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Determinants of Inflation in Bangladesh: An Econometric Approach

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Abstract

This study investigates the determinants of inflation from the perspective of an Asian emerging economy, Bangladesh, between 1977 and 2014. We explore both demand-side and supply-side factors causing inflation in Bangladesh, using econometric techniques for measuring the long-term and short-term relationship between variables under the concept of the Co-integration and Error Correction Model. Investigating causal relationships using the Granger causality test, the results reveal the existence of a stable long-run significant relationship of inflation with real GDP, money supply, imports, interest rate, remittances, and exchange rate. The findings herein suggest that the causes of inflation in Bangladesh are multi-dimensional and dynamic, and therefore the government should adopt proper strategies to curb inflation in the country.

Key words: inflation; Co-integration; Granger causality; Bangladesh

JEL classification: E31; C10

1. Introduction

Inflation makes people worse off by reducing their purchasing power of incomes, eroding living standards, and adding in many ways to life's uncertainties (Lipsey et al., 1982). Inflation denotes a constant increase in the general price level in an economy over a certain period of time, resulting in a decrease in the real value of money and reducing investment and savings. The existence of excess aggregate demand implies demand pull inflation where the upward pressure of production costs brings forth cost-push inflation. The genesis of inflation relates to a number of factors, including gross domestic product, broad money supply, interest rate, exchange rate, exports and imports, remittances, government expenditure, etc. Inflation is considered costly for poor people since their purchasing power is eroded. For those groups whose earnings are fixed in nominal terms, their assets are devalued more as they hold a larger share of their assets in liquid form compared to

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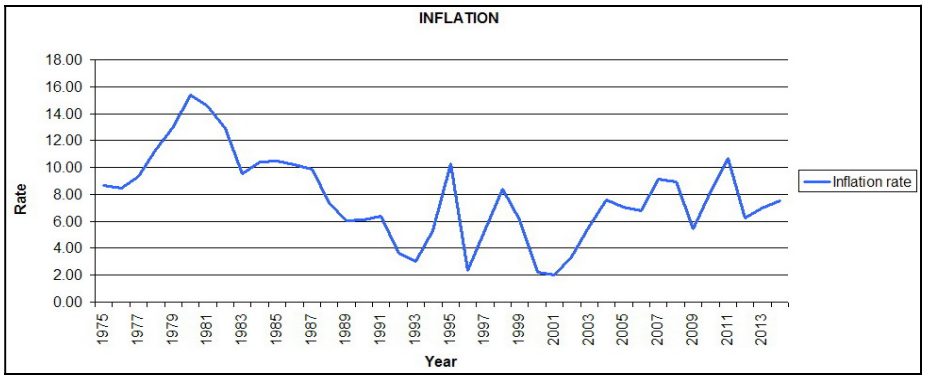
non-poor people. Thus, it is difficult for the poor to hedge against inflation due to their limited access to the financial system (Mujeri, 2008; Mujeri and Mortaza, 2008). Inflation is one of the major macroeconomic challenges facing many developing countries. Since independence in 1971, Bangladesh has been under persistent inflationary pressure, with its economy recently experiencing a rising rate of inflation, which is a major threat to the country's macroeconomic stability.

Figure 1. Trend of Inflation in Bangladesh, 1977-2014



Data source: World Development Indicators, World Bank.

Figure 1 shows the trends of inflation in Bangladesh during the period of 1977 to 2014, expressed in terms of the Consumer Price Index (CPI). There is a persistent increase of CPI from 15.45 in 1975 to 28.489 in 1980. The average change of CPI in this period is 13%. At the end of 1990 the CPI stood at 79.2 with an average yearly change of 10.82% from 1981. From 1991 to 2000 the average change of CPI fell to 4.93% from 10.82% over the previous 10 periods. After 2000, there is again an increasing trend in CPI, which stood at 175 by end-2014. The CPI growth rate during the study period is 6.58%, indicating that from 1977 to 2014, the CPI of Bangladesh has increased at an average rate of 6.58% per year. Hence, for policy making, it is necessary to identify those factors that have caused this inflation.

The present study aims at investigating both demand- and supply-side determinants of inflation in Bangladesh during the period 1977-2014. For this purpose, the paper employs different econometric techniques such as stationarity test, co-integration, error correction model, and Granger causality to analyze the statistical phenomenon of these variables. As controlling inflation in general helps to allocate resources efficiently as well as promotes market development through ensuring stable economic growth, it is necessary to determine the reason for inflation and also the mechanism of managing it effectively based on sound analysis. However, depreciation of the exchange rate, import dependency, money supply growth, remittance flow, interest rate differentials, high growth rate of population, and increase of money wage without productivity are some of the major factors that cause inflation in Bangladesh. This paper looks to reveal the more significant

variables causing inflation in Bangladesh so that they can be used for anti-inflationary policies.

2. Literature Review

The determinants of inflation are discussed widely in the literature. Economists from different schools of thought have presented their theories regarding the causes of inflation. The Keynesian school believes inflation is caused by either an increase in aggregate demand (i.e. 'demand-pull inflation') or a decrease in aggregate supply (i.e. 'cost-push inflation'). These economists consider fiscal policy as an important mechanism to control inflation. The model of the Phillips Curve developed by A.W. Phillips presents the idea of a 'trade-off' between inflation and unemployment. This model was further modified by Lipsey (1960) and Samuelson and Solow (1960), suggesting a negative relationship between inflation and unemployment. The model of "the quantity theory of money" robustly presented by Friedman (1968, 1970, 1971) and empirically tested by Schwartz (1973) states that money supply has a direct, proportional relationship with the price level. It emphasizes the role of monetary policy versus fiscal policy in controlling inflation.

Many empirical studies have investigated the possible determinants of inflation in both developed and developing countries. Factors typically related to fiscal imbalances, such as higher money growth and exchange rate depreciation arising from a balance of payments crisis, dominate the inflation process in developing countries, as discussed in Montiel (1989), Sergent and Wallace (1981), and Liviatan and Piterman (1986).

Abidemi and Malik (2010) have critically analyzed the dynamic and simultaneous inter-relationship between inflation and its determinants in Nigeria. They use the Johansen co-integration technique and error correction model to analyze determinants of inflation for time series data over the period from 1970 to 2007. The findings reveal that growth rate of GDP, money supply, imports, 1st lag of inflation, and interest rate give a positive impression on the inflation rate, while other explanatory variables such as fiscal deficit and exchange rate are indirectly associated with inflation.

Lim and Papi (1997) have studied the determinants of inflation in Turkey. Their study adopts time series data from 1970 to 1995 and applies the Johansen Co integration technique to find results. The analysis concludes that money, wages, prices of exports, and prices of imports have positive influences on the domestic price level, whereas the exchange rate exerts an inverse effect on the domestic price level in Turkey.

Khan et al. (2007) attempt to determine the most significant explanatory factors for inflation trends in Pakistan using time series data from 1972 to 2005. Their analysis concludes that government sector borrowing, real demand, private sector borrowing, import prices, exchange rate, government taxes, previous year's consumer price index and wheat support prices have direct contributions to the consumer price index of Pakistan.

Ratnasiri (2009) examines the main determinants of inflation in Sri Lanka over the period of 1980 to 2005 using Vector Autoregressive Analysis (VAR). The results indicate that money supply growth and rice price increases are the main determinants of inflation in Sri Lanka in the long run. He also finds that exchange rate depreciation and output gap have no statistically significant effect on inflation. Chhibber and Shafik (1992) develop detailed econometric models that consider both monetary and structural factors of inflation in Zimbabwe. The study shows that nominal monetary growth, foreign prices, exchange and interest rates, unit labor costs, and real income are main the determinants of inflation in Zimbabwe.

Loungani and Swagel (2001) conclude that, as a determination of inflation, money growth and exchange rate regimes are more important in countries with floating exchange rate regimes than in those with fixed exchange rates. Under different foreign exchange regimes, there may be divergent outcomes from the impact of remittances on inflation. Under a fixed exchange rate regime, increased remittance flows temporarily increase the rate of inflation and the nominal money supply. In contrast, under a flexible regime, increased remittance flows temporarily decrease the rate of inflation (Ball et al., 2013). Alagidede et al. (2008) show there exists a significant long-run association between nominal exchange rate and prices in Gambia, Ghana, Nigeria, and Sierra Leone. The study of West African Monetary Agency (2009) indicates that inflation exhibits a positive relationship with money supply in Benin, Guinea-Bissau, Mali, The Gambia, Ghana, Guinea, Cape Verde, and Liberia, but the relationship is negative in Burkina Faso, Cote d'Ivoire, Niger, Senegal, Togo, Nigeria, and Sierra Leone. Using data of high-inflation economies, Dornbusch et al. (1990) conclude that money growth and deficits are determined by, but do not determine, inflation. Bordo and Filardo (2005) study inflation for a number of countries, concluding that money growth usually does not contain useful information for inflation when it is low and stable, yet it is a major contributor during an episode of high inflation. For Japan, Miyao (2005) reports that money growth is statistically insignificant in forecasting inflations.

There are a few studies regarding the possible determinants of inflation in Bangladesh. In the context of the structuralist-monetarist question, Taslim (1982) analyze the inflationary process in Bangladesh using data for 1960 to 1980. The findings indicate that the rate of change of money supply and devaluation are the two most significant explanatory variables. Any devaluation of the domestic currency is followed by an almost equal proportionate increase in the rate of inflation, while an increase in money supply does not induce an equal proportionate increase in the inflation rate.

Akhtaruzzaman (2005) employs the Co-integration and Vector Error Correction Modeling (VECM) technique to identify the variables that are believed to generate inflation in Bangladesh. The results of the study reveal that inflation in Bangladesh is negatively related with real income. However, depreciation of the exchange rate, money supply growth, and deposit interest rate are statistically significant in explaining the inflationary process in Bangladesh.

The empirical test of Begum (1991) shows that the significant variables for inflation are agricultural and import bottlenecks, government expenditure, rate of interest, wage rate, bank credit, and expected inflation. Haque and Emran (1992) present that the ratio of imports to total food availability significantly affects inflation in Bangladesh. Similar to this finding, it has been observed that among supply-side factors of inflation, the import price index is the most significant variable (Majumder, 2006).

Kanam and Rahman (1995) indicate that as supply-side variables, import prices and money wages affect inflation significantly and positively while the GNP growth rate has no significant effect on inflation of Bangladesh. On the other hand, all demand-side factors i.e. growth rate of money supply, government development expenditure, domestic savings, remittances, and growth rate of population are insignificant in forecasting inflations.

Mortaza (2006) reveals that money supply has an explanatory power of forecasting the movements in the consumer price index, although the fluctuations seem relatively weak. Moreover, money supply has a short-run positive influence on inflation. He also finds that exchange rate depreciation positively affects inflation in Bangladesh and that the deposit interest rate has a significantly negative impact on CPI.

3. Data & Methodologies

This study investigates the relationship between inflation with other macroeconomic variables - namely, Real GDP, Money Supply, Import, Interest Rate, Remittance, and Real Effective Exchange Rate. The dataset comprises annual time series data for Bangladesh over the sample period 1977-2014. The sources include World Development Indicators released by the World Bank, The World Economic Outlook (WEO) Database of IMF, and monthly economic trends published by Bangladesh Bank. Data are processed using Eviwes-7 software.

Inflation: Inflation is measured in terms of Consumer Price Index (CPI), which reflects the change in the cost to the average consumer of acquiring a basket of goods and services (base year 2005=100).

Real GDP: GDP is the sum of the gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Data are in constant 2010 US dollars.

Money Supply: Money supply comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government i.e. M2. Money supply is measured in terms of US$ mn.

Import: Import of goods and services is measured in terms of constant 2010 US dollars.

Interest Rate: Interest rate is measured in percentage terms of the prime lending rate. The lending interest rate is the rate charged by banks on loans to prime customers.

Remittance: Workers' remittances are current transfers by migrants who are employed or intend to remain employed for more than a year in another economy and expressed as current US$.

Real Exchange Rate: Exchange rate is the value of the domestic currency in terms of foreign currency. Real exchange index is the trade-weighted nominal exchange rate deflated by the ratio of the foreign price to the domestic price. We construct the real exchange rate as $RER = e_{tw}(PPI_f / GDPdeflator)$, where e_{tw} is the trade-weighted nominal effective exchange rate, PPI_f is the producer price indices of the major trading partner (United States and base year 1982) of Bangladesh, and GDP deflator is used for the domestic price of non-tradables goods. This study defines the nominal effective exchange rate as the cost of one trade-weighted average of Bangladesh's major trading partner's (United States) currency in terms of Bangladesh's currency.

We transform most of the variables (except interest) in natural logarithms to smooth out the data, which display a high trend. The structural model to estimate the relationship between the study's variables is:

$$Y = \beta_0 + \beta_1 LGDP + \beta_2 LMS + \beta_3 LIMPORT + \beta_4 INTEREST + \beta_5 LREMITTANCE + \beta_6 LREER + \varepsilon$$

Here, Y is the Log of CPI, β_0 and β_i are the parameters respectively known as the intercept and slope coefficient, and ε is the classical random disturbance term.

To check for the non-stationarity property, we subject the data to the Augmented Dickey and Fuller test (ADF test). The null hypothesis of the ADF test states that a variable is non-stationary and the null hypothesis of non-stationarity is rejected if the calculated ADF statistics are less than the critical value. The following regression is for ADF test purposes:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \Sigma \Delta Y_{t-i} + \varepsilon_t$$

Here, ε_t is a white noise error term, and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$ and so on are the number of lagged difference terms empirically determined. Using Schwarz Information Criterion (SIC), we select the lag length automatically by E-views software.

Our next step is to determine whether the variables have a stable and non-spurious, long-run (cointegrating) relationship among themselves. For the purpose of testing co-integration, we choose the Johansen procedure and select the optimal lag order by employing Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ).

If there is at least one cointegrating relationship among the variables, then the causal relationship among these variables can be determined by estimating the Vector Error Correction Model (VECM). We use the Error Correction Mechanism to tie the short-run behavior of an economic variable to the long-run value. The error

correction term indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium state (Engle and Granger, 1987). The Error Correction Model (ECM) is based on following regression: $\Delta Y_t = \alpha + \beta \Delta X_t + \beta U_{t-1} + \varepsilon_t$.

Here, U is the one period lagged value of the residual and the error correction component of the model, which measures the speed at which the prior deviations from equilibrium are corrected, and Δ represents first-differences operator.

We carry out diagnostic checks to the estimated VECM model by employing the Jarque-Bera (J-B) test for normality, the Lagrange Multiplier (LM) test for serial correlation, and the White Test for heterosedasticity. The final step of our analysis is to test for causality between inflation and its determinants based on the Granger causality test. The test involves estimating the following regressions to examine Granger causality:

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-j} + \varepsilon_{1t} \quad (1)$$

$$X_t = \sum_{i=1}^{m} \lambda_i X_{t-i} + \sum_{j=1}^{m} \delta_j Y_{t-j} + \varepsilon_{2t} \quad (2)$$

Here, we assume that the disturbances ε_{1t} and ε_{2t} are uncorrelated. First regression assumes that the current value of Y is related with the past values of X. Second regression proposes that the current value of X is related with the past values of Y.

4. Analysis & Results

4.1 Descriptive Statistics

Table 1 reports the summary statistics of the variables, where mean, median, standard deviation, skewness, kurtosis, and minimum and maximum values of the study variables are given.

Table 1. Summary Statistics of the Study Variables

	CPI	GDP	MS	IMPORT	INTEREST	REMITTANCE	REER
Mean	64.87	58500000000	73469923	8810000000	13.00	2770000000	55.46
Median	54.84	49400000000	19038281	4030000000	12.79	1080000000	52.82
Max	175	131000000000	423000000	35800000000	16.00	14100000000	75.11
Min	15.45	23300000000	557754	1940000000	10.40	18761274	38.68
Std. Dev.	43.38	30300000000	110000000	9770000000	1.67	3730000000	9.75
Skewness	0.84	0.85	1.74	1.48	0.42	1.75	0.43
Kurtosis	2.83	2.64	5.07	3.74	2.16	4.90	2.36

Source: Author's own calculation.

4.2 Stationarity Test

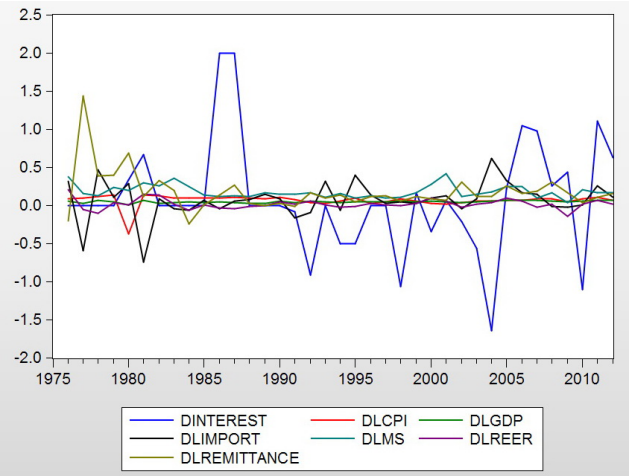
Table 2 shows the ADF statistic used to examine the null of a unit root LCPI, LGDP, LMS, LIMPORT, INTEREST, LREMITTANCE and LREER. The results in Table 2 clearly indicate that the ADF tests fail to reject the null of non-stationarity for all the variables at level. After first differencing, all variables turn stationary at the 1% significance level, implying that all variables are first-order integrated I(1). Figure 2 shows the stationarity trend after first differencing of the variables.

Table 2. Results of the ADF Test

Variables	ADF Test Statistic	
	Level	First difference
LCPI	0.255004	-4.148210***
LGDP	3.100315	-5.787824***
LMS	-1.674471	-4.897592***
LIMPORT	0.343210	-7.421085***
INTEREST	-1.992831	-4.317484***
LREMITTANCE	-2.398249	-5.843461***
LREER	-1.631271	-5.859797***

Note: *** indicates statistically significant at the 1% level.
Source: Author's own calculation.

Figure 2. Trend with Stationary



Data source: Author's own calculation.

4.3 Lag Length Selection and Testing Co-Integration

As reported in Table 3, except for SC (Schwarz information criterion), the other three i.e. FPE (Final prediction error), AIC (Akaike information criterion), and HQ (Hannan-Quinn information criterion), suggest that the appropriate lag length for the

model is '2'. Thus, the appropriate lag length that is selected in the current analysis is '2', which satisfies most of the criteria.

Table 3. Lag Length Selection

Lag	FPE	AIC	SC	HQ
0	5.61e-10	-1.436334	-1.128427	-1.328866
1	9.12e-16	-14.81843	-12.35518*	-13.95869
2	2.36e-16*	-16.49511*	-11.87652	-14.88310*

Note: * lag order selected by the criterion calculated using Eviews-7 software.
Source: Author's own calculation.

The next step in our empirical analysis is to test for co-integration. Since the variables are considered to be I(1), the co-integration method is appropriate to estimate the long-run relationship between variables. To explore the number of cointegrating vectors, we use both Maximal Eigenvalue and Trace statistics. The results are in Table 4.

Table 4. Unrestricted Co-Integration Rank Test

(Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	P-value**
None *	0.898407	247.1073	125.6154	0.0000
At most 1 *	0.830808	167.0699	95.75366	0.0000
At most 2 *	0.754703	104.8848	69.81889	0.0000
At most 3 *	0.470623	55.69981	47.85613	0.0077
At most 4 *	0.414594	33.43788	29.79707	0.0182
At most 5	0.256014	14.69714	15.49471	0.0657
(Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	P-value **
None *	0.898407	80.03741	46.23142	0.0000
At most 1 *	0.830808	62.18515	40.07757	0.0000
At most 2 *	0.754703	49.18498	33.87687	0.0004
At most 3	0.470623	22.26194	27.58434	0.2072
At most 4	0.414594	18.74073	21.13162	0.1046
At most 5	0.256014	10.35067	14.26460	0.1899
At most 6 *	0.116783	4.346471	3.841466	0.0371

**: MacKinnon-Haug-Michelis (1999) p-value.
Source: Author's own calculation.

We see that the Trace statistic identifies six and the Maximal eigen statistic identifies four cointegrating vectors, respectively. The presence of co-integration is evidence for the existence of a stable and long-run relationship between the proposed variables. The results of cointegrating coefficients are in Table 5.

The significant coefficient sign implies that in the long run the relationship of inflation with GDP, money supply, and interest rate is positive, whereas its relationship is negative with imports, remittances, and exchange rate.

Table 5. Co-Integrating Equation

Variable	Coefficient	Std. Error	t-Statistic	P-value
LGDP	1.183161	0.305021	3.878947	0.0005***
LMS	0.251997	0.078473	3.211270	0.0031***
LIMPORT	-0.095962	0.042253	-2.271131	0.0305**
INTEREST	0.019925	0.008478	2.350147	0.0255**
LREMITTANCE	-0.125670	0.024896	-5.047872	0.0000***
LREER	-0.690225	0.168357	-4.099770	0.0003***
Constant (C)	-22.19880	5.951117	-3.730191	0.0008***
Adjusted R-squared	0.988724			

Note: ** and *** indicate statistically significant at the 5% and 1% levels, respectively.
Source: Author's own calculation.

4.4 Error Correction Model

In order to find the short-run relationships among the variables, we apply a vector error correction mechanism. The results of VECM are in Table 6.

The estimated error correction coefficient indicates that the inflation (CPI) is adjusting to the long-run equilibrium at a rate of about 44% each period in the short run. The coefficient of determination indicates that the estimated error correction model has a moderate goodness of fit.

To check the validity of our models, we also carry out diagnostic checks analysis employing the LM test for serial correlation, the J-B test for normality, and the White test for heteroskedasticity, which we report in Table 7. The diagnostics tests indicate the considered model is well specified.

When we estimate a multiple regression equation and use it for predictions at future points in time, we assume that the parameters are constant over the entire time period of estimation and prediction (Maddala, 2007). However, regressions are not always constant over time, especially when they involve economic data series. Therefore, researchers propose the CUSUM methods based on recursive residuals in order to test for a model's long-run consistancy (Brown et al., 1975). Therefore, to test the parameter stability, we take the Cumulative Sum Method (CUSUM) into account. According to Figure 3, CUSUM test for aggregate model does not show any structural breaks, because the whole sum of recursive errors does not go outside the two critical lines at the 5% significance level.

4.5 Granger Causality Test

As there is a lagged relationship between the variables, we apply the Granger causality test to determine the direction of such a relation in the long run. The results are in Table 8.

Table 6. Error Correction Model

Regressors	D(LCPI)	D(LGDP)	D(LMS)	D(LIMPORT)	D(INTEREST)	D(LREMITTANCE)	D(LREER)
ECM_{t-1}	-0.440341	-0.076962	0.089104	-0.605198	-1.638934	-0.108664	0.098314
	[-2.95346]	[-3.06028]	[0.47172]	[-1.39993]	[-0.93616]	[-0.35707]	[0.80233]
D(LCPI(-1))	-0.343659	-0.076163	-0.100740	1.768318	-0.051593	0.604815	-0.267962
	[-2.04440]	[-2.68611]	[-0.47303]	[3.62799]	[-0.02614]	[1.76275]	[-1.93959]
D(LCPI(-2))	-0.112599	0.052586	0.041296	-0.316250	2.415335	-0.733422	-0.263785
	[-0.43538]	[1.20546]	[0.12604]	[-0.42173]	[0.79536]	[-1.38938]	[-1.24104]
D(LGDP(-1))	-2.720503	-0.251038	-0.323452	-5.108011	-2.287741	-2.114458	0.219116
	[-1.41613]	[-0.77470]	[-0.13290]	[-0.91701]	[-0.10142]	[-0.53924]	[0.13878]
D(LGDP(-2))	-4.437721	-0.341482	0.487365	-2.577391	-19.89193	4.987890	0.152563
	[-3.74208]	[-1.70711]	[0.32438]	[-0.74955]	[-1.42849]	[2.06062]	[0.15653]
D(LMS(-1))	-0.361180	-0.063981	0.068224	-0.028182	1.553883	0.176852	-0.088714
	[-1.52637]	[-1.60299]	[0.22757]	[-0.04108]	[0.55925]	[0.36616]	[-0.45617]
D(LMS(-2))	-0.287193	-0.062992	0.050667	-0.753045	1.946854	0.212450	0.095206
	[-1.44274]	[-1.87603]	[0.20090]	[-1.30467]	[0.83290]	[0.52288]	[0.58194]
D(LIMPORT(-1))	0.016726	-8.02E-05	-0.003523	0.066592	0.687140	0.112413	0.017354
	[0.22184]	[-0.00631]	[-0.03688]	[0.30460]	[0.77614]	[0.73045]	[0.28006]
D(LIMPORT(-2))	-0.086170	0.004705	-0.070807	0.125655	0.045639	0.012236	-0.020659
	[-1.44062]	[0.46631]	[-0.93438]	[0.72451]	[0.06498]	[0.10022]	[-0.42024]
D(INTEREST(-1))	0.005385	-0.004350	-0.004137	-0.101463	0.352634	0.021490	-0.004561
	[0.33995]	[-1.62813]	[-0.20613]	[-2.20898]	[1.89577]	[0.66461]	[-0.35031]
D(INTEREST(-2))	0.012994	-0.003373	-0.013315	-0.023682	0.003594	-0.045587	-0.015185
	[0.69391]	[-1.06792]	[-0.56123]	[-0.43616]	[0.01634]	[-1.19265]	[-0.98668]
D(LREMITTANCE(-1))	-0.150871	-0.014517	0.038434	0.096568	0.581564	0.304841	-0.003061
	[-1.97133]	[-1.12453]	[0.39638]	[0.43516]	[0.64714]	[1.95143]	[-0.04867]
D(LREMITTANCE(-2))	-0.037127	-0.001458	0.116316	-0.060236	-0.996664	0.140611	0.044120
	[-0.53685]	[-0.12498]	[1.32753]	[-0.30039]	[-1.22731]	[0.99610]	[0.77623]
D(LREER(-1))	-0.156286	0.004406	0.571371	-0.480914	3.246728	0.153960	0.281498
	[-0.50447]	[0.08431]	[1.45573]	[-0.53536]	[0.89250]	[0.24347]	[1.10558]
D(LREER(-2))	0.412093	0.053380	0.122698	-0.378738	-8.192089	-1.140653	-0.169180
	[1.64402]	[1.26249]	[0.38636]	[-0.52110]	[-2.78326]	[-2.22943]	[-0.82122]
C	0.568717	0.100252	0.119640	0.480241	0.408180	-0.117312	0.021603
	[3.98150]	[4.16086]	[0.66111]	[1.15952]	[0.24336]	[-0.40237]	[0.18402]

R-squared	0.688591	Log likelihood	58.52466
Adj. R-squared	0.442741	Akaike AIC	-2.429981
Sum sq. resids	0.072310	Schwarz SC	-1.718964
S.E. equation	0.061691	Mean dependent	0.063611
F-statistic	2.800862	S.D. dependent	0.082641

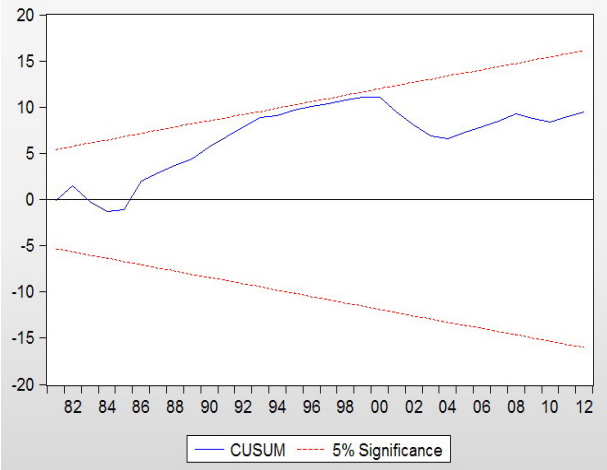
Note: Figures in parenthesis represent the t-statistics.
Source: Author's own calculation.

Table 7. Diagnostic Checks Analysis

VEC Residual Serial Correlation LM Tests		
Lags	**LM-Stat**	**P-Value**
1lag	56.89387	0.2048
2lag	60.01888	0.1345
3lag	56.46881	0.2160
VEC Residual Normality Tests-Joint J-B Test [Orthogonalization: Cholesky (Lutkepohl)]		
Joint Test of Chi-square		**P-Value**
29.04996		0.0561
VEC Residual Heteroskedasticity Tests		
Joint Test of Chi-square		**P-Value**
793.9280		0.3949

Source: Author's own calculation.

Figure 3. CUSUM Test for the Aggregate Model



Source: Author's own calculation.

Table 8. Granger Causality Test

Null Hypothesis	F-Statistic	P-Value	Granger Causality
LGDP does not Granger cause LCPI	3.56865	0.0154**	Yes
LCPI does not Granger cause LGDP	2.18838	0.0898*	Yes
LMS does not Granger cause LCPI	7.61519	0.0003***	Yes
LCPI does not Granger cause LMS	1.35792	0.2812	No
LIMPORT does not Granger cause LCPI	3.38988	0.0191**	Yes
LCPI does not Granger cause LIMPORT	4.67920	0.0044***	Yes
INTEREST does not Granger cause LCPI	3.22182	0.0235**	Yes
LCPI does not Granger cause INTEREST	5.21657	0.0025***	Yes
LREMITTANCE does not Granger cause LCPI	4.70420	0.0043***	Yes
LCPI does not Granger cause LREMITTANCE	2.96545	0.0324**	Yes
LREER does not Granger cause LCPI	4.70420	0.0043***	Yes
LCPI does not Granger cause LREER	1.92151	2.96545	No

Note: ***, **, and * indicate statistically significant at the 1%, 5%, and 10% levels, respectively.
Source: Author's own calculation.

Granger causality results suggest that there is uni-directional causality running from money supply to inflation and exchange rate to inflation. Furthermore, the test indicates that there exists a bilateral causality between inflation and GDP, inflation and imports, inflation and interest rate, and also between inflation and remittance.

5. Discussion and Conclusions

This study analyzes the causative factors of inflation in Bangladesh for the period 1977-2014 using different econometric frameworks. The results of the analysis reveal that there exists a stable long-run significant relationship of inflation with real GDP, money supply, import, interest rate, remittance, and exchange rate.

The relationship between consumer price inflation with real GDP is positive as supported by the previous studies of Bashir et al. (2011), Hussain and Malik (2011), and Uddin et al. (2014). According to Kandil (2009), the inflationary effect due to aggregate consumption is much more pronounced across developing countries. Nevertheless, Mallik and Chowdhury (2001) previously indicate a positive association between the variables in South Asian regions, showing that inflation and growth are positively related in India, Pakistan, Bangladesh, and Sri Lanka. The explanation runs as follows. During peak periods, businesses seek workers to produce greater output, and subsequently a rapid growth in real GDP causes an increase in employment and a reduction of unemployment. This rapid growth in real GDP can cause price inflation as firms are forced to bid against one another for increasingly scarce workers. Thus, the variable shows a positive coefficient, but at the same time we have to consider that there is also the possibility of an unstable inflation rate if economic growth is achieved too fast. Therefore, a country should focus on achieving an economic growth rate consistent with a stable inflation rate.

Our second independent variable, money supply, also demonstrates a positive sign that is consistent with the prior studies of Bayo (2011), Bashir et al. (2011), Ezeabasili et al. (2012), and Hossain (2013). This positive association is well explained in theory. If the money supply grows faster than real output, then it will cause inflation, because individuals can spend their excess money balances directly on goods and services, which results in rising aggregate demand and subsequently causes inflationary pressure. On the other hand, the higher demand for goods and services will cause greater demand for labor. This will contribute to inflation through a rise in money wages and unit labor costs. Again, there is also an increase of imports due to excess demand for goods and services. This leads to increases in the money supply in the foreign exchange market, causing imported inflation due to downward pressure on the exchange rate.

Another study variable for the current study is imports, and interestingly we find a negative relationship between imports and inflation. Normally, this coefficient is assumed to have a positive sign due to the depreciation in the exchange rate as a result of high import volume. The result is not unique, because this negative relationship is also supported by some previous studies, such as Bowdler and Nunziata (2006) and Romer (1993). In fact, the availability of cheaper imports due

to trade openness and foreign competition force domestic producers to cut down their prices, which ultimately reduces the inflation. This is very true for Bangladesh, which imports goods at lower prices, especially from China and India, which actually affect its domestic price level. Due to increased openness and competition, there is faster domestic productivity growth, which enables the firm to pay a high wage instead of setting high prices.

We find a positive relationship between interest rate and inflation, which agrees with the findings of Bayo (2011), Hossain (2013), and Uddin et al. (2014). It is obvious that an increase in the interest rate results in a higher cost of capital, which ultimately leads to a higher production cost. Producers are expected to pass on this increased cost in the form of higher selling prices. Moreover, due to higher production costs, many produces are forced to shift their supply curve downward, and as a result there is also a possibility for the scarcity of goods. This also results in higher prices and thus inflation.

The relationship between remittance and inflation is assumed to be positive. In general, the more money that recipient families get from remittances, the more they will spend, which leads to an increase in the demand for goods and services and subsequently increases in the price level. However, in our current model we find a negative coefficient for the variable of remittance, which means workers' remittances inversely affect a country's inflation. The direct effect of remittances on inflation may be overwhelmed by other factors such as the exchange rate. Under different foreign exchange regimes, there may be a divergence in the impacts from remittances on inflation. For a fixed exchange rate regime, increased remittance flows temporarily increase the rate of inflation and the nominal money supply. In contrast, in a flexible regime, increased remittance flows temporarily decrease the rate of inflation (Ball et al., 2013). Remittances cause an increase in the supply of foreign currency, which means an appreciation of the local currency or a depreciation of the foreign currency, making imports cheaper and exports more expensive. This may result in a reduction in inflation under a flexible foreign exchange regime. Bangladesh has entered a flexible foreign exchange regime since 2003. As it is an import dominant country, the coefficient thus shows a negative sign.

Our last variable, real exchange rate, demonstrates a negative coefficient in relation to inflation. Normally, this variable is expected to be positively related with inflation, but here we see a reverse sign that is consistent with the prior findings of Hossain (2013) and Uddin et al. (2014). The reason is well explained by Hafer (1989), whose evidence suggests that the role of US dollar depreciation in initiating an inflationary spiral is dubious. He points out that a movement in the exchange rate is a reflection of the relative economic situation, and therefore exchange rate movements appearing to statistically 'cause' inflation are merely an indication that they respond faster to changes in the relative economic conditions than do to observed price levels. Our findings indicate that while a depreciating Bangladeshi taka may cause an increase in import prices, these relative increases are not inflationary nor do they cause higher prices in the future. Therefore, the argument of

imported inflation is due to exchange rate fluctuation may not be valid for Bangladesh.

The Bangladesh economy has faced varying inflationary trends over the years. Thus, it is necessary to determine the factors affecting such inflation. This paper has investigated the more significant variables that are causing inflation in Bangladesh. As such, the findings herein need to be put in place so that they can be used for anti-inflationary policies, thus ensuring a more stable economic growth for the country.

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