Understanding Dynamics of CPI Using Statistical Instruments

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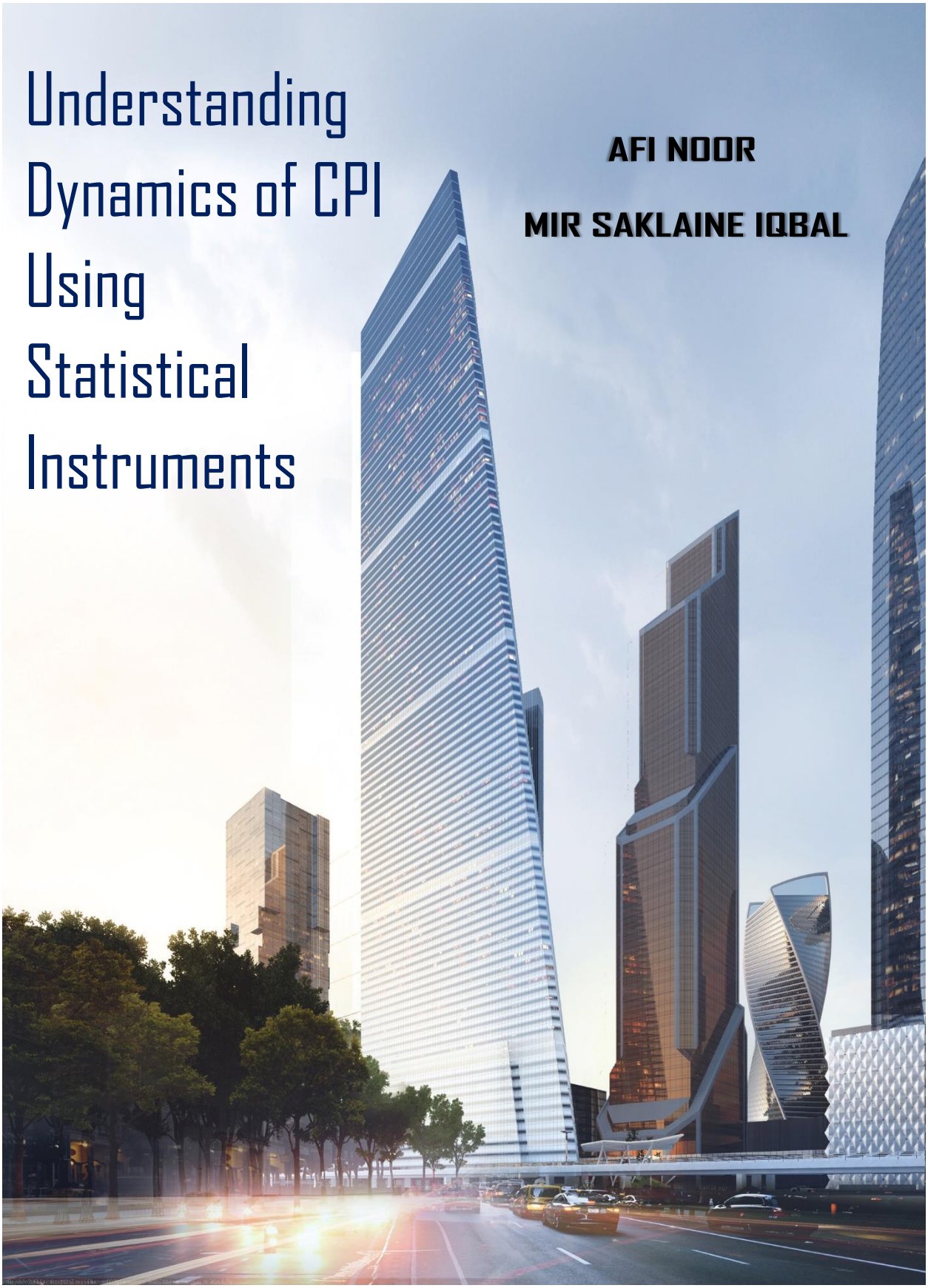

1 Introduction

The report examines the dynamics of Consumer Price Index in the context of the economy of Bangladesh. Firstly, to predict and understand the impact of Bangladesh's top 5 trade partners on the consumer price index of Bangladesh a regression model has been developed. It was found that among the top 5 trade partners China's and Germany's CPI change has strongest correlation with Bangladesh's CPI. Correlation has been used to comprehend the importance of other macroeconomic factors on consumer price index. Here, remittance was found to have strongest correlation with Bangladesh's CPI. Finally, the CPI of Bangladesh has been compared with other developing countries using ANOVA testing. . It was found that CPI of Vietnam, Cambodia and Bangladesh did not have statistically significant differences among each other.

2 Statistical Analysis

2.1 Trends in CPI with Major Import Partners

In this section, statistical analysis is conducted to determine whether the correlation with trade partners are statistically significant.

Null Hypothesis: There will be no significant prediction of CPI change of Bangladesh by CPI change of USA, UK, India, China and Germany.

Alternate Hypothesis: There will be significant prediction of CPI change of Bangladesh by CPI change of USA, UK, India, China and Germany.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	United States, India, China, United Kingdom, Germany[b]	.	Enter

a. Dependent Variable: Bangladesh

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.871[a]	.758	.678	1.263194514994693

a. Predictors: (Constant), United States, India, China, United Kingdom, Germany

Here, the value R is .871, for the predictor constant: United States, India, China, United Kingdom, and Germany. The R-value indicates a simple correlation of the CPI values of Bangladesh with the United States, India, China, United Kingdom and Germany. The correlation between the CPI values of Bangladesh with its top 5 Trading Partners (Import) is very high and positively correlated. Therefore, if the value of the CPI of the trading partners changes, the CPI of Bangladesh will also have an impact with a correlation of 0.871.

Additionally, the value of R Square for this model is 0.758, which indicates how much variability in CPI of Bangladesh can be explained by our independent variables: CPI of United States, India, China, United Kingdom, Germany. Therefore, 75.8% of the variation in the CPI of Bangladesh can be explained by this comparative model.

Secondly, we have an ANOVA table, which indicates how well the regression equation predicts the independent variable. Using this table, we can interpret that our model is statistically significant. Because, the significance of regression is less than our significance level 0.05. We have enough evidence to conclude our regression model to be statistically significant, which means the model can statistically significantly predict CPI of Bangladesh.

Coefficients[a]

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	75.028	5	15.006	9.404	.000[b]
	Residual	23.935	15	1.596		
	Total	98.963	20			

a. Dependent Variable: Bangladesh

b. Predictors: (Constant), United States, India, China, United Kingdom, Germany

		B	Std. Error	Beta		
1	(Constant)	3.587	1.126		3.187	.006
	China	.832	.202	.753	4.127	.001
	United Kingdom	1.012	.589	.368	1.719	.106
	India	.223	.127	.313	1.760	.099
	Germany	-2.381	.923	-.673	-2.580	.021
	United States	.525	.488	.249	1.075	.299

a. Dependent Variable: Bangladesh

Finally, the Coefficient table gives us information to predict our dependent variable CPI of Bangladesh. From the P value given in the chart we see that the CPI of China has the highest statistical significance with The UNited States having the lowest. The unstandardized coefficients tell us that for 1 unit change in the index of CPI of China we will see a 0.832 index change in the CPI of Bangladesh. Similarly for 1 unit change in index of CPI of United Kingdom, India and The United States, the CPI of Bangladesh will change at 1.012, 0.223 and 0.525 units. But in case of Germany the relation is negative, that is for 1 unit increase in the CPI of Germany, The CPI of

Bangladesh will decrease by 2.381 and vice versa. In the same way, for one standard deviation positive change in the CPI of independent variable countries we find that the highest positive change is found with China followed by the United Kingdom, India and United States respectively with negative change in terms of Germany.

2.1.1 Regression Equation

To predict Bangladesh's CPI change, the following equation can be used:

CPI change of Bangladesh = 3.578 + (CPI change of China)*.832 + (CPI change of USA)*0.525 + (CPI change of UK)*1.012 + (CPI change of India)*0.223 + (CPI change of Germany)*(-2.381)

2.1.2 Result

The significance level in ANOVA table is 0.000(i.e., p value = 0.000). Since, the p value is less than the significance level 0.05, we reject the null hypothesis in favor of alternative hypothesis. Therefore, there is significant prediction of CPI change of Bangladesh by CPI change of USA, UK, India, China and Germany.

The statistical analysis can be backed up by real life events. Such as the slowdown India's and China's economy due to COVID-19 may impact our economy as our economists believe.[1] Furthermore, with a recession likely in India, more protectionist policies can be expected against products from Bangladesh which will further impact our country's revenue and hence the CPI in future (Ahsan, 2019).Similarly, the ongoing trade war of China with the USA has slumped our exports, especially apparel and leather goods, contributing to 0.23% to gross domestic products (GDP).[2]

[1] According to an article in The Business Standard titled 'Economic slowdown in India and China may hit Bangladesh: Analysts'

[2] The Asian Development Bank has proposed trade liberalization in order to minimize the impact of conflict.

2.2 Predicting CPI using Remittance, Real Interest and Exchange Rate

In this section a regression analysis has been conducted below in which CPI is the dependent variable. Based on the availability of data and their correlation with the changes in the CPI of Bangladesh, 3 factors have been selected. The three factors initially chosen are Currency Exchange rate (US Dollar), Remittance and Real interest rate.

The explanation of the results are given below.

Null Hypothesis: There will be no significant prediction of CPI of Bangladesh by remittance, real interest, and exchange rate of Bangladesh

Alternate Hypothesis: There will be significant prediction of CPI of Bangladesh by remittance, real interest, and exchange rate of Bangladesh

Here, the value of R is 0.962, for the predictor constants: Remittance, Real interest, Exchange rate. The R Value indicates the correlation of CPI of Bangladesh and Remittance, Real interest, Exchange rate. The Correlation here is very high. So if the value of the constants changes, the CPI of Bangladesh will also change with a correlation of 0.962.

Furthermore, the value of R square for this model is 92.6% which indicates the variability in CPI of Bangladesh that can be explained using the independent variable: Remittance, Real interest, Exchange rate. That is 92.6% of variation can be explained using these 3 variables.

ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Remittance, Real interest, Exchange rate[b]	.	Enter

a. Dependent Variable: CPI

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.962[a]	.926	.912	18.397546771372760

a. Predictors: (Constant), Remittance, Real interest, Exchange rate

1	Regression	71492.137	3	23830.712	70.407	.000[b]
	Residual	5753.985	17	338.470		
	Total	77246.122	20			

a. Dependent Variable: CPI

b. Predictors: (Constant), Remittance, Real interest, Exchange rate

Secondly, we have an ANOVA table, which indicates how well the regression equation predicts the independent variable. Using this table, we can interpret that our model is statistically significant. Because, the significance of regression is less than our significance level 0.05. We

have enough evidence to conclude our regression model to be statistically significant, which means the model can statistically significantly predict CPI of Bangladesh.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	51.038	100.305		.509	.617
	Real interest	-3.663	4.191	-.105	-.874	.394
	Exchange rate	.537	1.403	.093	.383	.707
	Remittance	9.342E-9	.000	.797	4.078	.001

a. Dependent Variable: CPI

Finally, the Coefficient table gives us information to predict our dependent variable CPI of Bangladesh. From the P-value (Sig.) We find that Remittances are statistically significant with Real interest and Exchange rate having lesser impacts. The unstandardized Coefficient shows us that, for 1 unit increase in real interest, the CPI of Bangladesh decreases by 3.663.Whereas the changes are 0.537 and very small Remittance. But the impact of Remittance is highest due to the higher P value. That can be seen through the 0.797 standard deviation for 1 standard deviation change in Remittance.

2.2.1 Regression Equation

To predict Bangladesh's CPI, the following equation can be used:

CPI of Bangladesh = 51.038 + (Real Interest)*(-3.663) + (Exchange rate)*0.537 + (remittance)*9.342E-9

2.2.2 Result

The significance level in ANOVA table is 0.000(i.e., p value = 0.000). Since, the p value is less than the significance level 0.05; we reject the null hypothesis in favor of alternative hypothesis. Therefore, there is significant prediction of CPI of Bangladesh by real interest, exchange rate and remittance (together).

2.3 Comparison with other Developing Countries

From an economic point of view, **Bangladesh**, **Vietnam** and **Cambodia** have been performing extraordinarily well among the developing countries. Vietnam and Cambodia are two of our biggest competitors when it comes to RMG export. Compared to Vietnam and Cambodia, Bangladesh had better GDP growth. On the other hand Bangladesh had a inflation rate of 6%. Using one-way Anova, the statistical significance of CPI differences among these three countries can be understood. For ANOVA testing, data of CPI change percentage has been used.

Null Hypothesis: $V_m = C_m = B_m$

Here,

$\boldsymbol{V_m}$ = Vietnam's CPI change mean

$\boldsymbol{C_m}$ = Cambodia's CPI change mean

$\boldsymbol{B_m}$ = Bangladesh's CPI change mean

Alternate Hypothesis: Means of Vietnam, Cambodia and Bangladesh are not equal

Report

CPI Change

Country	Mean	N	Std. Deviation
Bangladesh	6.2372%	23	2.29450%
Vietnam	6.3562%	23	5.47496%

Cambodia	4.9657%	23	5.54464%
Total	5.8530%	69	4.66361%

Before analyzing the ANOVA, the means of CPI can be used to describe the differences. Here Bangladesh and Vietnam have almost the same CPI mean. Using ANOVA, we can find if Cambodia's comparatively lower CPI change is statistically significant or not.

ANOVA

CPI Change

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	27.328	2	13.664	.621	.540
Within Groups	1451.625	66	21.994		
Total	1478.952	68			

Here, the significance value is **0.540** (i.e., p value = 0.540), which is greater than 0.05 significance level. Therefore, there is no statistical significance difference among CPI change of Bangladesh, Vietnam and Cambodia. As there is no significant difference, we do not have enough evidence to conclude that Cambodia is performing better in terms of Consumer Price Index.

2.3.1 Result

We fail to reject the null hypothesis. There is not enough evidence available to suggest the null hypothesis is false at 95% confidence interval. We can conclude that there is no statistically significant difference among Bangladesh, Vietnam and Cambodia CPI change means.

3 Policy Implications

Based on the findings and analysis of this report, the following policy implications are relevant:

- Statistical analysis indicates that trends in CPI of Bangladesh can be predicted based on the CPI of its top 5 trade partners (which are China, Germany, India, United Kingdom, and United States). So short term predictions of CPI and corresponding policy decisions related to the predictions of CPI can be based on (or further authenticated using) CPI data of the trade partners.

- Empirical observations suggest that the impact of real interest rates or exchange rates on CPI is not very significant. However, the correlation between CPI and remittance is extremely high. So major trends and predictions regarding remittance should be a point of discussion in making decisions or policies related to CPI.

- There is no statistically significant difference among the CPI of the developing countries taken into consideration. This indicates we are on par in this regard. However, close monitoring of the CPI of these countries and comparison with ours may indicate shortcomings or advantages in case of future deviations.