# The Applicability of Phillips Curve to Bangladesh

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**Abstract:** *A.W.Phillips (1958) popularized the Phillips curve by drawing a relationship between the rate of inflation and the rate of unemployment in the United Kingdom from 1861 to 1957. In the 1970s, the relation broke down for both US and OECD countries. Actually, it clearly depends on the nature and structure of the economy. The main purpose of this study is to analyze the applicability of Phillips Curve to Bangladesh using the most recent macroeconomic time series data from 1995-96 to 2009-2010 for around 14 years. The Johansen multivariate Cointegration test indicates that long run Phillips curve does not exist in Bangladesh. Again, Granger causality test suggests a unidirectional positive causality from rate of inflation to rate of unemployment that is totally the opposite picture of the expected relationship in Phillips curve. The important finding is that stagflation is evident in Bangladesh.*

## I. Background of the Study

In Bangladesh, the persistently growing rate of inflation has become one of the major crucial issues since 2002-2003. Although it was possible to slow down the rate from 9.94% in 2008 to 6.66% in 2009, it has already been intensified within the last decade. The nexus between inflation and unemployment has drawn a widespread notice of the macroeconomists and policy makers as the two goals of the policymakers, low inflation and low unemployment, often conflict while they are to use monetary or fiscal policy to expand aggregate demand. So, the Phillips curve has a greater significance for inflation targeting & economic growth of the country, better usefulness for describing the determinants and prediction of inflation.

A.W.Phillips[i] (1958) popularized the Phillips curve by drawing a relationship between the rate of wage inflation and the rate of unemployment in the United Kingdom from 1861 to 1957. Actually the Phillips curve is a reflection of the short-run aggregate supply curve. When the policymakers expand aggregate demand, the economy moves up along the short-run supply curve, unemployment may fall temporarily by inducing inflationary effects in both labor and product markets that arise from an increase in national income, output and employment and vice-versa. It suggests a short-run trade off between inflation and unemployment that is known as the Phillips curve. But the original Phillips curve came under sustained attack- in particular from the monetarist economists. In the late 1960s, Milton Friedman and Edmund Phelps stated that such trade-off could exist only if wage setters systematically under predicted inflation and that were unlikely to do so forever.

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[i] See Blachard, Olivier. Macro Economics, chapter-8, page-149

Then the explanation that Friedman came up with was to include the role of expectations in the Phillips curve-hence the Expectations-Augmented Phillips curve was developed. In the 1970s, the relation broke down for both US and OECD (Organization for Economic Cooperation and Development) countries. Robert Solow[ii] captured the concept of inflation inertia well during the high inflation of 1970s; he mentioned "Why is our money ever less valuable? Perhaps it is simply that we have inflation because we expect inflation, and we expect inflation because we've had it."

The main purpose of this study is to analyze the applicability of Phillips Curve to Bangladesh, that means, whether there is any short run or long run Phillips exercise exists in Bangladesh by using necessary econometric tools like cointegration and Granger Causality test. In addition, there will also be an attempt to check for the applicability of Expectation Augmented Phillips curve if the conventional Phillips curve is not appropriate for Bangladesh.

All the empirical analysis of this paper has been conducted using annual data set on unemployment and inflation in Bangladesh for the period of 1995-96 to 2009-10 over 14 years. The result of this analysis will provide useful guidance for our domestic policy makers. The remainder of this paper is organized as follows: Section-II reviews the empirical literature on inflation and unemployment. Section-III briefly explains the adopted methodology for this study. Section-IV and section-V provide a brief overview on the nature of inflation and unemployment of Bangladesh respectively. Section-VI presents the estimated results & discussions. Finally, section-VII represents a summary of the main conclusions, limitations of this paper and discusses a possible future extension.

## II. Literature Review

To date, the relationship between inflation and unemployment remains controversial or somewhat inconclusive and several empirical studies confirm the existence of either positive or negative between these two major macroeconomic indicators which clearly depend on the nature and structure of the economy and vary across countries. Some crucial findings from different studies of Bangladesh and some other developing & developed countries are presented here.

Using annual data set on real GDP (Gross Domestic Product) and CPI (Consumer Price Index) for the period of 1980 to 2005 of Bangladesh Ahmed et al. (2005) demonstrates that there exists a statistically significant long-run negative relationship between inflation and economic growth for the country. In addition, the estimated threshold model suggests 6-percent as the threshold level (i.e., structural break point) of inflation above which inflation adversely affects economic growth. Ahmed et al (2005) further suggested a positive relationship between inflation and GDP growth up to the inflation rate of 7 percent (approximately) and a negative relationship is observed after that level of inflation rate on the basis of data of 2000, 2001 and 2005. Policy Analysis Unit of Bangladesh Bank (2008) stated that such relationships are somewhat elusive and unstable. It is also emphasized that even if such relationship exists, it is more likely to be non-linear and the desired rate of inflation can change in space and over time. Besides,

[ii] *See Mankew, N. Gregory.2004. Macroeconomics., fifth edition, pp: 362*

Mubarik (2005) estimated that an inflation rate beyond 9-percent is detrimental for the economic growth of Pakistan. This in turn, suggests that inflation rate below the estimated level of 9-percent is favorable for the economic growth

Actually, all the above studies have confined their research in determining short run or long run relationship between inflation & economic growth rate and threshold level of inflation. They did not show whether inflation is affected by unemployment through the output growth or the applicability of Phillips curve in Bangladesh. However, some important findings relating inflation for US, Germany, France and Namibia are summarized below.

Kitov (2009) stated that there is no Phillips curve in the United States, i.e. unemployment does not drive inflation at any time horizon. There is a statistically robust anti-Phillips curve -inflation leads unemployment by 10 quarters. Several tests for cointegration do not reject the hypothesis that there exists a long-term equilibrium relation between inflation and unemployment in the US. Besides, US, Germany, France and other biggest developed countries demonstrate the presence of similar linear lagged relationships.

Christensson (2009) measured the oil price pass-through to various consumer price categories on a national, regional and city level in the United States. A significant pass-through to inflation (including all items) is recorded for all regions, while core inflation remains largely muted. The West region has experienced a much lower pass-through than other regions due to mainly greater oil efficiency, lower inflation variability and a lower exchange rate. There was an increasing trend for pass-through to inflation from the late 1980's and the contrary was found for core inflation.

LeBlanc et al. (2004) estimated the effects of oil price changes on inflation for the United States, United Kingdom, France, Germany, and Japan using augmented Phillips curve framework and this study suggests that current oil price increases are likely to have only a modest effect on inflation in the U.S, Japan, and Europe. Oil price increases of as much as 10 percentage points will lead to direct inflationary increases of about 0.1-0.8 percentage points in the U.S. and the E.U. Inflation in Europe is unlikely to show any significant difference in sensitivity from that in the United States and in fact may be less in some countries. It is evident from the results and discussion of Ogbokor (2005) that the economy of Namibia does not conform to the traditional Phillips curve postulation. The Namibian economy rather exhibits the presence of stagflation. In the last eight years or so the Namibian economy has been simultaneously facing a high level of unemployment and inflation, mainly imported inflation.

Against this backdrop, the research paper of Ogbokor (2005) for Namibia motivated me to a great extent to do Phillips exercise in the context of Bangladesh. As far as concerned, there is no well-defined work on Phillips curve which directly emphasizes the applicability of negative relationship between inflation and unemployment rate for Bangladesh. Still we have to face the adverse effects of inflation more frequently and the figures of unemployment also show a consistent increasing trend. Actually, both figures give an impression of positive relationship apparently. But we can not surely define it unless we do proper econometric analysis to explore whether the relationship is statistically negative or positive. This study will check for the applicability of Phillips

curve and Expectation augmented Phillips curve for Bangladesh during the period of 1995/96- 2019/10 by applying the Johansen Cointegration test for determining long run relationship and Granger's Direct Causality test for short run dynamics.

## III. Methodology

The research methodology adopted for this study is both descriptive and econometric in nature. The pattern of data collection method and the formulation & specification of regression models are briefly discussed by the following two sections.

### A. Data Sources

All the Information are collected through secondary sources. Data on unemployment have been collected from different years' reports of Labor Force Survey of Bangladesh and that on inflation is recorded from the annual report 2008-09 of Bangladesh Bank. Besides, publications in Articles, books, journals, reports of BBS (Bangladesh Bureau of Statistics) & Bangladesh Bank and other relevant institutions were used for further information. A little modification has been done to bring completion in the data of unemployment of different years although it was already adjusted for cyclical unemployment. As Labor Force Survey did not conduct its survey every year, it could have provided data on unemployment rate only for 1995-96, 1999-00, 2002-03 and 2005-06. From FY07 - FY09, data have been collected from the projected labor market situation of policy analysis unit, Bangladesh Bank. Again, interpolation method is used to remove the data inconsistency of unemployment between different periods that were not readily available in any kind of data sources. All of the labor force surveys in Bangladesh strictly followed the concepts and definitions as recommended by International Labor Organization (ILO). The labor force survey1995-96 considered the civilian labor force aged "10 years and above" and the surveys from 1999-00 to onwards considered the concept "15 years and above", so this shift has caused the drop in the recorded employment growth. It was not possible to ignore the data of 1995-96, as most of developing or poor countries, like Bangladesh, don't have a sufficient record of unemployment to do a thorough study in this respect. Moreover, statistics of 1995-96 are needed in order to get a precise estimation of the parameters & a fairly accurate nature of the Phillips curve.

On the contrary, the record of inflation rate and price level (CPI) from different bulletins of Bangladesh Bank defines the inflation rate as the annual percentage change in consumer prices compared with the previous year's consumer prices and it maintained a complete uninterrupted pattern in each year. In case of annual oil price, the weekly raw data of all countries spot price (dollars per barrel) is collected from the corresponding website of U.S. Energy Information Administration (EIA) and transformed into annual from weekly by taking proper calculation in MS Excel spreadsheets. Finally, all data like Consumer Price Index, number of yearly unemployed Laborers and annual average oil price have been transformed into natural logarithmic figures to express rate of inflation, unemployment and annual oil price respectively and also for performing proper econometric analysis through the software package STATA 9.

## B. Model Formulation And Specification

Theoretically, the equation of Phillips curve has been derived from the aggregate supply relation. Thus the Phillips exercise[iii] can be written as-

$$\Pi_t = \Pi_t^e - ß\ (u - u^n) + v \qquad \ldots\ldots\ldots\ldots\ldots\ldots (i)$$

Where $\Pi_t$ denotes the rate of change in prices from last year to this year, $\Pi_t^e$ denotes the rate of change in prices (expected by wage setters as of last year) from last year to this year, v represents the exogenous events and the parameter ß determines how responsive inflation is to cyclical unemployment ($u - u^n$). Here, the change in world oil prices is considered as an exogenous event since different theories suggest it as a significant factor influencing inflation. Basically, an increase in oil price leads to an increase in the cost of production by shifting the aggregate supply curve leftward and wage-price spiral takes place. According to the theory, the expectations are formed as $\Pi_t = \theta\ \Pi_{t-1}$ where the value of parameter θ captures the effect of last year's inflation rate on this year's expected inflation rate. Thus, equation (i) can be written as-

$$\Pi_t = \theta\ \Pi_{t-1} - ß\ (u - u^n) + v \qquad \ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

The change in expectation formation can cause a variation in the nature of relationship between unemployment and inflation .When $\theta = 0$, we get the original Phillips curve like the following that Phillips, Solow and Samuelson found for UK and US.

$$\Pi_t = - ß\ (u - u^n) + v \qquad \ldots\ldots\ldots\ldots\ldots\ldots (iii)$$

When $\theta = 1$, the reflection becomes –

$$\Pi_t = \Pi_{t-1} - ß\ (u - u^n) + v \qquad \ldots\ldots\ldots\ldots\ldots\ldots (iv)$$

It is often called the Modified or the Expectation-Augmented Phillips curve which states that inflation depends on past inflation, cyclical unemployment (the difference between actual unemployment and natural rate of unemployment) and a supply shock.

On the basis of this theoretical background, two regression equations are formulated to examine the relationship between inflation and unemployment in Bangladesh. In this regard, the variables to be used in this model can be defined in the following way:

Let, $\Pi_t$ = Rate of Annual Inflation at time period t,

$\Pi_{t-1}$ = Rate of Annual Inflation at time period t-1,

$\Delta\ \Pi_t = \Pi_t - \Pi_{t-1}$

$UNE_t$ = Unemployment

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[iii] *See Mankew, N. Gregory.2004. Macroeconomics., fifth edition, pp: 359*

$V_t$ = International oil price shock.

$\varepsilon_{1t}$ = Stochastic Error term of the first model

$\varepsilon_{2t}$ = Stochastic Error term of the second model

It is evident from the formulation of Phillips Curve that $\Pi_t = f(UNE)$. And there should be a negative relationship between these two variables in the short run and that means the first order derivative should be negative $\delta(\Pi_t)/\delta(UNE) < 0$.

Now, on the basis of the equation (iii) and (iv), econometric models will be like the following:

$$\Pi_t = ß_0 + ß_1 UNE_t + ß_2 V_t + \varepsilon_{1t}$$

$$\Delta \Pi_t = ß_0 + ß_1 UNE_t + ß_2 V_t + \varepsilon_{2t}$$

**C. Stationarity Of Timeseries Data**

Sometimes in regressing a time series variable on another time series variable, we often obtain very high $R^2$ even though there is no meaningful relationship between the variables. Non-stationarity generally arises due to the presence of trends in the data which is stochastic in nature (random walk process) and it confirms that the data has a unit root process. Stochastic behavior of time series data may be characterized by different possibilities. Pure random walk without drift which is a DSP (Difference Stationary Process) and random walk with drift (first upward and then downward) exhibits stochastic trend which is also DSP. Again, the data may be stationary around the trend that means TSP (Trend Stationary Process). The augmented Dickey-Fuller (ADF) test is a modification of the DF test to ensure that the error process in the estimating equation is residually uncorrelated and captures the possibility that $X_t$ is characterized by a higher order autoregressive process. The ADF test is estimated in three different forms:

1. $\Delta X_t = \delta X_{t-1} + \lambda i \sum \Delta X_{t-i} + u_{1t}$
2. $\Delta X_t = \alpha_0 + \delta X_{t-1} + \lambda i \sum \Delta X_{t-i} + u_{2t}$
3. $\Delta X_t = \alpha_0 + \alpha_1 t + \delta X_{t-1} + \lambda i \sum \Delta X_{t-i} + u_{3t}$

Where $\Delta$ is the first difference operator, $\alpha_0$ is the intercept (constant), t denotes a linear time trend and $\alpha_0$, $\alpha_1$ and $\lambda_i$ are the coefficients and $\delta = \rho - 1$ and $-1 \leq \rho \leq 1$ and the $u_t$ is the stochastic error term that follows some classical assumptions: $E(u_t) = 0$, $Var(u_t) = \sigma^2$ and $Cov(u_t, u_{t-1}) = 0$ (i, e., white noise disturbances). Now if $\delta = 0$ or $\rho = 1$, we say that the stochastic variable $X_t$ has a unit root or the variable is integrated of order one: $Xt \sim I(1)$. The random variable $\varepsilon_t$ is a normally distributed white noise error term (that is, the residual series $\varepsilon_t$ is free of any significant autocorrelation and it is NID with mean 0 and SD constant). The lag length $\lambda$ is set to ensure that any autocorrelation is absorbed, and the error term is distributed as white noise.

**D. Var Cointegration Test**

The following equations represent the relationship between CPI (price level), number of unemployment and the international oil price of the desired two models:

$$\ln CPI_t = ß_0 + ß_1 \ln Un_t + ß_2 \ln Oil\ price_t + \varepsilon_{1t}$$

$$\Delta \ln CPI_t = ß_0 + ß_1 \ln Un_t + ß_2 \ln Oil\ price_t + \varepsilon_{2t}$$

Variables are transformed by the natural logarithms so that coefficients of each variable represent the elasticity of CPI, unemployment and annual average price of oil. Regression model involving n variables may have **n-1** cointegrating vectors. As there may be more than one cointegrating vector in this model, the likelihood ratio test of Johansen (1988) and Juselius (1990) will be used to obtain all cointegrating vectors. The approach to testing for Cointegration in a multivariate system is similar to the ADF test, but requires the use of a VAR approach. It should be viewed nothing more than a generalization of the Dickey Fuller testing procedure to the multivariable one. If Xt is cointegrated, it can be generated by a vector error correction model (VECM):

$$\Delta \mathbf{X}t = \boldsymbol{\mu} + \sum_{i=1}^{\rho-1} \boldsymbol{\Pi_i}\ \Delta\ \mathbf{X_{t-1}} + \Pi\ \mathbf{X_{t-\rho}} + + \boldsymbol{\varepsilon}_t$$

where $\boldsymbol{\mu}$ is $_{nx1}$ vector with drift, $\boldsymbol{\Pi i}$ are $_{nxn}$ matrices of parameters, and $\boldsymbol{\varepsilon}_t$ is a $_{n\ x1}$ white noise vector. Here $\boldsymbol{\Pi i}$ represents the short run adjustment to changes in $\mathbf{Xt}$ and $\boldsymbol{\Pi}$ represents the long run adjustments. We know that the rank of a matrix is equal to the number of its characteristic roots that differ from zero. The number of distinct cointegrating factors can be obtained by checking the significance of the characteristic roots of $\boldsymbol{\Pi}$.

If the coefficient matrix $\boldsymbol{\Pi}$ has reduced rank r<n, then there exist $_{nxr}$ matrices $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}'$ each with rank nxr and rxn such that $\boldsymbol{\Pi} = \boldsymbol{\alpha\beta}'$ and $\boldsymbol{\beta' X_t}$ is stationary. Here, r is the number of cointegrating relationships, the elements of $\boldsymbol{\alpha}$ is known as the adjustment parameter that is similar to an error correction term and each column of $\boldsymbol{\beta}$ gives the long-run coefficients of cointegrating vector.

If rank ($\boldsymbol{\Pi}$) = 0, there is no cointegrating vectors and the variables of $\mathbf{Xt}$ are not co-integrated. If rank ($\boldsymbol{\Pi}$) = 1, there is single cointegrating vector and $\boldsymbol{\Pi}\ \mathbf{X_{t-\rho}}$ is the error correction factor. If 1< rank ($\boldsymbol{\Pi}$) < n, there are multiple cointegrating vectors. There are two tests for the significance of the characteristic roots. These are defined as –

Trace Statistic: $\boldsymbol{\lambda}_{trace}\ (r) = -\ T \sum_{t = r + 1}^{n} \ln [\ 1 - \hat{\boldsymbol{\lambda}}_i\ ]$

Maximal Eigen value statistic: $\boldsymbol{\lambda}_{max}\ (r, r + 1) = -\ T\ \ln [\ 1 - \hat{\boldsymbol{\lambda}}_{r+1}\ ]$

Here $\boldsymbol{\lambda}$ are the estimated value of the characteristic roots obtained from the estimated $\boldsymbol{\Pi}$ matrix and T is the number of usable of observation, **r** is the number of distinct cointegrating vectors. The trace test tests the null hypothesis of **r** cointegrating vectors against the alternative hypothesis of n cointegrating vectors. When all $\boldsymbol{\lambda_i} = 0$, then $\boldsymbol{\lambda}_{trace} = 0$. Again, The Maximal Eigenvalue test $\boldsymbol{\lambda}_{max}$ conducts separate tests on each eigenvalue. The null hypothesis is that there are *r* cointegrating vectors present against the alternative that there are $(\boldsymbol{r + 1})$ present. If the estimated values of the characteristic root are close to zero, $\boldsymbol{\lambda}_{max}$ will be very small. The distribution of both test statistics is non-standard. Neither of these test statistics follows a chi square distribution in general; asymptotic critical values can be found in Johansen and Juselius (1990) and are also given by most econometric software packages.

### E. Var And Granger Causality

Granger causality tests are conducted to determine whether the current and lagged values of one variable affect another by using the "Direct Granger Method". One implication of Granger representation theorem is that if two variables, say Xt and Yt are co-integrated and each is individually 1(1), then either Xt must Granger-cause Yt or Yt must Granger-cause Xt. The methodology suggested by Dolado and Lutkepohl (1996) has been implemented to test for the multivariate Granger causality tests for cointegrating systems. Following their suggested methods avoids the pretest biases associated with the usual procedure of estimating a first order VAR for I(1) variables and an error correction model for the cointegrated system. Therefore, preliminary unit root tests are not necessary and the testing procedure is robust to the integration and cointegration properties of the process. In absence of cointegration, in the context of this paper, the above method implies estimating the undifferenced VAR of VECM of equation (2):

$$Y_t = \alpha_1 + \sum_{i=1}^{n} a_i \; Y_{t-i} + \sum_{j=1}^{n} b_j \; X_{t-j} + \sum_{k=1}^{n} c_k \; Z_{t-k} + \varepsilon_{1t}$$

$$X_t = \alpha_2 + \sum_{i=1}^{n} a_i \; Y_{t-i} + \sum_{j=1}^{n} b_j \; X_{t-j} + \sum_{k=1}^{n} c_k \; Z_{t-k} + \varepsilon_{2t}$$

$$Z_t = \alpha_3 + \sum_{i=1}^{n} a_i \; Y_{t-i} + \sum_{j=1}^{n} b_j \; X_{t-j} + \sum_{k=1}^{n} c_k \; Z_{t-k} + \varepsilon_{3t}$$

Where $\varepsilon_{1t}$, $\varepsilon_{2t}$ and $\varepsilon_{3t}$ are random disturbances, $\alpha_1$, $\alpha_2$, and $\alpha_3$ are constants and i, j, k are the numbers of optimum lag length, which is determined empirically by SBIC criteria. For each equation in the above VAR, Wald $\chi 2$ statistics is used to test the joint significance of each of the other lagged endogenous variables in that equation. For $Y_t$ to be unaffected by $X_t$ and $Z_t$, $\Sigma c_{1t}$ and $\Sigma d_{1t}$, respectively must not be significantly different from zero. Similar logic applies to ($X_t$ and $Z_t$).

## IV. Observation Of The Nature Of Inflation And Overall Economic Phenomena Of Bangladesh

To get a vivid picture of the nature of inflation in Bangladesh**,** this section will firstly provide some basic ideas regarding determinants of inflation[iv] and then a brief discussion on recent inflation experience in Bangladesh.

### A. Determinants Of Inflation

Inflation can be treated as a country specific phenomenon as the determinants of inflation differ across the countries. Yet there are some common factors in determining inflation and these can be divided into two categories: (i) Demand factors and (ii) Supply factors

**Demand factors:**

If employment and production of the economy is above the long-term natural rate, the output gap is positive and the resulting inflation is demand-pull inflation. Demand factors include output gap, real money wage gap, nominal exchange rate and imported inflation.

**Supply factors:**

If the output-gap is constant but inflation is rising due to adverse supply shocks such as oil-price hikes, floods, and droughts, inflation is cost-push. Supply factors include food inflation, % change in index of food production, rainfall, differential between wage inflation and productivity growth and global oil prices.

### B. Inflation Experience Of The Bangladesh Economy

The data represented in the table *Appendix: 1* show the record of inflation in Bangladesh from 1996 to 2010 which accounts for about 14 years .As noted from the table, inflation figure in Bangladesh during FY 1996 was around 6.65%.

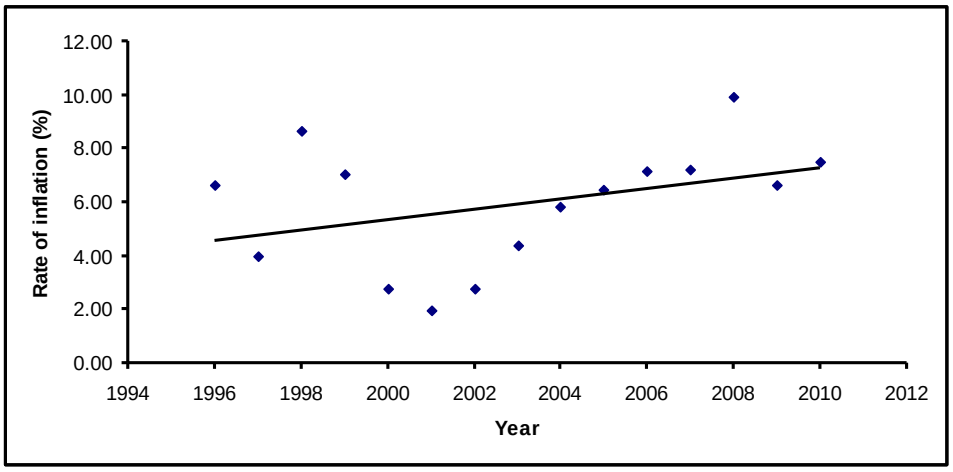


*Figure: 1*

[iv] *See the article "Determination of Inflation in an Open Economy Phillips Curve Framework: The Case of Developed and Developing Asian Countries" by Pami Dua.2009, pp:04*

After that it followed a declining trend (except positive fluctuation in 1998) which has been continuing till FY'01. Since FY'01 the rate was moving gradually upward up to FY'08 and then it declined to 6.7% in FY'09 and again, it slightly increased to 7.5% in FY10. This trend of inflation is shown in the above graph where the horizontal axis represents the time period and the vertical axis represents the rate of inflation. Although the scatter points show some fluctuations around the trend line, close inspection reveals that they are moving upward slowly over 14 years.

Bangladesh Economic Review provides that food inflation is always higher than that of non-food since 2003-04 in Bangladesh and reached at 12.28 %( the maximum level) in 2007-08 while that for non-food was only 6.32%. At present, the gap has been reduced basically due to the declined rate of food inflation. In the backdrop of such inflation record, a comparatively low but stable rate of inflation was widely recognized from the end of record devastating flood of 1998 as a result of four years' (1999-2002) bumper production of food and cereals in the country. The positive trend of inflation from FY'02 ( Fiscal Year 02) to FY'08 (Fiscal Year 08) is mainly due to high growth rate of nominal money supply during FY'04, high nominal devaluation from September 1995 to October 2000, a heavy shortfall of food and all other agricultural production due to catastrophic flood in 1998, adjustments in petroleum prices since 2003, increases in world commodity prices - especially food grain and petroleum, excessive growth of high powered money during FY'06 (Fiscal Year 06), an increase in disposable income in some groups due to the ban on hartals and lockouts, excessive liquidity due to massive crackdown on corruption, syndication by trading mafias who were hoarding goods and thereby driving up prices to make windfall profits and two consecutive floods in July-September 2007 and the cyclone in November 2007.

In contrast, the softening of inflationary pressures in Bangladesh was mainly due to fall in prices of foods and fuel in international markets, favorable weather condition, bumper domestic production, restoration of business confidence, stability in political situation, lower and subsidized input costs, open market operation, sufficient import of food grain and widening of social safety net programmes etc.

## V. Nature Of Unemployment In Bangladesh

In a labor-surplus economy such as Bangladesh, total labor force grew from 40.7 million in FY00 (Fiscal Year 00) to 49.5 million in FY06 (Fiscal Year 06) giving an average of nearly 1.5 million new entrants per year. However, the first part of this section will provide the types of unemployment on a theoretical background and then, the unemployment trend of Bangladesh will be discussed with adequate records of data in the second part of this section.

### A. Types Of Unemployment

Unemployment[v] is classified into three types that are based on its origins. They are Frictional, Structural and Cyclical unemployment. *Firstly*, frictional unemployment that arises from normal labor market turnover-as people are moving from one job to another,

[v] *A person aged 15 years and over is considered as unemployed if he/she did not work at all during the preceding week of the survey (even an hour in the reference week) and was actively looking for work or was available for work but did not work due to temporary illness or because there was no work available.*

either because they are fired or seeking to improve their lot, it may be due to labor force expansion or seasonal & part time employment. It is a sign of healthy & dynamic picture of economy. *Secondly*, structural unemployment arises when changes in technology or international competition change the skills needed to perform jobs or change the location of jobs. It really bothers government and worries social planners as it really lasts longer than frictional unemployment. *Finally*, cyclical unemployment is the fluctuating unemployment over the business cycle. It increases during a recession and decreases during an expansion. Full employment occurs when there is only cyclical unemployment or equivalently when all the unemployment is frictional and structural. .The unemployment rate at full-employment is called the natural rate of unemployment. As the real GDP fluctuates around potential GDP, the unemployment rate fluctuates around the natural rate of unemployment.

**B. Unemployment Experience Of The Bangladesh Economy**

A close inspection on the rate of unemployment over different time periods reveals three types of trends. It is evident from the table *Appendix2 (see Figure: 2)* that the unemployment rate shows a gradual upward pattern from 3.50% in FY 96 to 3.96% in FY 99. In contrast, the rate slowly declined in each year from the FY 04 (Fiscal Year 04) up to 09. One mentionable point is that unemployment rate was totally stabilized at 4.3% from FY 00 to FY03. Again, it can be noted that unemployment rate rose sharply to 5.1% from 3.76% for the time period of FY09 (Fiscal Year 09) to FY10 (Fiscal Year 10). It is noticeable *(see Figure: 2)* that the average trend line is highly flatter and is almost like a horizontal line. Actually, the rate of change in unemployment seems to be trivial in Bangladesh although it exhibits an increasing trend.

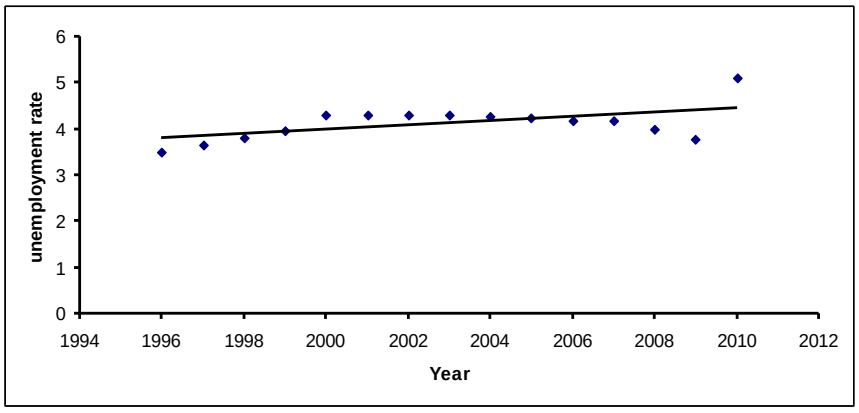


*Figure: 2*

In fact, according to the LFS (Labor Force Survey), the number of unemployed people has increased at a comparatively slower pace over the survey periods and so for the unemployment rate (table *Appendix: 5)*. In such an economy, a low unemployment rate reflects involvement in low productive self-employment and work sharing with family workers as noted research director of Bangladesh Institute of Development Studies.

Although the unemployment rate is very low in Bangladesh, the underemployment[vi] rate is much higher, as it accounts 16.6% for LFS(Labor Force Survey) 1999-00, 37.6% for LFS(Labor Force Survey) 2002-03, 24.5% for LFS(Labor Force Survey) 2005-06 and 28.7% for 2009-10 (table *Appendix: 5*). Again, the estimate of LFS (Labor Force Survey) 2005-06 shows that the underemployment rate of female and male were 68.25% and 10.86% respectively. Of the unpaid family workers 77.9% were female. A distinguishing feature of labor market in Bangladesh is that male participation rate was much higher (86.8% compared to 29.2%) than that of female and the participation rate of male declined to 86.8% in 2005-06 from 87.4% in 1999-00 while that rate for female increased from 26.1% to 29.2% during the period . It is observed from the LFS that there is a gender difference in the participation rate and the unemployment rate for educated person was 4.4% in 1995-96 and it increased at a slower pace over the study period and reached at 5.62 % in 2005-06. Moreover, educated unemployment was higher in case of female during the period (table *Appendix: 5).*

Although agriculture is the largest sector of employment[vii] (48.07% compared to 14.52% in industry and 37.4% in the service sector in 2005-06), there was a decline in employment by 2.63% in this sector during 2009-10 (table *Appendix: 6*). It is observed that employment in manufacturing, construction, finance and business and real sectors witnessed 33 to 50 percent fall. Another noticeable feature is that the service sector is getting more weight day by day. It is clear from (table *Appendix: 6*) that the job creation process is much higher in informal sector than that of formal sector as of the total employed labor over the period of 1995-96 to 2005-06.

It is evident from the table (*Appendix: 7*) that the rate of unemployment was always greater in urban than that of rural over all LFS. Again, unemployment rates were recorded high among the educated people rather than uneducated people (8.88% for SSC & HSC, 6.83% for degree and 6.74% for ix-x in 2005-06.). Moreover, a higher rate of the unemployment is observed in case of female than male which reveals the adverse socio-economic conditions of women in Bangladesh (table *Appendix: 7*).

## VI. Emperical Findings And Discussion

Firstly, the stationarity of the rate of inflation, unemployment and international oil price is tested using the usual ADF (augmented Dickey-Fuller) tests. As there are more than two variables Johansen trace test has been carried out to identify the long run relationship between the variables of these models. Finally, Granger's direct causality has also been applied to check for short run relationship among all variables.

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[vi] *As per ILO definition, any person who did not work for pay or profit even an hour in the preceding week are termed as unemployed. The persons who worked less than 35 hours in the reference week may be termed as underemployed*

[vii] *According to the Employment definition of BBS, An employed person is someone who was either working one or more hours for pay or profit or working without pay in a family farm or enterprise or organization during the reference period or found not working but had a job or business from which he/she was temporarily absent during the reference period.*

## A. Result of Unit Root Test

The results of ADF unit root test are represented in the following two tables. It is based on the three types of specifications for identifying the stationarity of each variable of these two models such as with drift & no time trend, without drift & time trend and with drift & time trend. In this study the optimal lag-length for ln CPI (natural log of Consumer Price Index), ln UNE (natural log of Unemployment) and ln Vt (natural log of Oil price) is one (1) according to the SBIC criteria.

**Table (a)**: Unit Root test for Stationarity at Levels

| Variables | ADF( with drift) | ADF (without drift) | ADF (with drift and trend) |
|---|---|---|---|
| Ln CPI | -0.115 | 2.216* | -1.793 |
| Ln UNE | -0.722 | 1.914* | -2.466 |
| Ln Vt | -0.544 | 1.236 | -3.980* |

* indicates significance at 10% level.

**Source:** Estimation using STATA 9

The result in table shows that all the variables are not stationary in levels 10% level of significance. Result from table 1 provides strong evidence of non stationarity. Therefore, the null hypothesis (each variable is not stationary or each variable is integrated of order 1) is not rejected and it is sufficient to conclude that there is a presence of unit root in the variables at levels.

**Table (b): Unit Root test for Stationarity at First Difference**

| Variables | ADF( with drift) | ADF without drift) | ADF (with drift and trend) |
|---|---|---|---|
| Ln CPI | -2.390 | -1.291 | -3.373* |
| Ln UNE | -3.760* | -1.652* | -3.733* |
| Ln Vt | -4.539* | -2.635* | -3.917* |

*indicates significance at 10% level.

**Source:** Estimation using STATA 9

So, all the variables were differenced once and the ADF test were conducted on them, the result as shown in Table (b).The above table reveals that all the variables are stationary at first difference, on the basis of this, the null hypothesis of non-stationary is rejected and it is safe to conclude that the variables are stationary. This implies that the variables are integrated of order one, i.e. 1(1).

## B. Cointegration Results

Having confirmed the stationarity of the variables at 1(1), it is required to identify the presence or absence of cointegration among the variables. When a cointegration relationship is present, it means that inflation, unemployment and international oil price share a common trend and long-run equilibrium as suggested theoretically. The cointegration analysis is done by employing the Johansen-Juselius multivariate

cointegration test. Table:3 shows the result of the Cointegration test for the first model-the Original Phillips curve.

**Johansen ML results:**

Table(c): Johansen ML results (Trace Statistics and Maximum Eigenvalue )

| **Hypothesized No. of CE(s)** | **Trace Statistic** | **0.05 Critical Value** | **Max-Eigen Statistic** | **0.05 Critical Value** |
|---|---|---|---|---|
| None | 21.40 | 29.68 | 11.30 | 20.97 |
| At most 1 | 10.10 | 15.41 | 8.59 | 14.07 |
| At most 2 | 1.50 | 3.76 | 1.50 | 3.76 |

* denotes rejection of the hypothesis at the 0.05 level

**Source:** Estimation using STATA 9

Table (d): Johansen ML results (Trace Statistics and Maximum Eigenvalue )

| **Hypothesized No. of CE(s)** | **Trace Statistic** | **0.05 Critical Value** | **Max-Eigen Statistic** | **0.05 Critical Value** |
|---|---|---|---|---|
| None | 23.28 | 29.68 | 17.96 | 20.97 |
| At most 1 | 5.31 | 15.41 | 5.11 | 14.07 |
| At most 2 | 0.20 | 3.76 | 0.20 | 3.76 |

* denotes rejection of the hypothesis at the 0.05 level

**Source:** Estimation using STATA 9

Table: (c) and (d) show the result of the cointegration test. In the tables both trace statistic and maximum eigenvalue statistic indicate no cointegration at the 5 percent level of significance, suggesting that there is no cointegrating or long run relations between the variables so tested. In the present study, since linear combinations of non-stationary variables are not found stationary, the variables are not cointegrated. So, short run Granger's Causality test can be performed.

**C. Multivariate Granger Causality Test Results**

The lag length *k* for the VAR is determined using the SBIC Information Criterion. Using the appropriate lag length, Wald tests are then carried out on coefficients using the standard chi-squared distribution. Results of the causality tests are presented in Table(e).

**Table (e):** Pair-wise Granger Causality test between ln CPI and ln UNE

| **Null Hypothesis** | **Obs** | **Wald Stats** | **P value** |
|---|---|---|---|
| ln UNE does not Granger Cause ln CPI | **14** | **0.52** | **0.60** |
| ln CPI does not Granger Cause ln UNE | **14** | **3.95*** | **0.00** |

* denotes rejection of the hypothesis at the 0.05 level

**Source:** Estimation using STATA 9

It is evident from Table: (e) that there is a positive unidirectional causality running from ln CPI to ln UNE, implying that past values of inflation rate have a predictive ability in

determining the present values of unemployment rate. This suggests that stagflation situation is experienced in Bangladesh.

**Table (f):** Pair-wise Granger Causality test between ln CPI and ln Vt

| **Null Hypothesis** | **Obs** | **Wald Stats** | **P value** |
|---|---|---|---|
| ln Vt does not Granger Cause ln CPI | **14** | **0.91** | **0.36** |
| ln CPI does not Granger Cause ln Vt | **14** | **1.77** | **0.07** |

* denotes rejection of the hypothesis at the 0.05 level

**Source:** Estimation using STATA 9

Again, it is observed from Table (f) that there is no causality in any direction between inflation rate and rate of international oil price. In fact, still Bangladesh is highly dependent upon its own reserves of natural gases. The rate of international oil price seems neither to depress nor to promote the domestic inflation situation of our country.

**Table (g):** Pair-wise Granger Causality test between ln UNE and ln Vt

| **Null Hypothesis** | **Obs** | **Wald Stats** | **P value** |
|---|---|---|---|
| ln Vt does not Granger Cause ln UNE | **14** | **-2.34*** | **0.02** |
| ln UNE does not Granger Cause ln Vt | **14** | **1.94*** | **0.05** |

* denotes rejection of the hypothesis at the 0.05 level

**Source:** Estimation using STATA 9

As can be learned from the p-values of the Wald statistic in Table(g), there is an opposite causality running from rate of international oil price (ln Vt) to unemployment rate (ln UNE), implying that increase in international oil price contributes to decreasing unemployment for Bangladesh.

## VII. Conclusion

This paper empirically examined the long-run and causal relationship between inflation, unemployment and international oil price for Bangladesh over 14 years' time series data. The Johansen multivariate cointegration test indicates no cointegration or long run relationship among the variables of Original Phillips curve and Expectation Augmented Phillips curve in Bangladesh. The Granger causality test result suggests that there is a unidirectional positive causality from rate of inflation to rate of unemployment that is totally the opposite picture of the expected relationship in Phillips curve. It implies that if money wage rates rise or if the prices of raw materials rise, firms decrease their supply of goods and services causing the leftward shift of the aggregate supply curve. As a result, the price level rises and the real GDP falls behind the potential GDP, unemployment rate is above its natural rate. The combination of a rise in the price level and a fall in real GDP

that means stagflation is evident in our country. In this case, if our policy makers want to restore the full employment level by expansionary monetary policy, it will call forth the cost-price inflation spiral. So, to control inflation we should emphasize the supply side factors. Again, the international oil price Granger causes the rate of unemployment in Bangladesh. Moreover, it is found that the "adaptive expectation' of Milton Freidman does not significantly contribute in the second model. Besides, the pattern of relationship is necessary for those countries which are more likely to experience inflationary pressure due to their conventional deficit budget like Bangladesh.

There are some limitations and possible future extensions of this study. For example, this study did not incorporate some important variables as the representatives of external supply shock like the price index of agricultural products although the agricultural production contributes around 67.9% of the wholesale price indices. Again, imported inflation has a pivotal role in the price level. Moreover, there is a greater difficulty of achieving adequate data on unemployment to run a very rigorous regression in most of the developing countries like Bangladesh. Inclusion of some important variables along with sufficient data might have provided a more robust estimation of the models. Besides, the study can be extended to determine the true factors for which the Phillips exercise is not applicable to our country.

## Appendix:1

### Table-1: Inflation in Bangladesh (Base year: 1995-96=100)

| Year(Fiscal year-FY) | Rate of Inflation (Πt) (%) | Consumer Price Index(Base year=1995-1996) |
|---|---|---|
| 1996 | 6.65 | 100.00 |
| 1997 | 3.96 | 103.96 |
| 1998 | 8.66 | 112.96 |
| 1999 | 7.06 | 120.94 |
| 2000 | 2.79 | 124.31 |
| 2001 | 1.94 | 126.72 |
| 2002 | 2.79 | 130.26 |
| 2003 | 4.38 | 135.97 |
| 2004 | 5.83 | 143.90 |
| 2005 | 6.48 | 153.24 |
| 2006 | 7.16 | 164.21 |
| 2007 | 7.20 | 176.04 |
| 2008 | 9.94 | 193.54 |
| 2009 | 6.66 | 206.43 |
| 2010 | 7.5(estimated) | 214.04 |

*Source: (i) Bangladesh Bank, Economic Trends Monthly Bulletin, Various issues. (ii)Bangladesh Bank, Annual Report 2008-09 and Medium Term Macroeconomic Framework: Key Indicators.*

## Appendix: 2
## Table-2: Unemployment in Bangladesh

| Year (Fiscal Year-FY) | Rate of Unemployment (%) | Number of Unemployed People ( in million) |
|---|---|---|
| 1996 | 3.50 | 1.30 |
| 1997 | 3.65 | 1.36 |
| 1998 | 3.80 | 1.42 |
| 1999 | 3.96 | 1.48 |
| 2000 | 4.30 | 1.70 |
| 2001 | 4.30 | 1.70 |
| 2002 | 4.30 | 1.70 |
| 2003 | 4.30 | 2.00 |
| 2004 | 4.27 | 1.99 |
| 2005 | 4.24 | 1.98 |
| 2006 | 4.18 | 2.07 |
| 2007 | 4.17 | 2.11 |
| 2008 | 3.98 | 2.06 |
| 2009 | 3.76 | 1.99 |
| 2010 | 5.10 | 2.70 |

*Note: BBS=Bangladesh Bureau of Statistics*
*Source :(i) Bangladesh Bureau of Statistics, (Different Rounds of Labor Force Survey)*
*(ii) Bangladesh Bank, Recent Employment Situation and Labor Market Developments in Bangladesh, Policy analysis unit, June, 2008.*

## Appendix: 3
## Table:3 Annual Average International Oil Price

| Year | Annual Oil Price ($ per Barrel)= Vt | ln Vt |
|---|---|---|
| 1996 | 19.41 | 2.97 |
| 1997 | 18.17 | 2.90 |
| 1998 | 11.78 | 2.47 |
| 1999 | 16.80 | 2.82 |
| 2000 | 27.10 | 3.30 |
| 2001 | 22.73 | 3.12 |
| 2002 | 23.52 | 3.16 |
| 2003 | 27.03 | 3.30 |
| 2004 | 34.68 | 3.55 |
| 2005 | 49.79 | 3.91 |
| 2006 | 60.39 | 4.10 |
| 2007 | 69.07 | 4.24 |
| 2008 | 95.09 | 4.55 |
| 2009 | 60.27 | 4.10 |
| 2010 | 75.53 | 4.32 |

*Source: U.S Energy Information Administration, Independent Statistics and Analysis, Release Date: 21st July,2010.*

## Appendix:4

**Table:4 Natural log of Inflation, Unemployment and International Oil Price**

| Year | ln CPI | ln UNE | ln Vt |
|---|---|---|---|
| 1996 | 4.61 | 0.26 | 2.97 |
| 1997 | 4.64 | 0.31 | 2.90 |
| 1998 | 4.73 | 0.35 | 2.47 |
| 1999 | 4.80 | 0.39 | 2.82 |
| 2000 | 4.82 | 0.53 | 3.30 |
| 2001 | 4.84 | 0.53 | 3.12 |
| 2002 | 4.87 | 0.53 | 3.16 |
| 2003 | 4.91 | 0.69 | 3.30 |
| 2004 | 4.97 | 0.69 | 3.55 |
| 2005 | 5.03 | 0.68 | 3.91 |
| 2006 | 5.10 | 0.73 | 4.10 |
| 2007 | 5.17 | 0.75 | 4.24 |
| 2008 | 5.27 | 0.72 | 4.55 |
| 2009 | 5.33 | 0.69 | 4.10 |
| 2010 | 5.37 | 0.99 | 4.32 |

Source: done by Excel Data Worksheet

## Appendix:5

**Table: 5 Characteristics of Labor force in Bangladesh**

| *Characteristics of Labor Force* | *1995-96* | *1999-00* | *2002-03* | *2005-06* | *2009* |
|---|---|---|---|---|---|
| *Economically active population/Labor force (million)(15+)* | *36.1* | *40.7* | *46.3* | *49.5* | *53.7* |
| *Not in Labor Force( million):* | | | | | |
| *Total* | *N/A* | *33.5* | *34.5* | *35.1* | *N/A* |
| *Male* | *N/A* | *6.2* | *5.2* | *5.7* | *N/A* |
| *Female* | *N/A* | *27.3* | *29.3* | *29.4* | *N/A* |
| *No of Employed population (million)* | *34.8* | *39* | *44.3* | *47.4* | *51* |
| *No of Unemployed population (million)* | *1.3* | *1.7* | *2* | *2.1* | *N/A* |
| *Labor force participation rate (%)* | *N/A* | *51.9%* | *57.3%* | *58.5%* | *N/A* |
| *Female labor force participation rate (%)* | *15.8%* | *23.9%* | *26.1%* | *29.2%* | *N/A* |
| *Unemployment rate (%)* | *3.5%* | *4.3%* | *4.3%* | *4.3%* | *5.1%* |
| *Underemployment rate (%)* | *N/A* | *16.6%* | *37.6%* | *24.5%* | *28.7%* |
| *Educated unemployment rate (%)* | *4.4%* | *4.1%* | *5.2%* | *5.62%* | *N/A* |
| *Youth labor force(15-29)(million)* | *N/A* | *14.5* | *19* | *17.3* | *N/A* |

*Source: BBS, Different rounds of Labor Force Survey*
** BBS=Bangladesh Bureau of Statistics*

## Appendix: 6

**Table: 6 Employment rate determined by different types of socio-economic characteristics**

| *Rate of employment by different types of factors* | *1995-96* | *1999-00* | *2002-03* | *2005-06* | *2009* |
|---|---|---|---|---|---|
| *Employment by broad economic sectors:* | *63.2%* | *51.3%* | *51.7%* | *48.07%* | *N/A* |
| *Agriculture* | *9.5%* | *13.1%* | *13.7%* | *14.52%* | *N/A* |
| *Industry* | *27.3%* | *35.6%* | *34.6%* | *37.4%* | *N/A* |
| *Service* | | | | | |
| *Employment by sector (million):* | *N/A* | *9.6* | *9.2* | *10.2* | *N/A* |
| *Formal* | *N/A* | *29.3* | *35.1* | *37.2* | *N/A* |
| *Informal* | | | | | |
| *Employment by status: Self employed(million)* | *N/A* | *18.2* | *19.8* | *19.9* | *N/A* |
| *Unpaid family workers (million)* | *N/A* | *4.7* | *8.1* | *10.3* | *N/A* |

*Note: Industry sector includes manufacturing, construction, mining and gas, electricity and water sectors. Service sector includes trade, hotel & restaurants, transport & communication, banking & insurance and other services.*

*Source: BBS, Different rounds of Labor Force Survey [ BBS=Bangladesh Bureau of Statistics ]*

## Appendix:7
## Table: 7 Unemployment rate determined by different types of socio-economic characteristics

| *Rate of unemployment by different types of factors* | *1995-96* | *1999-00* | *2002-03* | *2005-06* | *2009* |
|---|---|---|---|---|---|
| *By Region:* | | | | | |
| *Urban* | *4.8%* | *5.8%* | *5%* | *4.3%* | *N/A* |
| *Rural* | *3.1%* | *3.9%* | *4.1%* | *4.2%* | *N/A* |
| *By Sex:* | | | | | |
| *Male* | *2.8%* | *3.4%* | *4.2%* | *3.4%* | *N/A* |
| *Female* | *7.8%* | *7.8%* | *4.9%* | *7%* | *N/A* |
| *By Education:* | | | | | |
| *ix-x* | *3%* | *13.1%* | *5.6%* | *6.74%* | *N/A* |
| *SSC, HSC or equivalent* | *10.3%* | *11.5%* | *7.8%* | *8.88%* | *N/A* |
| *Degree and Above* | *9.2%* | *7.8%* | *9.5%* | *6.83%* | *N/A* |

*Source: (i) BBS, Different rounds of Labor Force Survey (ii) Bangladesh Bank, Recent Employment Situation and Labor Market Developments in Bangladesh, Policy analysis unit, June, 2008*

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