United International University

QUEST FOR EXCELLENCE

Impact of Economic Growth and Inflation on Unemployment in Bangladesh: A Time Series Analysis

Submitted by

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A Thesis

Submitted to the School of Business and Economics

Of United International University

In partial fulfillment of the requirements for the degree

Masters of Science in Economics

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School of Business & Economics

United International University

May 29, 2018

Acknowledgement

At the very beginning, I would like to express my deepest gratitude to the almighty Allah for giving me the knowledge, strength and ability to finish the task properly and pursue the graduate degree. Completion of anything requires supports from various sources. I am very much fortunate to get the sincere guidance and supervision from a number of people.

I would like to express my profound gratitude to my Supervisor, Abul HMG Azam, Ph.D. Professor and Dean of School of Business and Economics for his continuous guidance, individual suggestions, constructive criticism, continuous encouragement and unfailing enthusiasm throughout the process of completion of this thesis program which helped me a lot to prepare the report in a well-organized manner. I would like to extend my sincere appreciation to all of my teachers for the individual contribution and cooperation in advancing this thesis and hereby complete my graduate program ultimately.

I would like to give special thanks and greetings to my fellow friends for giving me some required information, valuable advices and suggestions to complete the thesis in a comprehensive manner. I am grateful for the overwhelming love and endless inspiration of my mother and my entire family. I would like to acknowledge the cordial help and participation of all the above people from the bottom of my heart.

Abstract

This study investigates the effect of economic growth and inflation on unemployment in case of Bangladesh using time series data considering the period of 1991 to 2015. Variables of the study include unemployment as a dependent variable and economic growth, inflation, industry and age dependency ratio as an explanatory variable. Simple descriptive statistics, Augmented Dicky-Fuller test and Ordinary Least Square (OLS) method have been applied in this paper. Results of Augmented Dicky-Fuller test shows that there is no unit root problem as all the variables are stationary at level. The OLS estimation displays that economic growth has insignificant positive impact on unemployment concluding invalidity of Okun's Law and inflation has insignificant negative impact on unemployment confirming Phillips curve in Bangladesh. It also shows that industry inversely affect unemployment. Also the impact of age dependency ratio on unemployment is found to be statistically inversely significant. Diagnostic result of the study shows that the model is free from heteroscedasticity, first order positive autocorrelation and multicollinearity. The R-squared value is 43.33% for the model; therefore the model delivers a comparatively good fit of the data.

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1. Introduction

Bangladesh is a small densely populated country and considered as a developing country. Inflation, economic growth and unemployment are the three important macroeconomic factors for a country like Bangladesh. Every government tries to accomplish price stability, low unemployment rate and fast and sustainable economic growth through sound macroeconomic policy.

Unemployment is considered as one of the gravest problems throughout the world. It has been the most consistent issue facing by all technologically advanced and poor countries. As per International Labor Organization (ILO) report (2017), 5.7% of the world's workforce was unemployed. However, this problem is acute in Bangladesh. In case of Bangladesh the unemployment rate measures the number of people without work but actively looking for it as percentage of the labor force. As indicated by the 13th Quarterly Labor Force Survey (QLES) of the Bangladesh Bureau of Statistics released on March 2017, 4.18 % workforce of the country is currently unemployed. The problem of youth unemployment is vital for sustainable development of Bangladesh. The rate of youth unemployment has increased over the years. The World Bank data (updated 4/24/2018) revealed that youth unemployment rate (% of total labor force aged 15-24) was 11.4% in 2017. In Bangladesh jobless graduates are growing alarmingly. The scenario of unemployment of the graduate level has become a great issue in Bangladesh. Female graduates are more unemployed than male graduates. Unemployment rate of female graduates is 16.8% which is about 2.5 times more than the male graduates as per the Quarterly Labor Force Survey (QLFS) 2015-2016 by Bangladesh Bureau of Statistics.

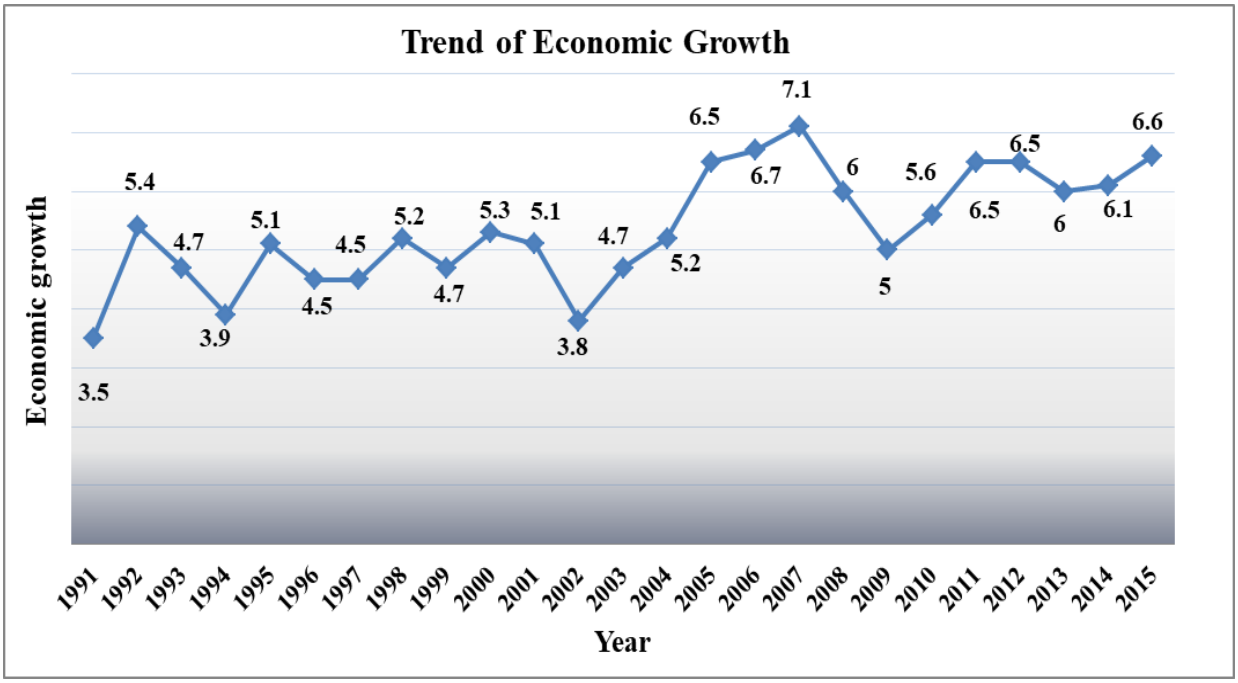
Unemployment in Bangladesh has become a serious issue. Economic growth contributes to reduce unemployment. As per the Bangladesh Bureau of Statistics, Bangladesh has achieved economic growth rate of 7.11% in 2016 (WDI-updated 4-19-2018) exceeding all the previous records in the country's economic history. But unemployment problem has remained unaffected despite economic growth in Bangladesh. The trend of unemployment in Bangladesh is shown in figure below.

Source: World Development Indicator

Figure 1: Trend of Unemployment

From **Figure 1** we can see a repeated fluctuations in the unemployment rate over the period from 1991 to 2000 , reaching an all time high rate of 5.1% in 1997 because of political unrest and newly formed government. Then it shows an increasing trend till 2004 and a fluctuations from 2004-2006. After 2006 the unemployment rate started falling upto the year 2008 and became 5% in 2009 which was its second highest level. Unemployment rate remained constant at 4.5% during the period of 2010 to 2012. Afterwards, it started falling and reached to 4.2% in 2015.

Gross Domestic Product (measurement of country's total output) is one of the acknowledged parameter for capturing the state of an economy. In this study economic growth is defined as GDP growth (annual%). From the time of its liberation in 1971, Bangldesh economy has experienced notable progresses. But years of political insecurity and uncertain natural conditions hindered the country's growth. The following figure shows the trend of economic growth in Bangladesh over the period 1991 to 2015.

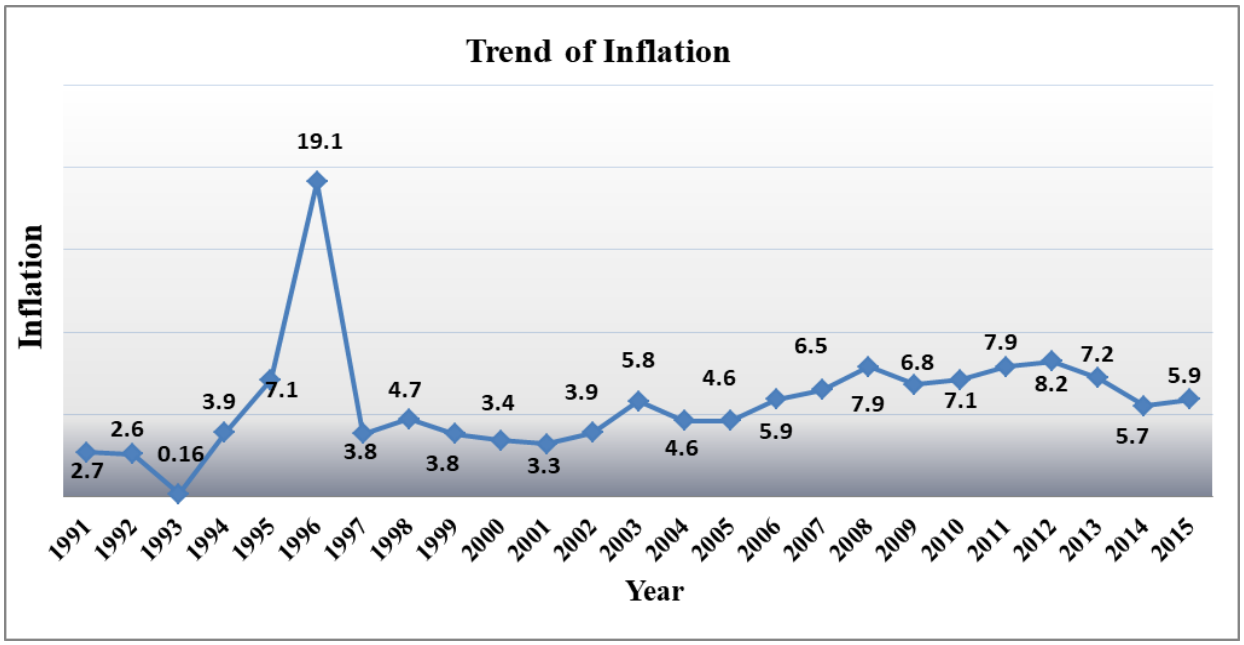


Source: World Development Indicator

Figure 2: Trend of Economic Growth

Figure 2 shows that the average GDP growth rate in Bangladesh is 5.4% from 1991 until 2015. GDP growth rate fluctuated frequently from 1991 to 2002. Then it shows an increasing trend up to 2007. After 2007 it started falling and became 5% in 2009. From the year 2009 to 2012 it again exhibits an increasing trend. Afterwards, it decreased slightly in 2013 and started showing an increasing trend and reached to 6.6% in 2015. GDP growth rate was highest at rate 7% in 2007. From graph, we can see an unstable trend in economic growth.

It is usually said that when economic growth takes place in the country, it expands the action of economic behavior in the country causing higher employment. The progress in employment opportunities will improve peoples' purchasing power in the country and consequently consumption increases which in turn increases aggregate demand and therefore inflation in the country. As a developing country, high growth and exchange rate depreciation arising from balance of payment crisis causes high rate of inflation in Bangladesh. The trend of Inflation in Bangladesh for the period of 1991 to 2015 is shown in figure below.



Source: World Development Indicator

Figure 3: Trend of Inflation

From **Figure 3** we can see that inflation rate fluctuates from 1991 and reached only 0.16% in 1993. From 1993 it shows an increasing trend until 1996 reaching a much higher rate of 19.1% in 1996.Then it was decreased in 1997 and slightly increased in 1998. From then it shows a slightly decreasing trend up to the year 2001. From the year 2001 the inflation rate started increasing and became 5.8% in 2003. It then decreased from the year 2003 and remained constant at 4.6% for the next two consecutive years. From 2006 it shows an upward trend till 2008. After falling in 2009 at 6.8%, the inflation rate again exhibits an increasing trend till 2012. It then started falling up to the year 2014. Then it slightly increased and became 5.9% in 2015.

This study is an attempt to investigate the impact economic growth and inflation on unemployment in Bangladesh. The study is structured as follows: Introduction, Literature review, Data and Methodology, Data Analysis and Discussion of Result and Conclusions with some Recommendations.

2. Literature Review

The impact of inflation and economic growth on unemployment has been a matter of interest for economic research for decades. In the literature, there are many researches observing the impact of macroeconomic factors for example inflation, economic growth, population, foreign direct investment etc. on unemployment. In view of information gathered from existing literature, an attempt has been made to make an overview of the existing literature.

Makun and Azu (2015) studied the relationship among economic growth, unemployment and investment in Fiji. They used data from the year 1982 to 2012 for this study. The authors sought to examine the long run connection between growth and unemployment. They applied Johanson Cointegration test and dynamic error correction model to determine the long run connection among the variables, unit root test for checking the stationarity. The study used economic growth (growth rate of output) as the explained variable and unemployment rate and inflation as the independent variables. The paper stated that in the long run growth rate of output and unemployment was inversely related and the effect of investment on economic growth was positive. Investment stayed one of the vital components in unemployment reduction and therefore economic growth. The paper suggested that policy makers should strengthen economic policies for progressing investment.

A study on Nigerian economy by Saidu and Mohammad (2015) discovered that the impact of unemployment on economic growth was not significant. They used secondary time series data on from 1986-2010. The variable of the study were economic growth, unemployment and inflation. They used traditional Cobb-Douglas production function taking economic growth as dependent variable and unemployment and inflation as independent variable. For this study they applied Ordinary Least Square (OLS) method, Augmented Dicky- Fuller test and Granger Causality test. The outcome of OLS method showed the positive and significant impact of inflation and insignificant impact of unemployment on economic growth. Unit root test revealed that the model has stationary variables. Causality test recommended the presence of Granger Causality between inflation and economic growth. The paper suggested some policy options and the requirement for future research concentrating panel data.

Strat et. al. (2015) studied the interdependencies amid FDI inflow and unemployment. Yearly data was collected from 1991 to 2012 for this study covering latest thirteen EU member states. They applied Toda Yamamoto (T-Y) procedure for checking short run causality connection between FDI and Unemployment. They used this procedure as it can be applied in level Vector Autoregressions (VARs) for stationarity and co integrated variables too. They investigated the short term causal connection between FDI and unemployment. The results of the study show that there was no causal link between FDI and unemployment for six countries but a unidirectional causal link was recognized for the rest of the states.

Chowdhury and Hossain (2014) studied and mentioned that underutilization of human capital that is unemployment plays a vital part in the growth of economies. In this paper, they examined macroeconomic factors of unemployment rate in Bangladesh considering the period of 2000 to 2011. They applied Simple Single Equation Linear Regression Model (SSELRM) for exploring the determinants of unemployment and the variables they used for this study were Unemployment rate as dependent variable, GDP growth rate, Exchange rate, and Inflation rate (CPI based) as explanatory variables. They found significant results through the regression analysis. The results of the study showed that the impact of inflation on unemployment was positive and GDP growth rate and Exchange rate influenced unemployment inversely. They suggested that making the influence of growth better for employment rate policy makers should develop income distribution.

Abbas (2014) examined the effect of economic growth on unemployment in Pakistan. The study period was 1990-2006. They applied Autoregressive Distributed Lag (ARDL) bounds testing approach to examine the long run impact of economic growth (Independent variable) on the rate of unemployment (Dependent variable). The findings of the study displayed the presence of long run significant and inverse impact of growth on unemployment but in the short run no connection was identified. The coefficient of parameters in the short run was insignificant. The calculated model strength was tested by several diagnostic tests such as Autoregressive Conditional Heteroscedastic (ARCH) test to heteroscedasticity , Lagrange multiplier test for detecting whether the model had serial correlation or not and Jarque-Bera test for checking the normality of residuals. The outcomes displayed that residuals were normally distributed and the model was free from heteroscedasticity and serial correlation. The study recommended that

efforts should be taken to make economic growth as an unemployment reducing factor in the long-run.

A work of Thayaparan (2014) on Impact of Inflation and Economic Growth on Unemployment: A study of Time series analysis investigated the impact of inflation and economic growth on unemployment in Sri Lanka. Data was collected from 1990 to 2012 for this study. The study model includes the variables unemployment rate as dependent variable and inflation and economic growth as independent variables. They applied Augmented Dicky-Fuller (ADF) test for checking the unit root problem, lag length criteria, Johanson test, and vector error correction model for investing long-run link among the variables, and Granger Causality test for testing the causality among the variables. The Augmented Dicky-Fuller test explained that all the variables were non-stationary at level but not GDP and they became stationary after transforming into their first difference. The results of coefficients of the variables showed inverse and significant effect of inflation and GDP on unemployment. Through Granger Causality test the results of this study displayed the presence of bi-directional causality between inflation and unemployment and one-way causality between GDP and inflation in Sri Lanka.

Bayar (2014) conducted a paper on Effects of economic growth, exports and foreign direct investment inflows on unemployment in Turkey. The study period was 2000-2013. The author applied Augmented Dicky-Fuller test for checking the stationarity of time series and Autoregressive Distributed Lag (ARDL) and Error Correction Model (ECM) to investigate the long term as well as short term connection among the dependent (unemployment) variable and independent (economic growth , exports, foreign direct investment inflows) variables. He discovered the existence of long run association among the variables. Further he revealed that the connection of unemployment with economic growth, export was adverse and with foreign direct investment inflows unemployment was positively connected. But the impact of FDI inflows on unemployment usually altered depending on the types of FDI inflows: Green field investment or brown field investment. Turkey had been in form of brown field investment and hence FDI inflows did not create employment in turkey. The author suggested that Turkey should execute policies in order to attract green field investment for creating employment.

Aurangzeb and Asif (2013) studied and examined macroeconomic factors of unemployment. For this study they selected India, Chaina and Pakistan as the study area. Data was collected from 1980 to 2009. The variables for this study include unemployment, inflation, gross domestic product, exchange rate and the increasing rate of population. On the basis of theoretical work and empirical literature they constructed a model where the dependent variable unemployment was a function of explanatory variables: economic growth, inflation, exchange rate and annual growth rate in population. They used co integration to calculate the long-run connection among the variables of the model, granger causality analysis to detect the causality among variables and regression analysis to investigate the impact of independent variables on dependent variables. The findings of regression analysis demonstrated that the influence of all the variables on unemployment were statistically significant in all three countries. Granger causality test displayed that there was no bidirectional connection amid any of the variable but one-way causality exists among the GDP (from GDP to unemployment) and exchange rate (from unemployment to exchange rate). Cointegration outcome discovered the presence of long-run connection among the variables.

Imran et. el. (2013) conducted a paper on Unemployment and Economic Growth of developing Asian Countries: A Panel Data Analysis and offered the new regression estimates of the connection concerning unemployment and economic growth. They selected 12 Asian countries and the study period was 1982-2011. The model of this study showed output level (i.e. Per capita GDP) is function of labor amount (measured by Labor force of the country) and capital (measured by Gross Capital Formation). They applied fixed effect; Pooled Ordinary Least Square (OLS) technique, time effects to find out the impact of the unemployment (Explanatory variable) on the economic growth (Dependent variable) of these countries. The other explanatory variables of this study includes gross capital formation (% of GDP), population growth (annual %), trade openness (% of GDP), real interest rate(%), domestic credit provided by banking sector (% of GDP), inflation, consumer prices (annual %), general government final consumption expenditure (% of GDP), gross savings (% of GDP), and foreign direct investment, net inflows (% of GDP).They found that high rate of unemployment was inversely related to GDP per capita growth. The findings of the study further examined the seemingly significant influence of other factors for example inflation, population growth, trade openness etc. on economic growth.

Umair and Ullah (2013) explored the effects Inflation on GDP and the rate of unemployment in Pakistan. The study period was from 2000 to 2010 and data was collected from secondary sources. They completed this research based on correlation, regression analysis, t test; Analysis of Variance (ANOVA) model .They used SPSS 16 software for examining numerical calculation that provides statistical evidences. Descriptive analysis of the study showed that minimum and maximum values of inflation had large gap in the study period that indicated an inconsistent and highly unstable inflation in Pakistan. It also showed that the values of GDP were vibrant. From correlation, it is showed that inflation rates with GDP and unemployment was insignificantly correlated. From regression analysis they found that the impact of inflation on GDP and unemployment was insignificant.

Jaradat (2013) conducted a study and investigated the influence of inflation and unemployment on GDP in Jordan. The data was collected from 2000 to 2010. The author used SPSS software to test the correlation between the dependent (GDP) and independent variables (inflation and unemployment). The model of the study was linear regression model. The findings showed that unemployment and GDP was inversely related and the connection between inflation and GDP was positive.

Al-Habees and Rumman (2012) examined the link between unemployment and economic growth in Jordan and some Arab countries over the period 2006 to 2011. They used Okun's Law which directs the link between economic growth and change in unemployment rate. As per this approach, it was supposed that a decrease in unemployment requires the national economy growth rate surpasses the minimum or natural limit. The findings of their study showed the negative association between growth and unemployment. They also demonstrated that in some Arab countries for example Algeria it was improbable to lower the rates of unemployment although the growth rate was positive at that time. The authors suggested distinct policies for growth and reduction of unemployment rates.

Hossain et. al. (2012) conducted a paper on Inflation and Economic Growth in Bangladesh and analyzed the long run nexus between inflation and economic growth in Bangladesh. The study period was 1978 to 2010. They applied Augmented Dicky-Fuller (ADF) and Phillip-Perron (PP) tests for checking stationarity. They employed two econometric models: The first one investigated the long-run and short-run association between GDP as dependent variable and GDP

deflator (GDPD) as independent variable through Johansen (1988) co-integration test and the related Error Correction Model (ECM). The second one determined the way of causality between the variables by Granger causality test. The unit root test showed that variables were stationary at first difference. They discovered that during 1978-2010 inflation and economic growth did not show co-integrating connection among them for Bangladesh data by using co-integration test. They further found a one-way causality going from inflation to economic growth through Granger Causality Tests.

By examining the data in 2009, Daly and Hobjin (2010) showed that the real GDP was closed upon flat in 2009 and trend level raised by 3% which should make a 1.5% rise in unemployment under Okun's law. But in actual fact, the unemployment increased by 3% which was in excess of twice the predicted increase. This was because fast progress in productivity enabled business to sustain output levels with fewer labors. This result was estimated by taking into account potential factors, measurement errors, changes in employer and worker behavior, unusual surges in productivity and the efficiency of producing output.

A work of El-Agrody et. al. (2010) on Egyptian economy investigated the influence on GDP of the increasing rate of agricultural unemployment during the period of 1994-2007. This study relied on secondary data from the Central Agency for Public Mobilization and Statistics (CAPMAS) and the Ministry of Central Agriculture and Reclamation (MOALR) and applied regression model using Ordinary Least Square (OLS) method to find out the impact of agricultural unemployment rate on GDP. They took the variable GDP as dependent and agricultural investment, interest rate, exchange rate, national unemployment, privatization as explanatory variables. The result of their study showed a statistically significant positive association amid the size of GDP and independent variables and a negative association between the size of GDP and the interest rate. The authors suggested revising the executed privatization policies.

Wajid and Kalim (2010) studied and investigated the effect of inflation and economic growth accompanied by trade openness and urban population on unemployment in Pakistan during 1973-2010. They applied Augmented Dickey Fuller Test for checking the stationarity and Johansen–Juselius Maximum Likelihood Approach to find out the impact of independent variables (inflation, economic growth, trade openness, urban population) on dependent variable

(unemployment). They discovered that in the long run inflation considerably raises unemployment and economic growth has an extensive adversarial influence on unemployment in the long run as well as in the short run. Moreover they found that although the long run effect of trade openness on unemployment was insignificant this turned into significant effect in the short run. Lastly they revealed that the influence of urban population on unemployment is unfavorable in the long run and short run too.

Messkoub (2008) analyzed data from 1980-2003 using descriptive analysis method and demonstrated that even though economic growth in MENA countries was stable they attained moderate increase in lowering unemployment. He found that economic growth does not alone lower unemployment. The author recommended that flexible rules and regulations for the SME and productive job creation should be the target.

Saaed (2007) conducted a paper and examined the association between economic growth and inflation in Kuwait during 1985 to 2005. To attain the empirical outcomes they used two econometric models. They applied Engle-Granger (1987) two stage co-integration technique and error correction models (ECM) to investigate connection between inflation and economic growth, logs of real GDP (LogRGDP) and CPI (LogCPI). They found that in the long-run the link between growth and inflation was negative.

Khaliq, Soufan and Shihab (2006) conducted a study and tested the linkage between unemployment and GDP growth for the 9 Arab countries during 1994 to 2010. They applied unit root testes methodology and Pooled Estimated Generalized Least Squares, EGLS (Cross-Section Least Seemingly Unrelated Squares, SUR) to calculate the long-run model where unemployment was the dependent variable and real economic growth rate and population growth rate are the explanatory variables. They found that economic growth significantly and inversely influenced the unemployment rate. The numerical value revealed that 1 percent rise in economic growth would decrease the unemployment rate by 0.16%.

Kitov (2006) conducted a paper on Inflation, unemployment, labor force change in the USA and observed the inflation taking into account 1960 to 2004 as study period. The variables of this study were unemployment (dependent) and inflation, change in labor (explanatory).He found that in the USA labor force change was the driving force of inflation and unemployment was a

lagged linear function of the labor force change. The outcomes of the study described that estimate of population created by Census Bureau of United States delivered a helpful instrument for assessing long- term behavior of changes in labor force. The study also described that inflation and economic growth were independent and driven by the various forces connected to population.

Ahmed and Mortaza (2005) studied and discovered the link between inflation and economic growth in Bangladesh perspectives. The authors empirically showed the presence of a statistically significant long-run inverse association between inflation and economic growth utilizing data set on real GDP and CPI considering the period 1980 to 2005 collected from Bangladesh Bureau of Statistics (BBS). They applied co-integration and error correction models to attain an evaluation of empirical confirmation. They also investigated an interesting policy issue about the threshold inflation level for the economy.

Cashell (2004) conducted a paper and examined the connection between inflation and unemployment. The data was collected from 1997 to 2001. He found that the sensitivity of inflation to changes in the unemployment was very low. The author concluded that existing calculation of natural rate suggested that unemployment rates below 5% will increase the inflation rate in the end.

Malik and Chowdhury (2001) studied the nexus between inflation and GDP growth taking into account four South Asian Countries (Bangladesh, India, Pakistan and Sri Lanka). They applied co-integration and error correction model to ascertain long-run connection between GDP growth rate (dependent variable) and inflation (independent variable). They discovered that the long-run connection concerning GDP growth rate and inflation was positive in four South Asian Countries. They also found some significant responses amid inflation and economic growth.

Calmfors and Holmlund (2000) conducted a paper on Unemployment and economic growth: a partial survey and described the factors of equilibrium unemployment as well as the association between long- term growth and unemployment. The authors discovered an unclear connection between long-term growth and unemployment. They also showed that the influence of unemployment on long-term growth can be positive and negative too.

Krugman (1994) conducted a research paper on Past and Perspective Causes of Unemployment. In this research, he stated great post-Bretton-Woods recessions and G-7nations' condition of unemployment particularly United States, Western Europe and West Germany. Moreover the paper addressed issues of unemployment in the Organization for Economic Cooperation Development countries and discussed on critical difference between cyclical and structural movements in unemployment as well as high unemployment in the industrial nations that time.

3. Data and Methodology

This part of the study narrated the type and source of data and econometric methods that are employed for calculating the effect of economic growth and inflation on unemployment.

3.1 Selection of variables and Data

Five variables are considered for this study. Unemployment is taken as dependent variable and inflation, economic growth are taken as explanatory along with two additional variables industry, age dependency ratio. The type of data used in this study is time series. Data are collected from secondary sources considering the period 1991-2015. The study period is confined to 25 years because data on unemployment is not available before 1991.

The annual data for unemployment (hereinafter UNEMP) as percentage of total labor force estimated by International Labor Organization (ILO), economic growth (hereinafter GROWTH) as GDP growth (annual %), inflation (hereinafter INF) as GDP deflator (annual %), industry (hereinafter IND) value added (annual % growth), age dependency ratio (hereinafter AGEDEP) (% of working age population) are taken from World Development indicators, WDI (2018).

3.2 Description of variables

Unemployment

International Labor Organization (ILO) defined unemployment as the number of people without work but available for and actively looking for it as percentage of total labor force (age between15-64). Unemployment is one of the common problems in Bangladesh. Unemployment is taken as dependent variable in this study.

Economic Growth

Economic growth is an expansion in the production of goods and services compared from one period of time to another. Gross domestic product (GDP) is the best way for measuring economic growth as it considers the overall output of the economy. As economic growth helps to lessen unemployment, this study tries to find out the impact of it on unemployment in Bangladesh. Economic growth as GDP growth (annual %) is taken one of the explanatory variables in this study.

Inflation

The definition of inflation can be stated as follows: a sustained rise in the general price level. of goods and services in a country over a period of time. The impact of inflation on an economy can be simultaneously positive or negative. When inflation is high it increases the prices of goods and services that lead to fall in aggregate demand as well as a fall in demand for labor and therefore low unemployment .Opposite can also happen when inflation is low. This study used inflation as a GDP deflator as a proxy to calculate the impact of it on unemployment.

Industry

Industry is a business action that is linked to processing, producing or manufacturing of products. As industry grows it generates employment opportunities and hence unemployment reduction. Industrial sector is one of the key employment opportunity creators. Industry value added (annual % growth) is used as another explanatory variable in this study to find out its impact on unemployment.

Age dependency ratio

The age dependency ratio is defined as the ratio of dependent people (ages below 15 and over 64) to the working age population (age between15-64) and expressed as the share of dependents per 100 working age population. When the dependency ratio is high the no of dependent people increases in relation to working labor force. This may cause a shortage of labor force and thus low unemployment. Also the high number of dependents compare to working age population may create a pressure on the working age population to actively looking for work and

hence lessen the unemployment. Based on this notion age dependency ratio is included as an explanatory variable in this study.

3.3 Model Specification

The negative connection between an economy's growth rate and unemployment is a broadly acknowledged theory in economics. The connection has been proposed and explained by Arthur Melvin Okun in 1962, known as Okun's Law, especially the other version of Okun's Law. It is an empirically observed association amid unemployment and country's production. The other version of Okun Law described that rate of unemployment changes from one quarter to the next with quarterly real output growth and can be written as:

Unemployment rate change = a+b* (Real output growth). This captures how growth rate of output changes simultaneously with unemployment rate change. The parameter b is often called "Okun's coefficient". (Knotek, 2007). "One would expect the Okun's coefficient to be negative, so that rapid output growth is associated with a falling unemployment rate and slow or negative output growth is associated with a rising unemployment rate. The ratio "-a/b" gives the rate of output growth consistent with a stable unemployment rate, or how quickly the economy would typically need to grow to maintain a given level of unemployment" described by Knotek (2007). Many researches have been directed to examine the applicability of Okun's Law. The validity of Okun's Law and significance connection concerning unemployment rate and economic growth rate varies taking into account the country and time period.

The Phillips Curve named after William Phillips describes the connection between the inflation rate and the unemployment rate. A study by Phillips (1958) on The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom during the period of 1861-1957 delivered evidence of a consistent negative association: high unemployment increased wages slowly and wages increased rapidly when the unemployment was low. Phillips supposed that lower unemployment make labor market tighter and consequently the quicker firms need to increase wages to attract limited labor. Higher unemployment rate decreased the pressure. Philips Curve shows short run tradeoff concerning unemployment and inflation but in the long run it has not been noticed. Friedman (1968) stated that Phillips Curve was found relevant only in the short run but in the long run unemployment won't reduce by inflationary

policies. After that Friedman accurately predicted that during the 1973-75 recessions, inflation as well as unemployment would rise. In modern times the long run Phillips Curve is seen vertical at the natural unemployment rate indicating no inflationary influence on unemployment.

On the basis of existing literature and objectives of the study, the regression model is constructed as follows:

UNEMP = f (GROWTH, INF, IND, AGEDEP)

$$\mathbf{UNEMP_t = \beta_0 + + \beta_1 GROWTH_t + \beta_2\ INFt + \beta_3 IND_t + \beta_4 AGEDEP_t + €_t}$$

Where,

UNEMP = Unemployment rate

GROWTH = GDP growth (annual %) as a proxy economic growth

INF = Inflation Rate

IND = Industry value added (annual % growth)

AGEDEP = Age dependency ratio (% of working age population)

β_0 = Intercept term

β_1, β_2, β_3, β_4 = Partial regression coefficient

t = Time period (1991-2015)

€ = Error term

The hypotheses regarding the signs of the independent variables are stated below:

(i) The association between unemployment rate and economic growth as stated by Okun's law is inverse. Faster growth in output leads to a reduction in unemployment whereas slow or negative growth raises unemployment.

(ii) Inflation is inversely connected to unemployment according to Phillips Curve. When labor demand rises because of monetary expansion, the rate of unemployment would

fall leading wages/prices to increase and therefore generating a trade-off between inflation and unemployment.

(iii) The industrial sector helps to reduce unemployment as an organized industrial sector must absorb an adequate number of workers by creating job opportunities. The sign of industry is expected to be negative.

(iv) High number of dependent people as share of the working age population encouraged the latter to more actively look for job to support the dependents and therefore probably lead to a fall in the rate of unemployment.

3.4 Estimation Technique

The study used descriptive statistics for the model. Since the data used in this study are time series, before going into regression analysis there is a need to test the data for stationarity. There are various techniques for testing unit root problem to determine whether it is stationary or not. This study employed Augmented Dicky-Fuller (ADF) test. After checking for stationarity and if it is required, testing co-integration and the impact of economic growth, inflation, and industry and age dependency on unemployment is tested by applying Ordinary Least Square (OLS) method.

3.5 Diagnostic Checking

After regression analysis the study use Jarque-Bera test for testing the normality of data, Breusch-Pagan test for heteroscedasticity, Variance inflation factor (VIF) for testing the presence of multicollinearity, Durbin Watson d statistic for testing first order autocorrelation, and Ramsey's Regression Specification Error Test (RESET) test for checking of omitted variable that are important and not included in the model.

4. Data Analysis and Discussion of Result

4.1 Descriptive Statistics

The data analysis starts with the descriptive statistics that helps to discover time series properties of the variables. Table 1 below is the descriptive statistics also called the summary statistics of the study.

Table1. Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
UNEMP	25	3.82	.837	2.2	5.1
GROWTH	25	5.368	.966	3.485	7.059
INF	25	5.698	3.426	.156	19.143
IND	25	7.632	1.548	4.711	10.134
AGEDEP	25	66.443	9.005	52.579	82.271

Table 1 describes descriptive statistics of the dependent (Unemployment) and independent variables (Economic growth, inflation, industry, age dependency ratio). The study has 25 observations. It shows there is a slight gap between minimum and maximum values of unemployment during the study period which directs a consistent and less unstable unemployment in Bangladesh. It is found that the variation and gap amid minimum and maximum values of economic growth is relatively low in Bangladesh. Inflation in Bangladesh has a large gap during the study period within its minimum and maximum values. It directs an unstable inflation. Industry shows a little variation and gap .It can be shown from the table that the gap between minimum and maximum values of age dependency ratio is large. The high variation and large gap exhibits a highly inconsistent age dependency ratio of Bangladesh.

4.2 Unit Root Test

Unit root problem is checked for individual variables by applying Augmented-Dicky Fuller test. Table 2 shows the result of the unit root test.

Table2. Unit Root Test Result

Augmented Dicky- Fuller Test											
At level						At first difference					
Variables	t-statistics	Critical values			p-value*	Variables	t-statistics	Critical values			p-value*
		1%	5%	10%				1%	5%	10%	
UNEMP	-5.103	-3.750	-3.000	-2.630	0.0000	UNEMP	-12.336	-3.750	-3.000	-2.630	0.0000
GROWTH	-3.752	-4.380	-3.600	-3.240	0.0192	GROWTH	-6.075	-3.750	-3.000	-2.630	0.0000
INF	-3.789	-3.750	-3.000	-2.630	0.0030	INF	-6.769	-3.750	-3.000	-2.630	0.0000
IND	-3.665	-3.750	-3.000	-2.630	0.0046	IND	-6.075	-3.750	-3.000	-2.630	0.0000
AGEDEP	-5.786	-3.750	-3.000	-2.630	0.0000	AGEDEP	-2.565	-4.830	-3.600	-3.240	0.2963

Notes *MacKinnon approximate p-value (5%)

Test contains constant term, and both constant and trend terms, testing hypotheses variable has unit root.

If p-value<0.05, the null hypothesis of non-stationary is rejected that is series is stationary.

The table above shows that all the variables are stationary at level. Unemployment, inflation, industry and age dependency ratio is successful to reject the null hypothesis of non-stationary while testing the hypothesis with constant term. Economic growth successfully rejects the null hypothesis while testing it with constant and trend terms. As all the variables are stationary at same level, there is no need for co-integration.

4.3 Regression Analysis

The following table shows the estimation of the regression model of the study. The estimation is done so by employing Ordinary Least Square Method (OLS).

Table3. Regression Result

UNEMP	Coef.	St.Err	t-value	p-value	Sig.
GROWTH	0.223	0.266	0.84	0.412	
INF	-0.035	0.043	-0.82	0.422	
IND	-0.147	0.128	-1.15	0.263	
AGEDEP	-0.053	0.023	-2.29	0.033	**
CONS	7.490	2.518	2.98	0.007	***
R-squared	0.433	**Number of obs**			25.000
F-test	3.815	**Prob > F**			0.018

***** p<0.01, ** p<0.05, * p<0.1**

The model can be expressed in equation form like this:

$$UNEMP_t = 7.490 + 0.223\ GROWTH_t - 0.035INF_t - 0.147IND_t - 0.053AGEDEP_t$$

(2.98)*** (0.84) (-0.82) (-1.15) (-2.29) **

$R^2 = 0.433$ F= 3.815 p-value = 0.018

Table 3 demonstrates the regression result of the study. The constant or intercept value of unemployment is 7.490 considering all the independent variables of the model are constant. To check whether the explanatory variables are separately statistically significant or not, t-statistics is used. The coefficient value of economic growth is 0.223 that indicates a positive connection between unemployment and economic growth but it is not significant. The findings exhibit that one unit increase in economic growth holding all other variables constant leads to a reduction of 0.223 units in unemployment. So it can be concluded that Osun's law of inverse link between unemployment and economic growth does not hold for Bangladesh. It is found that inflation has an insignificant adverse impact on unemployment. Though the impact is not statistically significant, the negative connection between unemployment and inflation shows the relevancy of Phillips Curve in Bangladesh. The coefficient value of industry shows an inverse and insignificant impact on unemployment in Bangladesh. If industry growth rises by one unit holding all other variables constant, then unemployment goes down by 0.147 units. It is found that age dependency ratio has a negative and statistically significant influence on unemployment for the case of Bangladesh. The value of -0.053 indicates that one unit increase in age dependency ratio holding all the other variables constant , lower the unemployment by 0.053 units. The $\mathbf{R^2}$ value of 0.433 or 43.3% shows that 43.3% variation in unemployment can be explained by the variation in explanatory variables (Economic growth, Inflation, Industry and Age dependency ratio). F-statistics shows the overall significance of the model. It is found that Prob>F= 0.018, this is <0.05(i.e. significant). So it can be concluded that the overall model is statistically significant.

4.4 Result of Diagnostic Checking

Jarque –Bera test: Through Jarque-Bera test, normality of data can be checked. Jarque-Bera statistics follow chi-square distribution. Hypothesis for this test is stated below:

H_0: Error term is normally distributed

H_1: Error term is not normally distributed

The result is Prob Chi =.923 > α = 5% or 0.05. So the null hypothesis cannot be rejected rather it is accepted. Therefore it is concluded that error term of the model is normally distributed.

Breusch-Pagan Test: By this, heteroscedasticity in a multiple linear regression model can be checked. Hypothesis for this test is stated below:

H_0: Constant variance or Homoscedasticity

H_1: Heteroscedasticity

The result is Prob > chi2 = 0.5592, this is >α= 5% or 0.05. So the null hypothesis cannot be rejected. The conclusion will be the model is free from heteroscedasticity.

Multicollinearity test: By variance inflation factor multicollinearity among explanatory variables of the model can be checked. The result of this test is given below. The Rule of thumb is that VIF above 4 recommends further inquiry.

Variance inflation factor

Variables	VIF	1/VIF
GROWTH	3.338	.3
AGEDEP	2.222	.45
IND	1.965	.509
INF	1.082	.924
Mean VIF	2.15	

From the result of variance inflation factor it is shown that for all the variables VIF is less than 4 that indicates explanatory variables are not correlated. So it can be concluded that the problem of multicollinearity is not present in the model.

Durbin Watson d-Statistics: For detecting first order serial correlation, Durbin Watson d-statistic is used. The critical values, $\mathbf{d_U}$ and $\mathbf{d_L}$ for several explanatory variables can be found from Durbin Watson d-statistics table. The decision will be reject the null hypothesis of no positive first order serial correlation if $d < d_L$, do not reject the null hypothesis if $d > d_U$ and if the result is inconclusive if $d_L < d < d_U$. From the result the value of Durbin-Watson d-statistic is d=2.647004. From the table for n= 25 and k= 4, at 5% level of significance Durbin Watson statistics, $d_L = 1.038$ and $d_U = 1.767$. As $d > du$, it can be concluded that the model is free from first order positive autocorrelation.

Ramsey RESET test: Regression Specification Error Test suggested by Ramsey is used for checking of important variables that are not included in the model. In other words, it is used for checking whether the model is correctly specified or not. The hypothesis for this test is stated below:

H_0: The model is correctly specified

H_1: The model is not correctly specified

The result is Prob > F = 0.2735, this is >α=5% or 0.05. So the null hypothesis of the model is correctly specified cannot be rejected rather it is accepted. Therefore the conclusion of the test is the model is free from misspecification.

5. Conclusion and Recommendations

5.1 Recommendations

Findings of this study have confirmed that economic growth along with inflation and industry has insignificant influence on unemployment but only age dependency ratio is significantly connected with unemployment. The study offers some recommendations that are given below:

- The study has found a positive insignificant connection between unemployment and economic growth which is undesirable in case of Bangladesh. Economic growth does not affect unemployment rate despite a gradual increase of it. So the government of Bangladesh should take a policy so that economic growth can influence the unemployment rate.

- Inflation is found adversely connected to unemployment from the result of this study. But it is not statistically significant. Fiscal and monetary policy makers need to form policies for achieving required level of inflation that could affect unemployment rate.
- The study also found that industry growth inversely affect unemployment rate albeit it is not statistically significant. As industry is a sector that creates job opportunities, government of Bangladesh should finance more on it and also encourage private investors to invest more for generating new job for the unemployed.
- The findings of the study have stated that as age dependency ratio increases; it reduces unemployment significantly. Increase in the dependent people relative to working age population causes a reduction in the labor force and hence lower unemployment. But it in turn could slow down economic growth. To make the impact of age dependency ratio on unemployment useful , productivity could be increased for avoiding economic slowdown due to decrease in labor force or expanded the elderly labor force participation rate by rising age for retirement or decreasing elderly workers' income tax.

5.2 Conclusion

This paper examines the influence of economic growth and inflation along with two additional variables industry and age dependency ratio on unemployment in Bangladesh utilizing the annual data over the period from 1991 to 2015. The addition of the variable age dependency ratio brings newness of the studied model. From regression results economic growth is found to be insignificantly and positively affecting unemployment that shows an unwanted situation for Bangladesh. The result leads to the conclusion that Okun's Law does not valid in case of Bangladesh. Inflation though inversely linked with unemployment is not a significant variable. But the negative connection confirmed Phillips Curve in Bangladesh. The study also found that industry's impact on unemployment is insignificantly negative. Only age dependency ratio is found a significant variable to explain unemployment in the case of Bangladesh. The R-squared value is moderate which assures this model as a good model by providing comparatively good fit of the data. The overall model is significant as indicated by the F-statistics.

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https://data.worldbank.org/indicator/NV.IND.TOTL.KD.ZG

https://data.worldbank.org/indicator/SP.POP.DPND

Appendix

Data of the study

Year	UNEMP	GROWTH	INF	IND	AGEDEP
1991	2.200000048	3.485227815	2.729531996	4.710898398	82.27105951
1992	3.799999952	5.442685551	2.582161899	6.989203263	80.96718817
1993	2.400000095	4.711561724	0.155518173	8.094186604	79.49188773
1994	2.900000095	3.890126441	3.966216316	8.129669182	77.93528373
1995	3.599999905	5.121277897	7.144938703	10.13436684	76.35107223
1996	2.5	4.522919218	19.14321311	6.736726694	74.97567655
1997	5.099999905	4.489896497	3.800232201	5.225481967	73.55850523
1998	2.700000048	5.177026873	4.736212562	8.726901365	72.11546914
1999	4.599999905	4.670156368	3.781037737	5.241305046	70.65180204
2000	3.299999952	5.293294718	3.44665935	6.255771363	69.17964641
2001	3.299999952	5.077287776	3.261160132	7.461679691	68.03508546
2002	3.400000095	3.83312394	3.892867435	5.803009825	66.83511761
2003	4.300000191	4.739567399	5.815816648	6.581699727	65.60706845
2004	4.5	5.23953291	4.56213638	7.049271768	64.37285129
2005	4.199999809	6.535944941	4.586360705	7.932370962	63.13470106
2006	4.5	6.671868265	5.875972258	9.797899954	62.23812084
2007	4	7.058636206	6.471223456	9.027828231	61.28605366
2008	3	6.013789759	7.860966092	7.033534043	60.29092485
2009	5	5.045124794	6.764354686	6.913173254	59.27227098
2010	4.5	5.571802274	7.14464873	7.032201959	58.23679263
2011	4.5	6.46438388	7.859446035	9.019130178	57.07321231
2012	4.5	6.521435078	8.164597746	9.435598764	55.97100881
2013	4.300000191	6.013596067	7.174963123	9.639358906	54.88728585
2014	4.199999809	6.061093054	5.668754958	8.160014237	53.76234991
2015	4.199999809	6.552633316	5.872776577	9.666904855	52.57851108

Data Source: World Development Indicators

Here, UNEMP = Unemployment, total (% of total labor force) (modelled ILO estimate)

GROWTH = GDP growth (annual %)

INF = Inflation GDP deflator (annual %)

IND= Industry Value Added (annual % growth)

AGEDEP = Age Dependency Ratio (% of working age population)