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# CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	ANALYSIS OF IPOs UNDERPRICING: EVIDENCE FROM BOMBAY STOCK EXCHANGE ROHIT BANSAL & DR. ASHU KHANNA	1
2.	BANKRUPTCY PREDICTION OF FIRMS USING THE DATA MINING METHOD ATIYE ASLANI KTULI & MANSOUR GARKAZ	8
3.	THE EFFECT OF BASEL III REQUIREMENTS ON IMPROVING RISK-MANAGEMENT CAPABILITIES IN JORDANIAN BANKS DR. MOHAMMED FAWZI ABU EL HAJJA	12
4.	CAPITAL STRUCTURE DETERMINANTS: CRITICAL REVIEW FOR SELECTED INDIAN COMPANIES DR. AVANISH KUMAR SHUKLA	18
5.	IMPACT OF INFLATION ON BANK LENDING RATE IN BANGLADESH EMON KALYAN CHOWDHURY	23
6.	THE PERCEPTION OF BANK EMPLOYEES TOWARDS COST OF ADOPTION, RISK OF INNOVATION, AND STAFF TRAINING'S INFLUENCE ON THE ADOPTION OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN THE RWANDAN COMMERCIAL BANKS MACHOGU MORONGE ABIUD & LYNET OKIKO	27
7.	ICT, ELECTION AND DEVELOPMENT IN AFRICA NDUONOFIT, LARRY-LOVE EFFIONG & ONWUKWE, VIVIAN CHIZOMA	32
8.	MODERATING ROLE OF EMOTIONAL INTELLIGENCE TOWARDS STRESS AND EMPLOYEE PERFORMANCE IN THE INDIAN BANKING SECTOR BEULAH VIJI CHRISTIANA.M & DR. V. MAHALAKSHMI	35
9.	FACTORS INFLUENCING CUSTOMER LOYALTY IN MOBILE PHONE SERVICE - A STUDY WITH REFERENCE TO COIMBATORE CITY DR. V.T.R .VIJAYAKUMAR & B.SUBHA	39
10.	A STUDY ON OCCUPATIONAL STRESS AMONG GRADE I POLICE CONSTABLES M.SHUNMUGA SUNDARAM & DR. M. JAYA KUMARAN	44
11.	A STUDY ON THE IMPACT OF SPIRITUALITY ON ORGANISATIONAL PERFORMANCE WITH SPECIAL REFERENCE TO ORGANISATIONS IN SALEM CITY DR. M. G.SARAVANA RAJ & R. FLORENCE BHARATHI	49
12.	A COMPARATIVE STUDY OF SELF- EFFICACY AND SUBJECTIVE WELL- BEING AMONG EMPLOYED WOMEN AND UNEMPLOYED WOMEN DR. K. JAYASHANKAR REDDY	54
13.	NETWORK SECURITY THREATS AND SOLUTIONS IN A VIRTUAL MARKETPLACE DR. PANKAJ KUMAR GUPTA & DR. AJAY KUMAR TIWARI	58
14.	A STUDY OF SUPPLIERS CERTIFICATION AT DIFFERENT LAYERS AND ITS IMPACT ON QUALITY IN AUTO COMPONENT INDUSTRY DR.DATTATRY RAMCHANDRA MANE	61
15.	GLOBAL LIFE INSURANCE PENETRATION AND DENSITY DR. GUDALA SYAMALA RAO	69
16.	AN ENHANCE SECURITY OF PLAYFAIR CIPHER SUBSTITUTION USING A SIMPLE COLUMNAR TRANSPOSITION TECHNIQUE WITH MULTIPLE ROUNDS (SCTTMR) GAURAV SHRIVASTAVA, MANOJ DHAWAN & MANOJ CHOUHAN	75
17.	CONSUMERS PERCEPTIONS OF CORPORATE SOCIAL RESPONSIBILITY: EMPIRICAL EVIDENCE AMIT B. PATEL, DR. VIMAL K. BHATT & JATIN K. MODI	79
18.	A STUDY ON FINANCIAL HEALTH OF KINGFISHER AIRLINES LTD: (Z- SCORE APPROACH) JIGNESH. B. TOGADIYA & UTKARSH. H. TRIVEDI	84
19.	STRATEGIES OF CUSTOMER RELATION MANAGEMENT IN MODERN MARKETING DR. T. PALANISAMY & K. AMUTHA	88
20.	CORPORATE GOVERNANCE IN OIL & GAS SECTOR: AN EMPIRICAL INVESTIGATION RASHESH PATEL & SWATI PATEL	92
21.	KNOWLEDGE MANAGEMENT & MOBILIZING KNOWLEDGE IN EDUCATION BY FOLLOWING CASE STUDY OF YU;GI-OH WORLD SMITA.SJAPE	101
22.	STUDY OF CRM THROUGH SOCIAL NETWORKING SITE: A FACEBOOK PERSPECTIVE TEENA BAGGA & APARAJITA BANERJEE	107
23.	ORDINARY LEAST SQUARES METHOD AND ITS VARIANTS R. SINGH	114
24.	IT INFRASTRUCTURE IN CREATING POTENTIAL MARKETING OPPORTUNITIES IN INDUSTRIES: AN EMPIRICAL STUDY OF SELECT INDUSTRIES IN KARNATAKA MANJUNATH K R & RAJENDRA M	120
25.	THE IMPACT OF KNOWLEDGE MANAGEMENT ON BUSINESS ORGANIZATION SUNITA S. PADMANNAVAR & SMITA B. HANJE	126
26.	LOCUS OF CONTROL AMONG HIGH SCHOOL TEACHERS DEEPA MARINA RASQUINHA	129
27.	KNOWLEDGE MANAGEMENT: A CONCEPTUAL UNDERSTANDING AINARY ARUN KUMAR	135
28.	A STUDY ON EFFECTIVENESS OF ORGANIZATIONAL HEALTH IN SMALL SCALE INDUSTRIES DR. J. S. V. GOPALA SARMA	142
29.	JOB SATISFACTION DURING RECESSION PERIOD: A CASE STUDY OF PUBLIC & PRIVATE INSURANCE IN PUNJAB HARDEEP KAUR	149
30.	BANKING SECTOR REFORMS IN INDIA DR. SANDEEP KAUR	156
	REQUEST FOR FEEDBACK	162

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## IMPACT OF INFLATION ON BANK LENDING RATE IN BANGLADESH

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## ABSTRACT

Ever since Irving Fisher (1930) provided the relationship between the expected inflation and interest rates considerable attention has been paid for it. Many financial controversies and literatures have surrounded this relationship. In Bangladesh context, very less study has been done in this regard as interest liberalizations are of recent past. This study is done with an objective to unearth the influence of inflation on lending rate of commercial banks in Bangladesh. The period 2002 - 2011 has been considered for study. The inflation and lending rate satisfy Dickey Fuller Test. Later, the dependent variable lending rates is regressed with the independent variable inflation. The obtained residuals are again subject to Augmented Dickey Fuller test. The result shows that the residuals are stationary, and the co-integration tests proves that during the period of study, there is no significant relationship between the rates.

## KEYWORDS

Inflation rate, Interest rate, Augmented Dickey–Fuller test, Co-integration.

## INTRODUCTION

Inflation is a key factor in things that affect interest rates. When a surge in inflation occurs, a corresponding increase in interest rates takes place. Over time, prices of things tend to steadily increase. Therefore the value of money decreases. Lenders are very aware that inflation will erode the value of their money over the time period of a loan, so they increase interest rates to compensate for the loss. This is how lenders are able to stay visible over time with multiple borrowers and multiple outstanding loans. Adjustments are made to interest to recoup the loss made when money loses value.

Whenever there is any news on interest rates, it is accompanied by inflation. It is a known fact that there exists a relationship between interest rates and inflation. But, the extent to which one affects the other for different time periods is not certain. The well-known Fisher hypothesis, introduced by Irving Fisher in 1930 maintains that the nominal interest rate is the sum of the constant real rate and the expected decline in the purchasing power of money. Starting with Fisher and extending to the present, this seemingly simple and intuitive hypothesis has found limited empirical support. Fisher hypothesis provides the relationship between the expected inflation and interest rates. Fisher's hypothesis is that the nominal interest rate ( $R_t$ ) can be taken to be the sum of real rate of interest ( $P_t$ ) and the rate of inflation anticipated by the public ( $\Pi_t$ ). Previous studies show that there is a positive relationship between interest rates and inflation (Research department, National Bank of Poland). Studies have shown that Fisher hypothesis is true in Bangladesh and that there is a long run relationship between interest rates and inflation rates, and interest rates can be modeled considering expected inflation and other macroeconomic variable to arrive at a more valid model of forecasting interest rates.

**Fisher hypothesis** is the proposition by Irving Fisher that the real interest rate is independent of monetary measures, especially the nominal interest rate. The Fisher equation is

$$r_r = r_n - \pi^e$$

This means, the real interest rate ( $r_r$ ) equals the nominal interest rate ( $r_n$ ) minus expected rate of inflation ( $\pi^e$ ). Here all the rates are continuously compounded. For simple rates, the Fisher equation takes form of

$$1 + i = (1 + \rho) \times E(1 + \pi)$$

If  $r_r$  is assumed to be constant,  $r_n$  must rise when  $\pi^e$  rises. Fisher Effect: The one for one adjustment of the nominal interest rate to the expected inflation rate.

To understand the relationship between money, inflation and interest rates it is important to understand nominal interest rate and real interest rate. The nominal interest rate is the interest rate you hear about at your bank. If you have a savings account, for instance, the nominal interest rate tells you how fast the number of dollars in your account will rise over time. The real interest rate corrects the nominal rate for the effect of inflation in order to tell you how fast the purchasing power of your savings account will rise over time. An easy estimation of the real interest rate is the nominal interest rate minus the expected inflation rate (Note that this estimate is unwise when looking at compounded savings.)

Real interest rate = Nominal Interest Rate - Expected Inflation Rate

Nominal Interest Rate = Real interest Rate + Expected Inflation Rate

If inflation permanently rises from a constant level, let's say 4%/yr., to a constant level, say 8%/yr., that currency's interest rate would eventually catch up with the higher inflation, rising by 4 points a year from their initial level. These changes leave the real return on that currency unchanged. The Fisher Effect is an evidence that in the long-run, purely monetary developments will have no effect on that country's relative prices (Kwong, Mary; Bigman, David; Taya, Teizo-2002)

**Interest rate:** An interest rate is the rate at which interest is paid by a borrower for the use of money that they borrow from a lender. Interest rates are normally expressed as a percentage rate over the period of one year.

**Nominal interest rate:** The rate of interest before adjustment for inflation. Suppose 'A' deposits Tk. 100 with a bank for 1 year and they receive interest of Tk.10. At the end of the year their balance is Tk. 110. In this case, the nominal interest rate is 10% per annum.

**Real interest rate:** The real interest rate is the nominal interest rate minus the inflation rate. It is a measure of cost to the borrower because it takes into account the fact that the value of money changes due to inflation over the course of the loan period. Except for loans of a very short duration, the inflation rate will not be known in advance.

**Purchasing power:** It is the number of goods and or services that can be purchased with a unit of currency. Currency can be either a commodity money, like gold or silver, or fiat currency like Taka. As Adam Smith noted, having money gives one the ability to "command" others' labor, so purchasing power to some extent is power over other people, to the extent that they are willing to trade their labor or goods for money or currency.

**Inflationary expectations**

According to the theory of rational expectations, people form an expectation of what will happen to inflation in the future. They then ensure that they offer or ask a *nominal interest rate* that means they have the appropriate real interest rate on their investment. The international Fisher relation predicts that the interest rate differential between two countries should be equal to the expected inflation differential. Therefore, countries with higher expected inflation rates will have higher nominal interest rates, and vice versa.

## LITERATURE REVIEW

The empirical research conducted in Bangladesh suggests that there does not exist any co-movement of inflation with interest rates and the relationship between the variables is also not significant. The inflation premium, equal to expected inflation that investors add to real-risk free rate of return, is ineffective. (Md. M Alam, K. A Alam and MD. G.S Uddin-2008). William J Crowder and Dennis L Hoffman (2007) recognizes that the persistence in nominal interest rates and inflation can be modeled under the unit root hypothesis. A fully efficient estimator that separates estimation of long run equilibrium relationship from nuisance parameters is applied. The study finds considerable support for the tax-adjusted Fisher effect. It reveals a long run relationship between interest rates and inflation. However, it also finds that the short term interest rates may not be good predictors of future inflation. Evans, Martin and Karen Lewis (1995) observes co-integration between nominal interest rates and inflation in a sample of post war data and applies the DOLS estimator to estimate the long run response of nominal interest rates with respect to inflation. They support their case with Monte Carlo evidence. They conclude that the Fisher hypothesis is generally consistent with postwar data once we recognize that agents have been forced to form expectations from an inflation process that has undergone several structural changes in the post war period and that their results simply suffer from small sample bias. Liu and Adedeji (2000), Ubide (1997), Leheyda (2005), and Khan and Schimmelpennig (2006) have recorded clear ideas about the determinants of inflation in developing countries. Most the studies stress money supply as the major source of inflation in the respective economies. Taslim (1982) attempted to analyze the inflationary process in Bangladesh in light of the structuralize monetarist controversy using the data for FY60 to FY80. The author systematically tested both the views in the context of Bangladesh as well as a hybrid model considering both views together. Martin Evans and Karen Lewis (1995) characterize the shifts in inflation by a Markov switching model. They argue that rational anticipations of infrequent shifts in the inflation process induce significant small sample biases in estimates of the long-run Fisher relationship. These small sample biases may create the appearance of permanent shocks to the real rates even when none are truly present. They examine the long-run relationship between nominal interest rates and inflation and are unable to reject the hypothesis that in the long-run nominal interest rates reflect expected inflation one-for-one

## NEED AND IMPORTANCE

Level of inflation always has a bearing on the interest rates. The interest rate is a key financial variable that affects decisions of consumers, business firms, financial institutions, professional investors and policy makers. Timely forecasts of inflation rates can therefore provide valuable to financial market participants. Forecasts of interest rates can also help to reduce interest rate risks faced by individuals and firms. In Bangladesh context the relationship between anticipated inflation changes and returns were not of much concern due to administered interest rate mechanism. Since the economic reforms and the liberalization of capital market the interest rates are market determined. The earlier findings report that no relationship between interest rates observed at point of time and rates of subsequently observed inflation exist. However the general finding is that there are relationships between current rates of interest and past rates of inflation. If interest rates are not adjusted for changes in inflation then the real rate of return decreases. Expected price changes have a bearing on the purchasing power, thus on the level of consumption also. Hence interest rate determination in Bangladesh context also needs focus.

## RESEARCH METHODOLOGY

### PROBLEM STATEMENT

This paper studies whether there is any such impact of bank lending rate on the inflation of Bangladesh

### OBJECTIVE

To check the relationship between inflation and bank lending rate

### LIMITATION

The study is limited to a period of 10 years only.

### DATA SOURCE

This study has been carried out on the basis of secondary data collected from the official web sites of Bangladesh Bank and Bangladesh bureau of statistics.

### SAMPLE FRAME

Yearly inflation and interest rate data for ten years from 2002 to 2011.

### RESEARCH TOOLS

**Augmented Dickey-Fuller test (ADF)** is a test for a unit root in a time series sample. It is an augmented version of the Dickey-Fuller test for a larger and more complicated set of time series models. The augmented Dickey-Fuller (ADF) statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit root at some level of confidence.

The testing procedure for the ADF test is the same as for the Dickey-Fuller test but it is applied to the model

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t,$$

where  $\alpha$  is a constant,  $\beta$  the coefficient on a time trend and  $p$  the lag order of the autoregressive process. Imposing the constraints  $\alpha = 0$  and  $\beta = 0$  corresponds to modeling a random walk and using the constraint  $\beta = 0$  corresponds to modeling a random walk with a drift.

By including lags of the order  $p$  the ADF formulation allows for higher-order autoregressive processes. This means that the lag length  $p$  has to be determined when applying the test. One possible approach is to test down from high orders and examine the t-values on coefficients. An alternative approach is to examine information criteria such as the Akaike information criterion, Bayesian information criterion or the Hannan-Quinn information criterion.

The unit root test is then carried out under the null hypothesis  $\gamma = 0$  against the alternative hypothesis of  $\gamma < 0$ .

$$DF_{\tau} = \frac{\hat{\gamma}}{SE(\hat{\gamma})}$$

Once a value for the test statistic is computed it can be compared to the relevant critical value for the Dickey-Fuller Test. If the test statistic is less (this test is non symmetrical so we do not consider an absolute value) than (a larger negative) the critical value, then the null hypothesis of  $\gamma = 0$  is rejected and no unit root is present.

The intuition behind the test is that if the series is integrated then the lagged level of the series ( $y_{t-1}$ ) will provide no relevant information in predicting the change in  $y_t$  besides the one obtained in the lagged changes ( $\Delta y_{t-k}$ ). In that case the  $\gamma = 0$  null hypothesis is not rejected.

A model that includes a constant and a time trend is estimated using sample of 50 observations and yields the  $DF_{\tau}$  statistic of -4.57. This is more negative than the tabulated critical value of -3.50, so at the 95 per cent level the null hypothesis of a unit root will be rejected (Elliott, G., Rothenberg, T. J. & J. H. Stock, 1996)

## HYPOTHESIS ON STATIONARITY OF DATA

Null hypothesis:  $H_1$ : Time Series Data is Stationary

Alternative hypothesis:  $H_0$ : Time Series Data is Non Stationary



**RESULT AND DISCUSSION**

Testing of stationarity  
For interest rates

Null Hypothesis: D(tseries) has a unit root Exogenous: Constant Lag Length: 0 (Automatic Based on AIC, MAXLAG=0)		
	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.273113	0.014674
Test critical values:	1% level	-4.581538
	5% level	-3.321041
	10% level	-2.801304

*Interpretation*

The data is stationery at 5% critical value.

For inflation rate:

Null Hypothesis: D(tseries) has a unit root Exogenous: Constant Lag Length: 0 (Automatic Based on AIC, MAXLAG=0)		
	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.320802	0.013827
Test critical values:	1% level	-4.581538
	5% level	-3.321041
	10% level	-2.801304

*Interpretation*

The data is stationery at 5% critical value.

**Co-intergration**

Since interest rate and inflation data series are proved to be Stationary, now test for co integration is executed to evaluate if these two are linearly related. *Engel-Granger Co-integration* technique is utilized in this study due to its simplicity and reliability. The residuals obtained are tested for Stationarity using ADF test. If this residual series is proved to be stationary then it can be said that a relationship exists between interest rates and inflation over a long term.

**Regression**

A regression of interest rate on inflation is run using both MS Excel and SPSS. The output of the regression is as follows.

Output	Interest rate on inflation
Observations	10.000
Sum of weights	10.000
DF	9.000
R <sup>2</sup>	0.147
Adjusted R <sup>2</sup>	0.025

Analysis of variance:					
Source	DF	Sum of squares	Mean squares	F	Pr > F
Regression	1	6.405	6.405	1.209	0.308
Residual	8	37.082	5.297		
Total	9	43.486			
Computed against model Y=Mean(Y)					

Model parameters:						
Source	Value	Standard error	T	Pr >  t	Lower bound (95%)	Upper bound (95%)
Intercept	4.769	3.041	1.568	0.161	-2.426	11.964
5.4	0.497	0.452	1.100	0.308	-0.573	1.568

Observation	Pred(9.65)	Residual
Obs1	7.654	1.836
Obs2	6.311	0.569
Obs3	7.555	-2.625
Obs4	7.754	1.816
Obs5	8.251	2.859
Obs6	8.350	-0.980
Obs7	9.678	0.562
Obs8	8.082	-3.692
Obs9	8.405	-0.345
Obs10	8.734	-0.187

Next, we check the stationarity of the residuals obtained. If the residuals are stationary, then the two variables are said to co-integrate with each other. i.e., there exists a relationship between inflation and interest rates.

The results obtained are as follows;

Null Hypothesis: D(tseries) has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic Based on AIC, MAXLAG=0)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.773237	0.032243
Test critical values:	1% level	-4.801997	
	5% level	-3.403396	
	10% level	-2.841690	

## FINDINGS

The above results show that there is stationary at 5% critical value. Hence, there might be some relationship between the two. However, also keeping in view the regression statistics, i.e., the values of F-test and significance of the test, it can be said that there is no significant relationship between interest rates and inflation.

## CONCLUSION

This paper has attempted to study the existence of relationship between interest rates and inflation. The data that has been collected was tested for stationarity and then put to further use. The stationarity was tested using the Augmented Dickey Fuller test (ADF) which revealed that the data was stationary for interest rate and inflation. The persistence of a relationship between interest rates and inflation was tested using the Engle Granger co-integration test. This test involves running a regression of long term interest rates on inflation. The test throws up a list of residuals. These residuals are then tested for stationarity, the result of which proves the existence of a relationship. This test showed feeble relationship between the two for the particular study period. From the above ADF and Granger co-integration test, it can be said there is no significant relationship between interest rates and inflation during the period of study i.e., from 2002 to 2011.

## SCOPE FOR FURTHER STUDY

This research showed the affect of inflation on interest rate only, a part from inflation there are other factors which influence interest rates, so further research can be done on other factors like deferred consumption, alternative investments, risk of investment, liquidity preference etc.

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## APPENDIX

### INTEREST RATES AND INFLATION RATES FROM 2002 TO 2011

Year	Interest rate	Inflation rate
2002	9.65	5.40
2003	9.49	5.80
2004	6.88	3.10
2005	4.93	5.60
2006	9.57	6.00
2007	11.11	7.00
2008	7.37	7.2
2009	10.24	9.87
2010	4.39	6.66
2011	8.06	7.31

Source: Bangladesh Bank and Bangladesh Bureau of Statistics

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