

# Macroeconomic Determinants of Unemployment: An Empirical Study for Pakistan

Bedi-uz-Zaman<sup>1</sup>, Muzammil Hussain<sup>2</sup> and Abdus-Salaam<sup>3</sup>

## Abstract

*This study is an attempt to investigate the determinants of unemployment in Pakistan. Annual data series is used from the period 1977 to 2011. The variables used in this study are inflation, gross fixed capital formation, rate of interest, GDP, unemployment rate and remittances. Unit root test is used to check the properties of time series data. The study has employed ARDL framework to investigate the determinants of unemployment in Pakistan. The study found a negative relationship of unemployment with remittances, GFC, GDP, interest rate and positive with inflation. The value of ECM (-0.6475) also shows a significant speed of adjustment.*

## Introduction

It is known that positive shocks in output reduce unemployment according to Okun's law. Magnitude may differ for different economies. Unemployment rate has increased from 5.6 percent in 2009-10 to 6.0 percent in 2010-11 and 6.10 percent in 2011-12 according to economic survey of Pakistan 2011-12. This rising trend of unemployment creates different problems for the economy as well as society. Political instability in Pakistan is deterring the foreign direct investment, which in turns reduce the employment level and enhance unemployment level. If someone looks in back there was a tight monetary policy, due to which cost of doing business increases which enhances the unemployment level in Pakistan. Population growth rate is higher in developing countries which is a key factor in enhancing the unemployment level.

If comparison is made between developed and developing countries, unemployment rate is higher in developing countries relative to developed countries. It is a key issue therefore this research is made to investigate what are the factors which are hindrance in reduction of unemployment. One of the causes according to Fadayomi (1992) was the inability to develop and utilize the nation's manpower resources effectively, especially in the developing countries. This, however, resulted in higher unemployment rate.

A large proportion of unemployed persons in a country have various negative effects, these negative effects include psychological problems like depression, hostility and increased criminal activities, and economic problems like lower gross domestic product, increased inequality of income and gradual drift in various economic variables.

The rising trend of unemployment in Pakistan is challenging economic problem for Pakistani government. In context of stagnant economy, lower GDP growth, Instability in political government and energy crisis deterred the demand for labor which in turns increases the unemployment.

## Literature Review

Looking into literature review, there are different factors which are affecting unemployment. Cascio (2001) investigated that monetary shocks affect unemployment for 11 OECD

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<sup>1</sup> Assistant Professor, Department of Economics, University of Sargodha, Pakistan

<sup>2</sup> M Phil Economics Scholar, University of Sargodha, Pakistan

<sup>3</sup> BS Student, Lahore University of Management Sciences, Lahore, Pakistan

countries by using vector auto regressive (VAR) methodology and concluded that monetary shocks have impact on all the countries but the effect is different for different countries.

Carlos et al (2002) used annual data on unemployment, interest rate, exchange rate and taxes on household expenditures for Brazil and Mexico. This study applied auto regressive distributed lagged model for empirical investigation and concluded that unemployment is negatively related with taxes on household expenditures for both countries. Unemployment is negatively associated with exchange rate for Mexico while positively related for Brazil. These results also indicated that unemployment is also positively related with interest rate.

Ozturk & Akhtar (2009) used VAR of Variance decomposition and impulse response function analysis and checked the relationship between foreign direct investment, Exports, Gross Domestic Product and unemployment in Turkey for quarterly data from 2000 to 2007. This study showed that the fluctuations in exports affect GDP growth but the results are insignificant, they also found that variation in GDP is not responsible for reduction in unemployment. The study also contributed that FDI is helpful for reduction in unemployment.

Rafiq et al (2009) conducted a study to find out the determinant of unemployment for the period of 1998 -2008 using simple linear regression model. The study used population growth, inflation rate and foreign direct investment as independent variables and concluded that population growth rate enhances unemployment while inflation and foreign direct investment reduces unemployment. This study also confirms the existence of short run Phillips curve.

Haug and King (2011) used US quarterly data from 1952 to 2010 by using band-pass filter method. This study found strong evidence of positive relationship between inflation and unemployment. These estimations reconcile with the idea of Friedman (1977) and White (2011). These studies said that there is positive relationship between inflation and unemployment in long run.

Mahmood et al (2011) identified basic causes of unemployment among the educated segment in Peshawar division of Pakistan. This study used 442 sampling individuals least first degree (graduate degree) or capable of any professional/technical job whether they are employed or unemployed. This study used Logistic regression and showed that high population growth attitude of getting high level job and lack of resources are main determinant of unemployment in Peshawar division of Pakistan and 69.6% of males and 30.4% females are educated and unemployed.

Dogan (2012) used quarter time series data for the period of 2000-2010 for Turkish economy. This study concluded that positive shocks to growth, shocks to export growth and inflation reduced unemployment while shocks in exchange rate, interbank interest rate and money supply increase unemployment. The results also reconciled with the Phillips curve and Okun's law.

## **Data and Methodology**

Researcher has used secondary data to scrutinize the determinants of unemployment rate in Pakistan. The variables used in this research are unemployment rate, inflation rate, interest rate, GDP and GFC. Data on these variables is used on annual basis and it ranges from 1977-2011. The researcher has collected statistics from different data sources like hand book of statistics on Pakistan economy (2011) and International Financial Statistics (IFS).

## **Unit Root Test**

Instability in time series with no particular mold are consider as random walk while the specific trended series are recognized as random walk with drift. There are different approaches to check the properties of time series data. However this study employs unit root test.

### Augmented Dickey Fuller (ADF) Test

Dickey and Fuller provided augmented edition of test to remove the autocorrelation. They used additional lag term of dependent variable to solve the problem. AIC and SBC are used to determine the optimal lags.

Three possible shapes of ADF test are given below

$$\Delta Y_t = \alpha Y_{t-1} + \sum_{k=0}^n \beta_k \Delta Y_{t-k} + \varepsilon_t \dots \dots \dots 1$$

$$\Delta Y_t = \delta_0 - \alpha Y_{t-1} + \sum_{k=0}^n \beta_k \Delta Y_{t-k} + \varepsilon_t \dots \dots \dots 2$$

$$\Delta Y_t = \delta_0 - \alpha Y_{t-1} + \delta_2 t + \sum_{k=0}^n \beta_k \Delta Y_{t-k} + \varepsilon_t \dots \dots \dots 3$$

The difference in the three equations is of elements  $\delta_0$  and  $\delta_2 t$  where  $\delta_0$  an intercept term is and  $\delta_2 t$  represent trend in a series.

### Choice of Model

Cointegration enlightens the central principle that the variables incorporated in the study reveals a long run relationship. Existence of long run relationship means that the variables are cointegrated and controlled divergence from the equilibrium.

### Autoregressive Distributed Lag (ARDL) Approach

The conventional approach to establish short run and long run relationships with variables is to employ the typical Johansen cointegration along with error correction mechanism (ECM) framework, although this framework experienced from some drawbacks as conferred by Pesaran et al. (2001). ARDL model is initiated by Pesaran and Shin (1999) and broaden by Pesaran et al. (2001). The model is useful for several reasons. It is not necessary for all the variables to be I (1) like Johansen technique. The model is appropriate if some variables are I (0) and others I (1). This model uses adequate lags to capture the information in modeling agenda. Another advantage is derivation of ECM through an easy conversion. The ECM incorporates the short run variations by way of long run stability with no loss of long run information. Estimation of ARDL involves two major stages. It tests long run relationship at initial stage and in the second stage long run and short run coefficients are estimated.

### The General Form of Unrestricted ECM model in ARDL (p,q,r,x,y,z) formulation:

$$dUNR_t = a_0 + \sum_{i=1}^p B_i dUNR_{t-i} + \sum_{i=0}^q C_i CPI + \sum_{i=0}^r D_i dDR_{t-i} + \sum_{i=0}^x E_i dGFC_{t-i} + \sum_{i=0}^y F_i dREM + \sum_{i=0}^z G_i dGDP_{t-i} \\ + \theta_1 UNR_{t-i} + \theta_2 INF_{t-i} + \theta_3 INT_{t-i} + \theta_4 GFC_{t-i} + \theta_5 REM + \theta_6 GDP_{t-i} + u_t$$

Here,

- “d” is the first difference operator
- The coefficients of first fraction such as  $B_i, C_i, D_i, E_i,$  and  $F_i$ , correspond to the short run dynamics
- The coefficients  $\theta_1, \theta_2, \theta_3, \theta_4,$  and  $\theta_5$  stand for the long run relationships between the variables
- And  $u_t$  for white noise error term

Long run relationship is investigated using bound test under the procedure of Pesaran et al. (2001) its mechanism is based on F-test.

Null hypothesis:

$$H_0: \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = 0$$

i.e., that there does not exist cointegration

Alternative hypothesis:

$$H_1: \theta_1 \neq \theta_2 \neq \theta_3 \neq \theta_4 \neq \theta_5 \neq 0$$

i.e., that there exists cointegration

Three potential conclusions for bounds test procedure are:

1. If F-statistics > upper bound → (cointegration exist)
2. If F-statistics < lower bound → (no cointegration exist )
3. If F-statistics lies amid upper and lower bounds → (inconclusive)

### The Long Run ARDL (p, q, r, x, y, z) Model

If cointegration found in the general form of unrestricted ECM model in ARDL (p,q,r,x,y,z) formulation, then subsequent long-run model is projected:

$$UNR_t = a_1 + \sum_{i=1}^p B_i UNR_{t-i} + \sum_{i=0}^q C_i CPI_{t-i} + \sum_{i=0}^r D_i DR_{t-i} + \sum_{i=0}^x E_i GFC_{t-i} + \sum_{i=0}^y F_i REM + \sum_{i=0}^z G_i GDP_{t-i} + u_t$$

If the study found long run relationship between the variables the next step is to estimate short run coefficients. The following ECM model is applied to estimate short run relationship between the variables.

### Testing Parameters Stability

The existence of cointegration does not necessary imply that the estimated coefficients are stable. If the coefficients are unstable the results will be unreliable. In order to test for long-run parameter stability, Pesaran and Pesaran (1997) suggest applying the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of recursive residuals of square (CUSUMSQ) tests proposed by Brown *et al* (1975) to the residuals of the estimated ECMs to test for parameter constancy. The advantage of these tests is that, unlike the alternative Chow test that requires break point(s) to be specified, they can be used without the requirement of pre knowledge of the exact date of the structural break(s).

### Empirical Results

The table “1” shows that all variables are stationary at first difference except inflation. Inflation is stationary at level so this study will employ ARDL technique to check the relationship between unemployment and other macroeconomic variables.

**Table 1: Results of ADF Test**

ADF Test Statistics		
Regressors	Level	1 <sup>st</sup> difference
UNR	-2.2805	-4.3994*
GFC	-1.5913	-3.2257***
GDP	-0.4185	-3.6546**
DR	-2.5036	-4.1491**
CPI	-3.6079**	-6.2635*
REM	-1.5344	-5.9046*

\*, \*\*, \*\*\* shows 1%, 5%, 10% significance level respectively

**Table 2: Estimated Long Run Coefficients using the ARDL Approach  
ARDL(1,0,1,2,1,1) selected based on AIC**

Dependent variable is UNR 32 observations used for estimation from 1979 to 2010			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
CPI	.3353	.0927	3.6163[.002]*
GDP	-.1448	.0715	-2.0242[.057]**
DR	-.2814	.1093	-2.5751[.018]*
GFC	-.0131	.0029	-4.6086[.000]*
REM	-.78E-6	.30E-6	-2.5288[.020]*
INPT	5.2565	1.6623	3.1623[.005]*

Note : \*, \*\*, \*\*\* shows 1%, 5%, 10% significance level respectively

The study has used bound test procedure to investigate the long run relationship among the variables used in this study. The value of F test 8.6862 greater than upper critical bound 3.805 has rejected the null hypothesis of no cointegration at 1% level of significance.

Table “2” shows long run coefficients and their T-Ratios. CPI is used as proxy of inflation which positively affects unemployment and also showing the existence of stagflation phenomenon in Pakistan. This is according to expectation and theory and these results are reconciled with the study of Haug and King (2011) and also resemble with the idea of Friedman (1977) and White (2011). These studies said that there is positive relationship between inflation and unemployment in long run. Coefficient of CPI is significant at 1% level

of significance. Coefficient of GDP shows that as GDP increases unemployment decreases which verify the Okun's Law.

**Table 3: Error Correction Representation for the Selected ARDL Model  
ARDL (1,0,1,2,1,1) selected based on AIC**

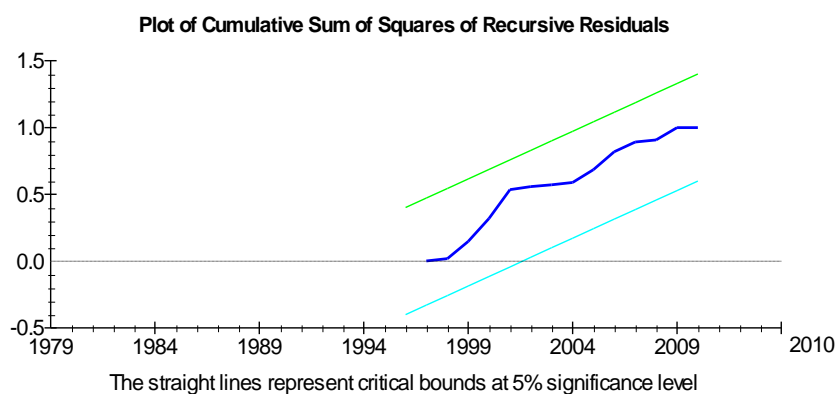
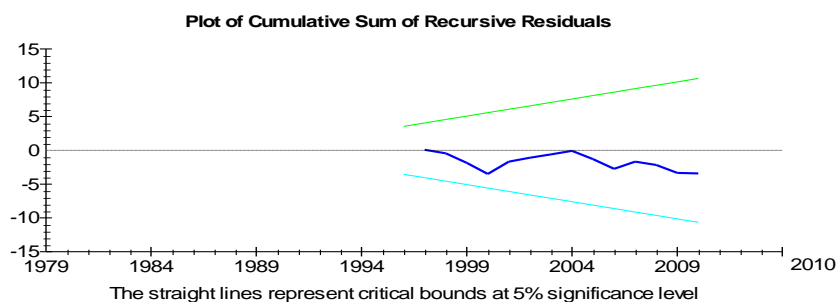
Dependent variable is dUNR 32 observations used for estimation from 1979 to 2010			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dCPI	.2171	.0521	4.1657[.000]
dGDP	.2000	.1498	1.3353[.194]
dDR	-.0105	.0824	-.12758[.900]
dDR1	.14963	.0923	1.6203[.118]
dGFC	-.0049	.0024	-1.9826[.059]
dREM	-.29E-6	.1061E	-2.8261[.009]
dINPT	3.4049	1.1467	2.9694[.007]
ecm(-1)	-.6475	.15559	-4.1633[.000]
R-Squared	.61310	R-Bar-Squared	.40030
S.E. of Regression	.63905	F-stat. F( 7, 24)	4.527[.002]
Mean of Dependent Variable	.084375	S.D. of Dependent Variable	.8252
Residual Sum of Squares	8.1678	Equation Log-likelihood	-23.557
Akaike Info. Criterion	-35.5575	Schwarz Bayesian Criterion	-44.351
DW-statistic	2.1506		

This coefficient is also significant at 5% level of significance. Gross fixed capital formation is expected to be negatively related with unemployment because as capital formation increases, it increases the employment opportunities and decreases the unemployment. Coefficient of remittance is low but it is significant at 1% level of significance.

In the following table 3 shows short run coefficients and error correction term. The coefficient of error correction term is -0.6475. It means if there is any disturbance in the equilibrium it will be adjusted or converges towards equilibrium in long run.

Finally to check the stability of log run estimates together with short run estimates, this study applies the cumulative sum CUSUM and cumulative square sum (CUSUMSQ) is applied. According to Pesaran and Shin (1999), Stability of error correction estimates can be graphically investigated with the help of CUSUM and CUSUMSQ.

If the plot of CUSUM and CUSUMSQ lies within the lower and upper bounds, this means the model is correctly specified and the coefficients are stable. If we look at the following graph same is happening so we can conclude that estimated coefficients are stable and model is correctly specified.



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