5.29	-5.05
4	-5.14	-4.85

Equation 1 given in model specification is used to find co-efficient of unemployment and results reveal inverse relationship between output gap and unemployment and the co-efficient value of ? is -0.002. We can interpret -0.2% based on selected log-lin model. The reason for using log-lin approach is that GDP actual values are taken while unemployment rate is already in the percentage form so there is no point of taking log of unemployment.

Regression	UE_GAP	t-STAT	P-Value
	-0.002	-0.57	0.57

Okun Law estimates for the case of Pakistan does not hold valid which is found in previous studies that Okun co-efficient is higher in developed countries as compared to developing countries. This argument is supported in study of Irfan et al., (1997) paper. Second, Okun co-efficient vary from country to country and the standard relationship given by Okun Law does not hold valid due to asymmetry as discussed by Lee (2000). In our case, we find that the priori is fulfilled as there is negative relationship but there is no long-term relationship between the two variables as both variables are integrated at level. As cyclical output does not impact significantly to cyclical output according to this research finding hence Okun Law cannot be used in policy making to ascertain optimum output levels. Villaverde and Maza (2007) estimated Okun Law for Spain and its region found negative relationship between variables but co-efficients obtained were lower than the orginal Okun estimates.

6. Conclusion and Recommendations

Research findings recommend that the unemployment does not have significant impact on output for the case of Pakistan. These results are contrary to research findings of more advanced countries and the possible reason for this difference seems to be changes in the economic structures.

Based on empirical evidence and literature on topic, there can be two possible reasons why Okun Law is not valid for the case of Pakistan. First and foremost, unemployment in Pakistan is not cyclical but rather frictional or structural. Structural unemployment is not because of the economic conditions but rather due to the inadequate skills of unemployed population. In frictional unemployment, people have necessary skills to perform job but they are unaware of job opportunities.

The second reason could be the rigidity of labor market in Pakistan. Okun co-efficient is higher when labor market is flexible. For the case of Pakistan, labor is primarily employed by government and semi-government sectors as well as the strong existence of labor unions in Pakistan, which is evident from recent case of KESC where company cannot fire 4000 people due to resistance of labor union.

The above mentioned reasons for Okun Law's failure for the case of Pakistan can be used by policy makers as an area of concern.

Future research can be conducted on cross country examination of Okun Law which will provide more insight into difference in economic structures. Further, there are many other variables that contribute to GDP like labor supply, weekly hour wages which can be taken into account to evaluate impact on level on output for policy decisions.

7. Limitations of the Study

There are few limitations with this research. The data available on unemployment is only for last 25 years, which has an impact on empirical findings. Also the data available was annual while quarterly data can take into account more variations in data. Further, time was short to analyze impact of other variables, like labor supply and weekly working hours on output to estimate better empirical result and policy framework.

References

Akaike, H. 1974, 'A New Look at the Statistical Model Identification,' *IEEE Transaction on Automatic Control*, pp. 716-723.

Blinder, A. S. 1997, 'Is There a Core of Practical Macroeconomics That We Should All Believe in' Papers and Proceedings of the Hundred and Fourth Annual Meeting of the American Economic Association, Toronto, Canada.

Edward S. K. II. 2007, 'How useful is Okun's law?' *Economic Review*. Federal Reserve Bank of Kansas City, Fourth Quarter, pp. 73-103.

Freeman, D. G., 2000, 'Regional Tests of Okun's Law', *International Advances in Economic Research,* Vol. 6, pp. 557-570.

Hodrick, R., Prescott, E. P. 1997, 'Post-war Business Cycles: An Empirical Investigation', *Journal of Money, Credit, and Banking,* Vol. 29, pp. 1-16.

Huanga, H & Lin, S 2006, 'A flexible nonlinear inference to Okun's relationship', *Applied Economics Letters,* Vol. 13, pp. 325-331

Lee, J. 2000, 'The Robustness of Okun's Law: Evidence from OECD Countries', *Journal of Macroeconomics,* Vol. 22, pp. 331-56.

Mizon, G. E. 1995, 'A Simple Message for Autocorrelation Correctors: Don't', *Journal of Econometrics,* Vol. 69, pp. 267-288.

Moosa, I. A. 1997, 'A Cross-Country Comparison of Okun's Coefficient', *Journal of Comparative Economics,* Vol. 24, pp. 335-356.

Okun, A. M. 1962, 'Potential GNP: Its Measurement and Significance', Proceedings of the Business and Economic Statistics, pp. 98-103.

Petkov, B. 2008, The Labour Market and Output in the UK - Does Okun's Law Still Stand? Discussion Papers Bulgarian National Bank.

Prachowny, M. F. J. 1993, 'Okun's Law: Theoretical Foundations and Revisited Estimates', *Review of Economics and Statistics,* Vol. 75, No. 2, pp. 331-336.

Silvapulle, P. Moosa, I. A., Silvapulle, M. J., 2004. 'Asymmetry in Okun's law', *The Canadian Journal of Economics / Revue canadienned 'Economique*, Vol. 37, No. 2, pp. 353-374.

Thirlwall, A. P. 1969, 'Okun's Law and the Natural Rate of Growth', *Southern Economics Journal,* Vol. 36, No. 1, pp. 87-89.

Weber, C. E. 1995, 'Cyclical Output, Cyclical Unemployment, and Okun's Coefficient: A New Approach', *Journal of Applied Econometrics,* Vol. 10, pp. 433-445.