**KEY DETERMINANTS OF INFLATION RATE IN BANGLADESH**

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**Abstract**

Inflation can be said to be the backsliding taxation against the poor. Bangladesh has shown a consistent growth over the past decade but inflation has always been alongside it. The paper shows the causal relationship of inflation with its determinants. The objective of this study is to estimate the influence of the factors of inflation which in turn influences the existent, rise & fall of the inflation rate. Probable factors like GDP, Real Interest rate, Export of Goods and Services and Foreign Direct Investment (FDI) are chosen and worked with. Secondary data from year 1980 to 2015 have been used to create an econometric model. It has been found that GDP and Interest rate shows negative relationship with inflation and the other two variables shows a positive relation with inflation rate. The study suggests to take necessary steps like increasing GDP and decreasing the export of goods and services, etc. to keep the inflation rate under control as per the result.

Key words: GDP, Unit Root, ADF, Inflation rate, Determinants of Inflation Rate, Money Supply, White Noise

**1. INTRODUCTION**

Inflation, a social and economic problem of every country, is the constant upsurge in the level of price in an economy. It is a course of the rise of the price index while the money keeps on losing its value. When inflation continues for over quite a period of time in a country, it has a distortionary effect on the economy and that is when it becomes an issue of concern. Inflation has become a deep-rooted problem in many countries. Fischer and Modigliani, (1978) said that inflation has the probability to impose some economic costs. Costs like the shoe-leather cost, menu cost, cost that is generated due to the confusion and inconvenience of the consumers, unintended inflation tax, lessening of the real money balances, and decrease in the effectiveness of the pricing structure, etc. Lack of understanding the problems that causes inflation also generates inflation (Davis, 1991). Inflation is said to be present in an economy if there is a constant rise in the level of price a minimum of three consecutive years (Gillis et at, 1996). Out of the many main objectives of the monetary policies, controlling the inflation is one of the mains because an economy comes to a rapid growth and stable economic condition and improve resource allocation due to the presence of low inflation. The objective also assumes that first of all inflation is a monetary occurrence. So, by using the contractionary fiscal policies and monetary policies, a lower inflation rate can be achieved mainly by controlling the aggregate demand. “In short, a tradeoff exists between inflation and growth (alternatively between inflation and unemployment) that makes inflation targeting as the dominant paradigm in monetary policy.” (Paul R. Masson, Miguel A. Savastano Sunil Sharma, 1998).

In order to solve and get to know more about the behavior of inflation, economists especially those who are work with the macroeconomic sector and the bankers of the central bank studies the behavior of inflation both theoretically and empirically. The behaviors of the economic factors like savings, consumption, investment and net export imports are affected by inflation. Subject to the type, inflation may have a significant role in the structuring of price. Due to the change in the manners of inflation, by influencing the real interest rates may cause the aggregate demand to change which may cause the price can be affected (Abdullah, Shamsher & Chowdhury, 2012).

Inflation is a major economic problem to different countries including Bangladesh. Out of the different major objectives of macro economy of a country, keeping inflation and price level under control is one of the main targets. In Bangladesh as well, policy makers and economists always keep a watch on the level of inflation and price rise.

The key objective of this paper is to assess the existing scenario of the inflation rate in Bangladesh and to identify the main factors causing the inflationary pressure in this country with the help of mathematical and theoretical analysis and reasoning. This paper starts with an introduction which gives a brief idea about the background and the present day state of Bangladesh and inflation. The second part includes the background study and literature review followed by data and methodology section which includes the data analysis with the help of different statistical tests and findings. Finally the paper finishes off with conclusion and recommendations made bases on the findings of this paper.

**2. Background Study and a Review of Existing Works**

A country with an inflation rate of 3% to 6% may experience a positive economic push to increase the productivity and hence GDP. The existence of less than 6% inflation rate encourages investment and production which in turn increases consumption and wage earning capability and hence increased savings. However, the concept of the rise in the inflation rate causes the level of price to increase to maintain the standard of living is a fallacy. Increase in inflation not only increases the price of goods and services and reduces the value of money but also rises the wages and salary. The real value of the money does not, of course, increase but the amount of money available to each individual increases. The price of goods increases hand in hand with the increase in the production cost of products. So, the spending to maintain the standard of living stays the same. But an inflation rate that is of a double digit meaning a high inflation may produce a negative economic effect. This will badly affect the purchasing power of consumers. Both buyers and sellers will get confused due to the price distortion as a result profit or loss will become hard to determine. “It can lead to uncertainty of the value gains and losses, borrowers and lenders as well as buyers and sellers” (Abdul, Syed and Qazi, 2007). Furthermore, higher level of inflation creates uncertainty which dampens savings and investment. As the inflation decreases the actual rate of return on the monetary assets, savings is automatically discouraged. In turn, this effect further causes low investment and a declining growth of the economy. The poor are left worse off due to a high rate of inflation which erodes the benefits from growth and thereby increases the difference between the rich and poor in the society. A high inflation rate result from increase in food prices, it hurts the poor because of their high marginal propensity to consume.

The main target of every nation’s monetary and fiscal policies, whether a developed or less developed nation has been the maintenance of a comparatively steady and low inflation rate. Economic stability is often regarded as the baseline for the realization of macroeconomic objectives (Metwally and Al-Sowaidi, (2004)).

The reasons and probable causes of inflation in countries like Bangladesh are explained by economists, policy makers and multidimensional capital donors in different perspective. Some them include the high growth rate of GDP and the per head capita GDP has resulted in a demand-pull inflation in Bangladesh as there has been excess demand. (Mortaza M. G 2006).

The fuel price is another major factor that has affected the domestic price situation. The middle-men or the whole sellers make cartels and set up prices even higher than that of the original cost on the essential commodities like rice, oil, etc. making extra profits by dictating the market (Mortaza, 2006).

The growth of foreign remittance has its connection with the rise of the inflation rate. . Over the last few years, there has been a steady flow of remittance. This inflow undoubtedly, adds up to cause demand-pull inflation in Bangladesh. This sort of demand-pull factors can drive up inflation which works as the Rising Prosperity Hypothesis (Rahman H. and M. G. 2008).

A set of data with the current and predicted inflation rate can help us to create a picture of the scenario of inflation in Bangladesh.

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Graph 1 : **The rate of Inflation in Bangladesh ( compared to the preceding year**

\*Predicted values of Inflation rate

The graph displays the rate of inflation of Bangladesh from 2012 to 2022 in which some are predicted values\*. The inflation rate has been compared to the previous year. A rise in the inflation rate can be seen from 2012 to 2013 from 6.23% to 7.54%. The value then again starts to fall from 2014 at 7.01% to 5.96% and then the inflation values show a pretty stable situation as predicted from 2017 to 2022.

Numerous macroeconomists over the world have done various studies for determining the factors that affects the rate of inflation or the CPI. The studies, however are all different from each other on the aspects of country, size of the sample, time period or the samples that they have worked with. Some of them are described below:

Taking the different price indicators like the CPI, WPI, SPI and the GDP Deflator and using the time series data from 1971 to 2005, Khan and Gill (2010) have conducted the study to determine the factors affecting the inflation rate in Pakistan. The OLS test statistic has been used to estimate the coefficients. The independent variables- budget deficit, exchange rate, wheat support price, Imports, Sugarcane support price and cotton and the money supply have been found to affect all the indicators of price directly whereas the interest rate indirectly influences the dependent variable. Similarly, Abidemi and Malik (2010) have critically investigated the relationship between the determinants of inflation and their effects on inflation in Nigeria. A time series data set from 1970 to 2007 has been used on which the Johansen Co-integration test and error correction model has been applied. The results interpreted that the growth rate of GDP, money supply, imports, 1st lag of inflation and interest rate have a positive relationship with inflation while fiscal deficits and exchange rate have a negative impact on inflation rate. Another similar type test has been conducted in Nigeria by Olatunji et al. (2010) using a time series data and Johansen test. The paper discloses that preceding year’s values of all the variables like total imports, CPI for food, government expenditure and exchange rate have a negative effect on the rate of inflation while the preceding year’s values of exports, agricultural outputs, and interest rate and crude oil exports have an indirect association with the inflation rate.

By using the Autoregressive and distributed lag model and a time series from 1971 to 2006, Mosayed and Mohammad (2009) have conducted a test to identify the determinants of inflation in Iran. The long run estimates have been estimated and the result shows that GDP, money supply, change in the domestic and foreign prices are directly affecting the domestic prices of Iran. The war in Iran is also a major factor to influence the inflation rate of this country.

The existence of an association between the rate of inflation and the variables such as import costs, rise in the oil price and exchange rate and production shocks has been shown in the study made by Majumder, M. Alamgir, (2006). The study showed that the inflation in wage is insignificantly related to the pricing system in Bangladesh. Whereas, a positive relationship of the money wage rate and import price with the inflation have been resulted in the study made by Khanam and Mohammad(1995) in which data from 1972 to 1992 have been considered. As the study was made 20 years back and even though econometric models were used, there is always a chance to further work with latest data sets.

Another test has been conducted in Nigeria by Kuijis (1998) where time series data and determinants of three different variables has been found out. The variables that were studied are the price level, exchange rate and output. Vector autoregressive model has been used in this study to estimate the determinants. The study reveals that 1st and 3rd lag of the price level, 1st lag of the money supply and the 1st lag of the output are positively related to the price level and 4th  lag of the price level and output are negatively related with the level of price.

After reviewing these papers, I have decided to work an econometric model where different test statistics will be used to analyze the data like the Praise-winston test, Newey-West test, White noise test, etc,

**3. DATA & METHODOLOGY**

The statistical and analytical part of this paper has been done using secondary data. The data set has been prepared by collecting data from different sources mainly World Development Indicators, World Bank, Monthly Economic Trends. Different published journals have also been used for authentication and ideas. The statistical software STATA has been used to run the statistical tests where an econometric model has been which is specified below. The model showed the association between the dependent and independent variables which expressed the relationship in the mathematical form.

Initially the Ordinary Least square method has been run on the model but it showed signs of autocorrelation among the variables. Since maximum t-values of the regression model are insignificant but the overall level of significance is quiet high which have been checked using OLS, thus it can be said that there is a presence of autocorrelation. That is why Newey-West, Praise-Winsten, (Auto-Regressive Integrated Moving Average (ARIMA) and Augmented Dickey-Fuller test (ADF) tests have been performed. All the variables has been smoothed before running the tests.

**Model of Analysis**

Y= α + β1X1 + β2X2 + β3X3 + β4X4 + β5X5 + ε

This is the model of the analysis that has been used in this study. Here, Y is the *dependent / explained variable* which represents the inflation rate.

Hypothesis- Inflation rate demand depends on these factors.

* X1 is the first *independent/explanatory variable* of this model which represents the Export Goods and Services (EGS).

Hypothesis – The amount of export goods and services affects the inflation rate.

Objective- The inflation rate depends on the amount of export goods and services.

The inclusion of this variable is supported by the Mundell-Fleming model. A significance of this model states that: "As the price level drops, interest rates fall, domestic investment in foreign countries increases, the real exchange rate depreciates, net exports increases, and aggregate demand increases.” So, the explanation appears to recommend that an increase in the rate of inflation means increased imports and fewer exports. But a rise in the inflation should also increase the exchange (currency depreciation). If there is exchange of the foreign currency for a greater amount of domestic currency, the exports is proposed to increase. (economics discussion.net)

* X2 is the second *independent/explanatory variable* of this model which represents the Gross Domestic Products (GDP).

Hypothesis-The GDP affects the inflation rate.

Objective- The inflation rate depends on the GDP.

The relationship between inflation and growth is shown to be negative by Fisher(1993). To be more precise, he claims that productivity, investment and hence growth all have a negative relation with inflation. He also said that budget deficits negatively affect the capital accumulation and growth of productivity. For almost 100 countries, the data collected by Barro(1995) for over the time from1960 to 1990, he discovered that the effect of inflation on growth and investment is significantly negative, taking the characteristics of the countries to be constant. These studies have supported me to take GDP as a determinant of Inflation rate.

* X3 is the third *independent/explanatory variable* of this model which represents Foreign Direct Investment (FDI).

Hypothesis- The foreign direct investment (FDI) affects the inflation rate.

Objective- The inflation rate depends on the foreign direct investment (FDI).

Foreign Direct Investment causes more employments to be created and hence leading to an increase in income. With an increase in income people will have a tendency to increase their consumption expenditure. As a result of the rise in expenditure, there will be an increase in the demand for goods and services causing the prices to rise if there is no proportionate rise in the quantity of goods. Thus increase in FDI will result in a reasonable rise in inflation over a long time period and it will be conducive for growth of economy as investment is for productive purpose and hence, including FDI in the model is justified. (Journal of International Economics, 2004)

* X4 is the fourth *independent/explanatory variable* of this model which represents the Real Interest Rate (IR).

Hypothesis- The interest rate affects the inflation rate.

Objective- The inflation rate depends on the interest rate.

Fishers’ effect that shows the relationship between the real interest rate and inflation supports the fact that IR can be used as a determinant of inflation. As there is a fall in the interest rate, more people will tend to borrow more money from the banks. This will cause the consumers to spend more as they now have more money to spend which will result in a growth of the economy and hence a rise in the rate of inflation. The opposite will happen in the case of the rise in inflation rates. This relationship justifies the inclusion of interest rate in this paper.

* α , β1, β2, β3, β4– parameters to be estimated
* ε- Error term

**4. RESULTS AND ANALYSIS**

**a) Praise-Winsten Test:**

**Prais–Winsten estimation** is a technique which uses the generalized least-square method (OLS) to approximate the parameters in a linear regression model and takes care of the errors which are serially correlated of type AR(1).

The result shown in table 1, that the R2 value 0.9826 which means that 98.26% of the dependent variable (interest rate) is being explicated by the independent variables and the overall significance of the model is explained by the F-statistics at (4, 30) df (degrees of freedom) with high significance level. The R2 is adjusted for the df at 0.9803. The overall model shows evidence of significance. The result shows that GDP and real interest rate are negatively related with the Inflation rate while the other two variables, foreign directed investment and export of goods and services have a positive relation with interest rate.

The Durbin-Watson statistics for the original and transformed, both are have values d>2 which means that there is a presence of slight negative autocorrelation which in very insignificant.

**b) Newey-West:**

In statistics and mathematics, where the usual norms of the regression analysis does not apply for a model, the **Newey–West estimator** is used to estimate the parameters of a regression model. As this time series contains auto correlation after testing it with OLS, therefore instead of using OLS, Newey-West estimator has been used. To overcome autocorrelation in a model, this estimator is used.

The result in table 2 in the annex shows that GDP and real interest rate are negatively related to the rate of inflation whereas foreign directed investment and export of goods and services are positively related to inflation rate. Only the variable real interest rate is statistically significant from zero at 95% confidence interval. This model is overall significant at (4, 30) df for F-statistics.

**c) AUGMENTED DICKEY-FULLER (ADF) Test:**

The Augmented Dickey-Fuller (ADF) test is used on the data to test for the unit root. The ADF test is a comprehended version of the Dickey-Fuller test. The ADF test is perfect incases when the error terms are correlated because in the AD test it is assumed that the error terms are not correlated or they are white noise. For each of the variables lag(5) has been taken and all the variables are stationary in their first differential form. (Table 3)

d**) ARIMA (AUTO REGRESSIVE INTEGRATED MOVING AVERAGE)**

ARIMA models form strong set of models that can be used in many real time series. The ARIMA models are constructed on three parts: (1) an autoregressive part, (2) a contribution from a moving average, and (3) a part involving the first derivative of the time series. ARIMA has two parts, the AR part and the MA part both of which used in the time series data to comprehend the data properly or to forecast the points in the time series. To remove non-stationarity, in some of the cases where there is existence of non-stationarity in the data, the ARIMA models are used of which the preliminary differentiating stages are applied more than once. (Table 4)

i) **ARIMA [AR(1)]**

In ARIMA model, the Auto-Regressive (AR) part demonstrates that the discrete values of a time series can be explained by the linear models on the basis of the previous observations.

The results in the table (table 5) the Chi2 value is 35.47 and p-value for Chi2 is 0.000\*\*\* which also shows strong evidence of significance. The model shows that for autoregressive lag(1) situation, the coefficient is negative and highly significant considering the p-value at 95% confidence interval.

ii) **ARIMA [AR (1 2)]**

The Moving Average (MA) model indicates that the values of time series can be said to be dependent on the previous errors of estimation. The previous estimations or predicted errors are considered while estimating the succeeding time series values.

As the variables are stationary at the first differential form, which is shown in the table 6 (annex) found with the help of ADF test, it is unnecessary the compute the MA test.

**e) WHITE NOISE TEST**:

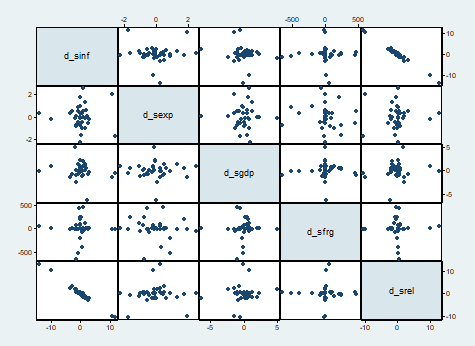
White Noise is a distinct sign, the samples of which are considered to be an arrangement of successively uncorrelated random variables with a mean of zero and finite variances. The residual has been predicted before performing the WN test.

Ho: no evidence of white noise

H1 : error is white noise

If the probability is less than 0.05, the Ho will be rejected and as per the result of the White-noise test, since the p-value of chi2 value is more than 0.05, so we do not reject the Ho and there is no evidence of white noise error in the model. (Table 7 Annex)

**e)** **Graph in the matrix form:**



Graph 2: A scatter plot of Inflation rate, GDP, Export of goods & services, FDI and Real Interest Rate in the matrix format.

After running all the tests, it can be seen that the model shows high level of significance with inflation rate having a positive relationship with foreign directed investment and export of goods and services while GDP and real interest rate has negative relation.

4. **CONCLUSIONS**

The study carries out long run estimates of some factors that might influence the Inflation rate of Bangladesh. The tests and analysis of the results shows that GDP and Real interest rate has got negative effect on inflation, meaning that a rise in GDP and Interest rate will cause a fall in the inflation rate and vice versa. On the other hand, Foreign Directed Investment (FDI) and Export of goods and services have a positive relationship with inflation which means that the rise of the values of these two variables will cause a rise in the level of inflation and vice versa.

Various studies (Shahiduzzaman, M. (2006)) have shown that in Bangladesh there is a biasness towards the expansionary monetary policy that is increasing money supply. Below are some of the strategic plans that can be used to reduce or keep inflation under control:

1. The government have to keep an eye on the inflow and spending of the FDI.

2. The export of goods and services have to be controlled. Quota and barriers to trade can be imposed to reduce export of goods and keep it under control.

3. Bangladesh Bank has to take necessary measures to increase the GDP either by using appropriate monetary policy as per need.

4. A close monitoring must be kept on the rise and fall and the adjustments made on the real interest rate.

The current rate of inflation in Bangladesh is not only described by the variables used in the model of this paper. The graphs and the economic numbers as per the analysis in this paper only gives us an idea on what factors might affect inflation. However there are some non-economic factors which affect the inflation in Bangladesh as well like market failures, low assurance in business, political instability, and some more. These factors and some more have also contributed in the rise in the price level. Therefore, in order to preserve the steadiness of price, the government must not only improve the economic aspects but also have to keep an eye on the non-economic factors when they are generating and reforming policies. Necessary measures to increase GDP and Real interest rate and reduce the FDI and Export of goods and services have to be taken to keep inflation under control.

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**ANNEX**

1. Praise-Winsten test

|  |  |  |  |
| --- | --- | --- | --- |
| d­\_sinf | Coefficient | Stdandard Error | P>|t| |
| d\_sexp | 0.670835 | 0.1018911 | 0.515 |
| d\_sgdp | -0.0069016 | 0.0617837 | 0.912 |
| d\_sfrg | 0.0004099 | 0.0004901 | 0.410 |
| d\_srel | -1.072696 | 0.0263339 | 0.000 |
| \_cons | 0.0006128 | 0.0809743 | 0.994 |

Table 1: The Praise-Winsten test

2. Newey-West test

|  |  |  |  |
| --- | --- | --- | --- |
| **d­\_sinf** | **Coefficient** | **Newey-West| Standard Error** | **P>|t|** |
| d\_sexp | 0.065407 | 0.1151287 | 0.574 |
| d\_sgdp | -0.0114037 | 0.037656 | 0.674 |
| d\_sfrg | 0.0004016 | 0.0004719 | 0.401 |
| d\_srel | -1.074974 | 0.277691 | 0.000 |
| \_cons | -5.34e-08 | 0.0869579 | 1.000 |

Table 2: The Newey-West test

3. Augmented Dickey-Fuller test

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Critical value at 95% CI** | **Calculated Value** | **Comment** |
| Inflation rate | -2.989 | -3.983 | Stationary |
| Export of Goods & Services | -3.723 | -5.101 | Stationary |
| GDP | -3.723 | -3.198 | Stationary |
| Foreign Directed investment | -3.723 | -3.594 | Stationary |
| Real Interest Rate | -3.723 | -3.958 | Stationary |

Table 3: The Augmented Dickey-Fuller test

4. ARIMA [AR(1)]

|  |  |  |  |
| --- | --- | --- | --- |
| **d­\_sinf** | **Coefficient** | **OPG**  **Standard Error** | **P>|t|** |
| d­\_sinf \_const | 0.0196626 | 0.49344723 | 0.968 |
| ARMA ar  L1 | -0.5487791 | 0.0920082 | 0.000 |
| /sigma | 3.483987 | 0.277553 | 0.000 |

Table 4: Auto Regressive Integrated Moving Average, lag(1) test

5. ARIMA [AR(1 2)]

|  |  |  |  |
| --- | --- | --- | --- |
| **d­\_sinf** | **Coefficient** | **OPG**  **Standard Error** | **P>|t|** |
| d­\_sinf \_const | -0.0189191 | 0.135986 | 0.889 |
| ARMA ma  L1  L2 | -1.067223  0.0672728 | 499.1043  33.41173 | 0.998  0.998 |
| /sigma | 3.483987 | 0.277553 | 0.000 |

Table 5: Auto Regressive Integrated Moving Average, lag(1 2) test

6. White Noise test

|  |
| --- |
| Portmanteau (Q) statistic = 14.7090  Prob > chi2(15) = 0.4726 |

Table 6: The White Noise test