

The Impact of Inflation on the Income Inequality of Bangladesh: A Time Series Analysis

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ABSTRACT

Income inequality has become a major public issue all over the world. Each year the gap between the rich and poor is rising, and the circumstance has turned to be miserable in many countries. This paper investigates the impact of inflation on income inequality using data from the period of 1990 to 2015. The study uses econometric techniques on the time series data. All data are found to be stationary at first difference by using Augmented Dickey-Fuller (ADF) test. The results of Johannsen co-integration test confirm that there is a long-run positive significant relationship among the examined variables. The result shows that if inflation increases by 1%, income inequality increases by 4.99%. The result of the vector error correction model (VECM) shows that inequality requires approximately 0.35% of error correction per year and inflation requires 22.74% of error correction per year to reach equilibrium. The result of the impulse response function indicates that one standard deviation shock from inequality and inflation causes inequality to rise over time. When one standard deviation shock is given to inequality causes inflation to decline after 1.5 years then neutralized after 3.5 years where shock from inflation, inflation becomes negative after two years and neutralized after six years.

Keywords: Co-integration, Inequality, Inflation, Impulse Response Function, VECM.

1. INTRODUCTION

Distribution of income is a prime concern for economic analysis. Income inequality relates to the unequal distribution of income among the population or group. Income inequality is one of the most discussed topics in the current world. All countries experience income inequality to some extent. Though there is a significant advancement in the economic performance of Bangladesh as reflected in high economic growth rates, women's empowerment, mortality rate, life expectancy, better improvement in various sectors, economy is still facing tremendous problems like income inequality and poverty as a major economic challenge. After the global financial crisis of 2007-08, there has been a dramatic rise in income inequality (Mahmood, 2017). This sharp rise in income inequality raises the poverty and unemployment situation and so on. Inequality can have a wide-ranging effect on communities, societies, families, and economies. Growing income inequality is a great challenge and featured prominently on the current international development agenda named as SDG (Sustainable Development Goal). The 10th goal of SDG draws attention to reduce inequality within and among countries reflecting the spirit of greater fairness of the society. The Gini coefficient is used as a tool for judging the level of inequality in a specific country or region ranging from 0 (when everyone has similar income) to 1 (when entire income goes to mere one person).

According to Bangladesh Bureau of Statistics (BBS), Household Income and Expenditure Surveys (HIES) 2016, the percentage share of income of the lowest 5 percent households has

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decreased from 0.78 to 0.23 percent respectively in HIES 2010 to HIES 2016. On the other hand, the income shares of top 5 percent households have increased from 24.61 percent in 2010 to 27.89 percent in 2016 (Government of Bangladesh, 2017). Rising income inequality in Bangladesh is a major concern. Though per capita income in Bangladesh is on rising from the last three decades along with economic growth, Bangladesh failed to stop widening inequality. Economic growth and income inequality are two crucial issues in the aspect of economic development. This income inequality varies in various classes due to the difference in birth status (child born in a wealthy and poor family), intelligence, capabilities, wage differential, unemployment, and inflation and so on. However, there is no unanimous decision about the relationship between income inequality and inflation among the researchers. It is debatable in both theory and empirical findings. Income inequality badly affects the living standard, and also it affects by inflation.

There has been a decline in the inflation rate from 6.41% to 5.92% in the Fiscal Year (FY) 2014-15 to FY 2015-16 respectively and declined to 5.44% in FY 2016-17. Food inflation declined from 6.68 percent in FY2014-15 to 4.90 percent in FY 2015-16, but in FY 2016-17 it shifted upward to 6.02 percent (BER, 2017). Food inflation grew to 6.18 percent in July 2018 (tradingeconomics.com). The recent rise in the relative prices of consumption bundle has a significant impact on the consumption bundle of the poor as food is the single largest item of expenditure for the poor. So recent rise in food prices especially rice price causes inflation and high inflation will cause a greater number of people towards below the poverty line increasing the gap in income inequality.

Inflation leads to a redistribution of income and wealth through the variation in the real value of wages, salaries, rents, interest, dividends, and profits. Another crucial channel is the debtor-creditor channel. Among different income classes, low-income class mainly holds their assets in cash that comes from their salaries while high-income classes have more money to invest in various assets. Inflation, a monetary phenomenon has an adverse effect on the poor group as it shrinks purchasing power and poor solely depends on their own income. Inflation makes the poor poorer. Thus, inflation accelerates the gap among different income groups and promotes income inequality. When income inequality becomes a larger problem, then it may pave the way of social unrest. The main objective of this study is to examine the impact of inflation on income inequality of Bangladesh.

2. LITERATURE REVIEW

Many studies have been accomplished to illustrate the relationship between income inequality and inflation. Feldkircher and Kakamu (2018) investigated the impact of monetary policy on income inequality on Japan and revealed the different impact on income inequality for various kinds of households. Depending on income data of households whose head were employed, a monetary tightening policy added to inequality in short-run. But the finding was opposite when all household i.e. self-employed, retired or unemployed were considered.

Munir and Sultan (2017) using panel data from 1973 to 2015 applying FEM model referred that per capita GDP, government consumption expenditure, fertility rate, agricultural value added sector, per capita arable land, urban population, and globalization were the key macroeconomic determinants of income inequality in India and Pakistan. In the same year using panel data across 33 Asian countries from 1990 to 2013, Deyshappriya (2017) confirmed inverted U-shaped phenomenon for GDP and inequality relationship besides that, official development assistance, education, and labor force participation shortened inequality where inflation, political risk, terms of trade, and unemployment enhanced inequality in referred Asian countries. Sieroń (2017) claimed inflation that accelerated just after the collapse of the Bretton Woods system in 1971 could have contributed to the rise in income inequality in the USA since

the 1970s. That paper dealt with the idea of an inflation tax and focused on the Cantillon effect (other redistributive mechanisms of inflation) as a leading cause of income inequality.

Adinde (2017) suggested that Kuznets inverted –U curve invalid for Nigeria. Employing multiple regression in the relationship among Gini coefficient, GDP and other independent variables, the result suggested that GDP, CPI, population growth and education were powerful determinants of income inequality in Nigeria. Lahouij (2017) indicated that income inequality slower the speed of economic development for MENA countries.

Using Household Income and Expenditure Survey of 2010, Islam et al. (2017) attempted to reveal the determinants of poverty and inequality in Bangladesh. Researchers referred that gender and religion didn't play a significant role in determining the poverty status of households and characterized that ingredients like age, rural-urban distribution, education, marital status, disability, remittance, region, and others had a distinguished effect on poverty situation rather than gender & religion.

Covering time 1976 to 2007 for the US and involving semiparametric instrument variable estimator Balcilar et al. (2017) concluded that below the threshold level inflation lowers income inequality and above that threshold level inflation raises inequality.

Trinh (2016) using Gini coefficient as dependent variable and inward FDI as main independent variable with other control variable like secondary education, domestic investment, trade openness, annual inflation rate, GDP per capita, population size and then selecting 63 provinces of Vietnam over the time period 2002-2012 as well as using the panel data analyses with pooled OLS model and fixed effects model, showed that inward FDI tended to reduce income gaps. While secondary education and trade openness were likely to flourish the equality of income distribution. On the other side, inflation rate, GDP per capita, and population enhanced the income gaps and insignificant effect of the Domestic investment on incomes were reflected.

Davtyan (2016) prescribed the distributional effect of monetary policy for USA & informed that contractionary monetary policy decreases income inequality. Chisti et al. (2015) analyzed the impact of inflation on per capita income of five emerging member countries of BRICS from the time 1999 to 2011. The study proclaimed that inflation did not have an impact on per capita income of India, Brazil, and South Africa. But for the remaining two Countries-China and Russia inflation had a significant impact on per capita income.

Matin (2015) showed rising growth was associated by rising inequality over the period under consideration. Using large panel data analysis, Škare and Stjepanovic (2014) identified inflation, unemployment, export, labor force, and population as the key determinants of the income distribution. Ali (2014) drew a conclusion about the negative relationship between income inequality and growth, while growth augmented inflation, FDI, remittance as well as manufacturing value added in Pakistan.

Walsh and Yu (2012) separated food inflation from non-food inflation and weighted whether food inflation exacerbates income inequality or not. Researchers noticed that nonfood inflation enhanced income inequality in Chinese provinces but food inflation had mixed role in Indian states, nonfood inflation had an increased effect on income inequality in rural & urban areas but in rural areas, food inflation had neutral to the positive impact on income inequality.

Thalassinou et al., (2012) taking inequality index named Gini as the dependent variable and the inflation rate, the growth rate, the employment level and the openness of the economies as independent variables for the period 2000 to 2009 in 13 European countries, the study revealed that inflation had a positive significant effect on income inequality. Yue (2011) from Korea suggested income inequality had a long-term co-integrated behavior with economic growth, a

high-income inequality hinders economic growth, but no long-term co-integrated behavior between inflation and income distribution.

Konya and Mouratidis (2006) adopted a cross-sectional analysis of two types based on all available annual observations of country averages, and the six-year average fix effects panel data analysis. In case of cross-sectional analysis, there seemed to be a mutual relationship of inequality with growth volatility across 70 countries during 1960-2002 with illogical signs of many significant coefficients and in case of panel data analysis inequality had an indirect effect on growth volatility.

Albanesi (2007) presented a political economy model where equilibrium inflation was positively associated to the extent of income inequality mainly low-income households. Heer and Süßmuth (2003) mentioned that inflation led to an unequal distribution of wealth although its quantitative effect was economically negligible and also told a lower welfare cost from anticipated inflation. Li and Zou (2002) showed a negative with the insignificant effect of inflation on the income shares of income of the poor as well as the middle-class people. They also found that inflation worsens income distribution as well as reduced economic growth.

Easterly and Fischer (1999) relating 31,869 respondents from 38 countries the study cited that inflation made poor worse off. Higher inflation led to lower income share for the bottom quintile. Bulíř (2001) identified that a decrease in the rate of inflation especially from the hyperinflation causes a reduction in income inequality. Al-Marhubi (2000) disclosed that income inequality accompanied by a higher rate of inflation. Jovanovic (2014) traced about how inflation redistributed income for 110 countries from 1970 to 2013. The study used oil price as an exogenous source of variation in inflation and the result suggested that exogenous inflation abates the Gini coefficient and the highest 1% share of income.

Reviewing the literature, we find the gap of conducting this study, as very few studies have been conducted in the field of impact of inflation on income inequality of Bangladesh. This study is distinct from others in the field of using data, variables, time frame, analytical tools and software.

3. DATA AND METHODOLOGY

In this study, data for income inequality (represented by Gini coefficient) and inflation (represented by consumer price index (CPI)) have been taken from UNDP data and World Development Indicators respectively over the period 1990 to 2015. Both data are taken in percentage form. Eviews 9.5 has been used to get econometric results. Firstly, the Augmented Dickey-Fuller test (1979) has been applied to check the existence of unit root in the time series. The ADF test runs the following regression equation:

$$\Delta Y_t = a_1 + a_2 t + \delta Y_{t-1} + \lambda_i \sum_{i=1}^m \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

Where Y_t is the time series variables under consideration, t is linear deterministic trend, ε_t is an error term and m refers to the number of lag in the dependent variable which is selected by the LR (sequential modified LR test statistic), FPE (Final Prediction Error), AIC (Akaike Information Criterion), SC (Schwarz information criterion) and HQ (Hannan-Quinn information criterion) criteria. The ADF test evaluates the null hypothesis of $\delta = 0$, representing the time series has a unit root. If $H_0: \delta \neq 0$, then it represents the time series is stationary. So, if the null hypothesis is rejected at first difference, then the series is regarded as integrated of order 1 i.e. $I(1)$ and so on. After accomplishing the unit root test, Johansen Co-integration test (Johansen, 1988; Johansen and Juselius, 1990) has been performed only on integrated of order one, i.e. $I(1)$ to examine the existence of a stable long-run equilibrium relationship between income inequality and inflation.

The following two test statistics are used to identify the number of cointegrating vectors. The trace test is computed as:

$$\lambda_{\text{trace}(g)} = -T \sum_{i=r+1}^g \ln(1 - \hat{\lambda}_i) \quad (2)$$

and the maximum Eigenvalue test is computed as:

$$\lambda_{\text{max}(r,r+1)} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (3)$$

Where T = no of observation and $\hat{\lambda}_i$ is the estimated values of the matrix and r is the number of cointegrating vectors under the null hypothesis. Both procedures test the null hypothesis that the number of cointegration vectors r against the alternative $r+1$ integrating vector.

When the series are cointegrated, then restricted VAR model i.e. VECM is designed to see the short-run and long-run dynamics of the relationship. Finally, impulse response function (IRF) can be stated as following bivariate framework:

$$\Omega_i = \phi_i B^{-1} \Lambda^{1/2} \quad (4)$$

Where Λ^{-1} is the coefficients matrix of all the variables at time t , $\Lambda^{1/2}$ denotes lower Cholesky decomposition of the variance –covariance matrix of μ_t , and ϕ_i represents another matrix that shows the effects of a one unit increase in error term at date t (μ_t) on the value of the other variable at time $t+s$. IRF has been constructed to take into consideration of shock in a VAR system, that is to recognize the response of dependent variables in the VAR when a shock is given to the disturbance term like v_1 and v_2 given below.

3.1 VAR System Model

The VAR econometric model is identified by the following equations:

$$\text{Inequality} = \beta_1 + \beta_2 \text{inflation}_{t-1} + \beta_3 \text{inequality}_{t-1} + V_1 \quad (5)$$

$$\text{Inflation} = \beta_4 + \beta_5 \text{inequality}_{t-1} + \beta_6 \text{inflation}_{t-1} + V_2 \quad (6)$$

Where V_1 and V_2 are called impulses or innovation or shock. A change in V_1 will bring a change in income inequality. It will change inflation and also income inequality during the next period. So, we give a shock to the innovation or residual, that is on V_1 and V_2 of the above VAR model to observe how it affects the entire VAR model.

3.2 Econometric Model

The study specifies the following econometric model:

$$\text{Income inequality} = \beta_0 + \beta_1 \text{inflation} + u_i$$

Where u_i = error term representing other variables that affect income inequality but are not taken into consideration.

4. RESULT DISCUSSION

This section describes the results of various tests that are described in the earlier section. Firstly, the stationarity of the time series is investigated to conduct the process for the co-integration test.

4.1 Unit Root

Table 1 shows that all the variables are stationary at 1% level of significance in case both with trend and without trend. Therefore, it can be said that both the time series under consideration are integrated of order one i.e. I(1).

Table 1 Augmented-dickey-fuller (ADF) test result

Variables	(Intercept) Level	(Trend and Intercept) Level	(Intercept) First Difference	(Trend and Intercept) First Difference
Inequality	-0.950591	-3.318421*	-3.811298***	-3.687751***
CPI	-3.597618***	-4.085538***	-6.614501***	-6.435258***

Note: *** is 1% level of significance, ** is 5% level of significance, and * is 10% level of significance.

4.2 Cointegration

With a view to investigating the long-run relationship, Johansen Cointegration test is applied in this study. Optimal lag length is one assigned by the LR, FPE, AIC, SC, & HQ criterion. Allowing linear deterministic trend in data the result of both trace and max-Eigen value test has been presented below in Table 2.

Both trace test and the Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level. As at maximum rank of none both trace statistic and max statistic value is greater than the 5% critical value, so null is rejected (Table 2). This implies that there is a stable long-run relationship between income inequality and inflation in Bangladesh.

Table 2 Johansen cointegration rank test result

Maximum rank	Eigenvalue	Trace statistic	Critical value 0.05	Max statistic	Critical value 0.05
None*	0.465856	16.29978	15.49471	15.05017	14.26460
At most 1	0.050735	1.249615	3.841466	1.249615	3.841466

*denotes rejection of the hypothesis at the 0.05 level

4.2.1 Long-run impact of inflation on income inequality of Bangladesh

The result is normalized on income inequality (Table 3). Because of normalization process the sign is opposite to enable appropriate explanation. The coefficient is interpreted as a 1% increase in inflation leads to a 4.99% increase in income inequality in the long-run.

Table 3 Normalized cointegrating coefficients

Cointegrating equation(s)	Coint. Eq ¹	SE	t-statistic
Inequality	1.000000		
CPI	-4.990626	1.02762	4.856489**
Log-likelihood	-46.61424		

4.3 Vector Error Correction Model (VECM)

As the series are cointegrated, we may utilize VECM model than utilizing unrestricted VAR model. VECM is applied to examine the adjustment to equilibrium between the variables.

VECM indicates that inequality requires approximately 0.35% of error correction per year (Table 4), so inequality becomes in equilibrium after nearly 284 years and inflation requires 22.74% of error correction per year to reach equilibrium, so inflation becomes in equilibrium approximately after 4.5 years

Table 4 Vector error correction estimates (speed of adjustment)

Cointegrating Equation(s)	Coint. Eq ¹	SE	T-Stat
D(inequality)	-0.003524	0.00529	-0.66674
D(CPI)	0.227461	0.05544	4.10293**
C	-17.66864		

Impulse response functions of inequality to CPI and vice-versa are depicted in the Figure 1. The horizontal axis shows year mainly for 10 years forward following a shock in the VAR system. The vertical axis shows the estimated values of a response variable following an external shock. In the upper part of the figure shows when one standard deviation shock is given how inequality is reacting to inequality and also how inequality is reacting to inflation. It is clear that shock leads to a rise in inequality over time. The lower part shows when there is an external shock how inflation is reacting inequality as well as how inflation is reacting to inflation. In case of the former left side of the graph, we see that after 1.5 years, inflation is on the decline and about to neutralize after 3.5 years. Then in case of latter right side of the graph, we find that initially it was positive but becomes negative after two years. Then after four years, it becomes positive and after six years it is neutralized.

Response to Cholesky One S.D Innovations

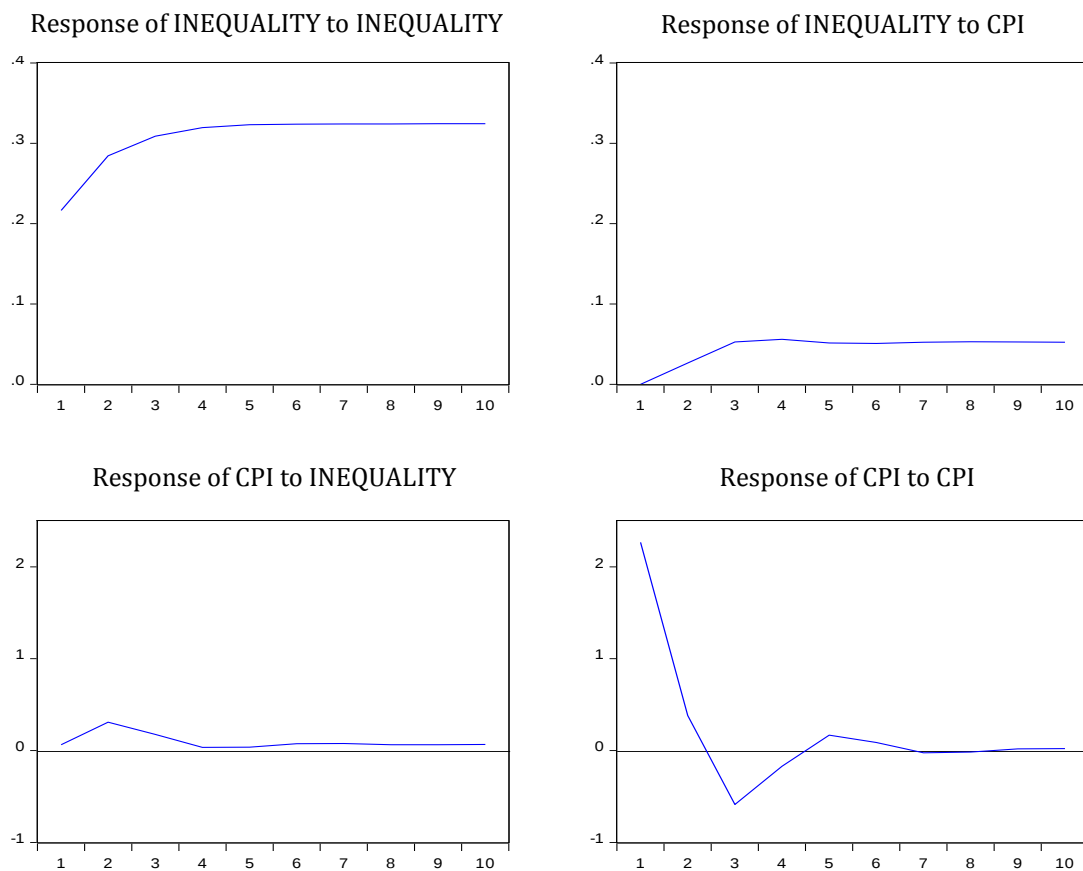


Figure 1. Impulse response functions for inflation and income inequality.

5. CONCLUSION AND RECOMMENDATION

The study examines the effect of inflation on income inequality of Bangladesh. Unit root test results reveal that the variables are integrated at the order I(1). Then employing Johansen cointegration over the period 1990 to 2015, the study indicates that there is one cointegrating vector relationship according to both trace and maximum Eigenvalue tests, which mean that there is long-run equilibrium relationship between the variables. In the long run, if inflation increases by 1% then income inequality increases by 4.99%. That is inflation has positive and statistically significant impact on income inequality of Bangladesh, which mean that if inflation increases, it aggravates income inequality which supports the findings of all the study considered here except few studies like-Li and Zou (2002), Jovanovic (2014) and Ali (2014). where inflation had negative impact on income inequality. Then VECM model shows that inequality requires approximately 0.35% of error correction per year and inflation requires 22.74% of error correction per year to reach equilibrium. Impulse response function shows that any external shock on particular variables has positive as well as negative effects on itself and on other variables over the time. Here, the result of the impulse response function indicates that one standard deviation shock from inequality and inflation causes inequality to rise over time. When one standard deviation shock is given to inequality causes inflation to decline after 1.5 years then neutralized after 3.5 years, where shock from inflation, inflation becomes negative after two years and neutralized after 6 years. This study focuses only on the impact of inflation on income inequality of Bangladesh. It's true that inflation affects income inequality but it is not the end of the story. Income inequality is also affected by many factors such as unemployment, wage, education, GDP growth, urbanization, globalization, political risk, education, trade and so on. Moreover, the study has not identified the threshold level above which inflation will be harmful. So, this is one of the limitations of the study which paves the way of further research. However, the study suggests policy adjustments to reduce the strength of income inequality. Fiscal policy can play a vital role by reforming taxation, tackling unemployment, improving social safety nets etc. while monetary policy also can play a crucial role in controlling money supply as well as inflation. Income inequality is a global problem and requires a global solution, which indicates a need for continuous effort to reduce the degree of income inequality through the implementation of policies.

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