

Fisher Effect in Pakistan

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This paper attempts to test the validity of the Fisher Hypothesis (FH) in Pakistan by investigating the long-run relationship between interest rate and inflation rate applying cointegration analysis. The FH has serious implications for debtors and creditors in an inflation prone economy since inflationary expectations influence nominal interest rate. Moreover, the effectiveness of monetary policy and efficiency in banking sector has direct bearing on the long-run relationship between nominal interest rate and expected inflation rate. Inflationary expectation has been modeled using adaptive and rational expectation approaches and sensitivity of the result to expectation formation has been compared.

The paper finds the long-run relationship between nominal interest rate and inflation rate and accepts the partial Fisher Hypothesis. This result suggests that interest rate does not fully cover or accurately anticipate inflation, which implies that bank deposits deteriorate over time. The result further implies that monetary policy may not be effective in such a situation and households' savings rate may suffer a decline. The acceptance of partial Fisher Hypothesis in case of rational expectation suggests that the rate of interest does not reflect all relevant information and real interest rate does not exhibit random walk behaviour, which is indicative of inefficiency in banking sector.

The analysis clearly shows the failure of interest rate as a hedge against inflation and as a predictor of inflation. Therefore, the paper recommends innovation and financial engineering for better alternative especially in banking. The paper also recommends the growth and encouragement of equity market vis-à-vis prevalent debt-biased market. Finally, the paper advocates the complete replacement of traditional credit-based banking by more efficient trade-based banking in Pakistan.

I. INTRODUCTION

The Fisher Hypothesis provides a theoretical framework for the study of the relationship between interest rate and inflation. It states that an increase in inflation does not affect real interest rate in the long run. In other words, nominal interest rate responds one for one with expected inflation rate. Since inflationary expectations influence nominal interest rate, the Fisher effect has far-reaching implications for debtors and creditors as well as for the effectiveness of monetary policy and efficiency in banking sector. A considerable volume of work has been devoted to test the Fisher Hypothesis. This proposition holds true in the context of the US economy in particular and in industrial countries in general. With the Keynesian revolution, Fisher's argument was decisively rejected. But in the late 1960's and in the 1970's as inflation and interest rates rose together, the Fisher Hypothesis got a second wind. Now a large number of studies can be found where the Fisher effect in interest rate determination equations based on the post-war experience has been included and verified [See, for example, Sargent (1972); Fama (1975); Graham (1988); Mac Donald and Murphy (1989)].

The persistence of a double-digit inflation has been one of the perplexing features of Pakistan economy in the 1990's. This feature of the economy together

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with nominal interest rate may have serious implications for bank depositors and investors since the function of interest rate as hedge and predictor of inflation becomes doubtful in a situation like this. Moreover, the effectiveness of monetary policy may also be affected by inflationary expectations. Efficiency in banking sector is another area relevant to the Fisher effect tested through the random walk and rational expectation theories [See, Fama (1975) and Pesando (1979)].

The objective of this paper is to test the validity of the Fisher effect in Pakistan economy through the investigation of long run relationship between interest rate and inflation rate using adaptive and rational expectations models. Three versions of the Fisher Hypothesis (FH) i.e.; (i) conventional FH, (ii) partial FH, and (iii) inverted FH will be tested in this paper. These hypotheses will be tested applying cointegration analysis using quarterly data from 1957Q1 to 1991 Q2¹ for nominal interest and inflation rates.² According to this scenario, the paper is divided into four sections: Section II estimates the model using adaptive expectations. Section III includes rational expectations in the estimation of the model. The final section delineates estimation results and concludes the paper with policy implications and recommendations.

II. THE MODEL

According to the Fisher Hypothesis:

$$(1 + r_t^e) = \frac{[1 + i_t(1 - T)]}{(1 + r_t^e \pi_t^e)} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

Or

$$i_t = \frac{1}{1 - T} r_t^e + \frac{1}{1 - T} \pi_t^e + \frac{1}{1 - T} r_t^e \pi_t^e \quad \dots \quad \dots \quad \dots \quad (2)$$

where,

i_t = nominal interest rate,

r_t^e = expected real rate of interest,

π_t^e = expected real rate of inflation,

T = average rate of tax on investment income, and

t = time.

Equation (2) is described as the strong form of Fisher's theorem because it predicts that a 1 percent increase in the expected rate of inflation will lead to an

¹Data are taken from IMF International Financial Statistics data base.

²Proxies used for nominal interest rate and inflation rate are inter-bank money rate, which to a large extent determined by the interaction of market forces, and Consumer Price Index respectively.

increase in the nominal interest rate of more than 1 percent (since $1/(1-T) > 1$ or $0 < T < 1$). Similarly, other coefficients are also expected to exceed unity.

Two assumptions are usually made for empirical testing of the model, namely:

- (i) short-dated maturities, for which both r_t^e and π_t^e are small, are used in order to justify suppression of the multiplicative third term, and
- (ii) since real expected rates of return are difficult to observe it is commonly assumed that these are constant but subject to random error. That is,

$$r_t^e = r + u_t \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

where r is a positive constant and u_t is $N(0, \sigma_t^n)$. Allowing $r_t^e \pi_t^e = 0$, substituting r_t^e in second equation and setting $T = 0$ (i.e. investment income is tax free) to get Fisher's original form, we get

$$i_t = r + \pi_t^e + u_t \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (4)$$

It is also called weak-form because a 1 percent increase in the expected rate of inflation is predicted to increase the nominal interest rate by only 1 percent, not more.

It has been argued that the independence of the real interest rate and expected inflation is an empirically reasonable characterisation of an economy.

III. THE METHODOLOGY AND RESULTS

a. Adaptive Expectation Approach

The estimation has been carried out using adaptive expectation (AE) model for expected inflation using quarterly data. Adaptive Expectation model due to Cagan (1956) states that in any one period expectations are revised (linearly) in the light of past error expectations. The procedure adopted in this section is as follows:

1. The AE model has been used to form inflation expectations and this expected inflation has been used in the model.
2. Cointegration analysis has been employed using following three-step procedure.
 - A. Test Unit Roots for individual series.
 - B. Test cointegration if individual series are I(1).
 - C. Estimate Error Correction Model (ECM) using lagged residual from cointegration regression.
3. Three forms of the Fisher hypothesis have been tested using the Wald test.
4. Cointegration results are verified using Johenson ML approach.

5. Sensitivity of cointegration to introduction of new variable has been tested using Johenson ML approach.

Cointegration Analysis

For any model of dynamic specification, there are two most recent techniques to apply on it. The first one is the Autoregressive distributed lags and the second is the Cointegration technique. The first technique has a disadvantage: lost information relating to the long run relationship between the variables. But the second technique has overcome this problem and is useful in depicting relationship between variables in the short run as well as in the long. Another advantage of this technique is that multicollinearity can be reduced.

Therefore, cointegration techniques are used to find the relationship between interest rate and inflation. This technique was pioneered by Granger (1981) and Engle and Granger (1987).³

Unit Root Test

The unit root has been tested for each series. The procedure is as follows: First the hypothesis that interest rate and expected inflation are I(1) series is tested. If this hypothesis is sustained, the test for cointegration can be carried out by testing the residuals from cointegrating regressions to see if they appear to be I(0). Only if the hypothesis is rejected that the cointegrating residuals are I(1) can it be claimed to have found cointegration and hence a long run relationship between interest rate and inflation.

Table 1 presents DF and ADF statistics to test whether the interest rate and inflation series are integrated of order 1. The null hypothesis that the series follow I(1) processes cannot be rejected.

Table 1

Unit Root Test for Full Sample

Statistic	Interest Rate Series		Expected Inflation Rate Series	
	With Trend	Without Trend	With Trend	Without Trend
DF	-2.49	-2.37	-2.35	-2.07
ADF(1)	-2.52	-2.48	-3.20	-2.97
ADF(2)	-1.64	-2.05	-3.82	-3.53
ADF(3)	-1.81	-2.08	-3.78	-3.99
ADF(4)	-1.95	-2.12	-2.53	-2.85

Notes: Sample period is from 1957Q1 to 1992Q2. The 5 percent critical values with trend and without trend are -3.44 and -2.88 respectively.

³See Engle and Granger (1987) or *Oxford Bulletin of Economics and Statistics* (November, 1986).

Given that the inflation rate and interest rate series are I(1) processes the test for cointegration is carried out. OLS estimations have been carried out on both normal and reverse regressions. The reason for using OLS in cointegration analysis being the superconsistency theorem which states that any bias which might arise is asymptotically negligible where the variables are cointegrated.⁴

Three tests of cointegration—the CRDW, DF, and ADF statistics—based on residuals are reported in Table 3. A preliminary inspection of all three statistics reveal that each is significant at 5 percent level of significance.

Error Correction Model

To estimate the Error Correction Model (ECM), lagged residual from cointegrating regression has been used. ECM shows short run dynamics and help these variables to cointegrate in the long-run. The following ECM model has been used.

$$\Delta i_t = r + \alpha_0 \delta \pi_t^* + \alpha_1 \{i_{t-1} - \pi_{t-1}^*\} + \varepsilon_t \quad \dots \quad \dots \quad \dots \quad (5)$$

where,

$\alpha_0 \delta \pi_t^*$ = equilibrium responses, and

$\alpha_1 \{i_{t-1} - \pi_{t-1}^*\}$ = disequilibrium responses.

The long-run relationship in the model is captured by $\alpha_1 \{i_{t-1} - \pi_{t-1}^*\}$, the Error Correction Term (ECT). Since the coefficient of ECT turned out to be negative, the tendency of the variables to drift apart, possibly due to large positive disturbances, has been cancelled. The OLS estimates for ECM are reported in Table 4.

Diagnostic Tests

Two important diagnostic tests have been performed for cointegrating regression. These are:

- (1) Test for serial correlation: It was found that OLS estimates were contaminated by positive serial correlation (The Durbin-Watson statistics were less than unity). This was corrected using a Cochrane-Orcutt, AR (1), process.⁵
- (2) Test for variation of parameters overtime: One important feature of the sample period considered in this study is that it encompasses a crucial regime or structure change. The period from 1947 to 1973 is a period of

⁴See Stock (1987).

⁵The equation corrected for serial correlation could not be used in cointegration. The problem is tackled by increasing the number of lags.

great political and hence economic turmoil and upheaval. The partition in August 1947 seriously disrupted Pakistan's trade, commercial and industrial organisation, channels of communication, and government. An improvement in overall situation was then disrupted remarkably by the 1965 and 1971 Indo-Pak wars and the separation of East Pakistan (now Bangladesh) from West Pakistan (now Pakistan). To account for the events that occurred before 1973, and to investigate the likely variation of parameters between two sub-periods the sample has been split.

Table 2 presents the tests of whether the series follow I(1) processes for the two sub-periods. For sub-sample 1, interest rate series without trend are found to be non-stationary and it is integrated of order 1. Interest series with trend show mixed results. DF and ADF (1) strongly reject the presence of unit roots in the series while orders of ADF show the presence of unit roots. In case of inflation series, except in one case, all other cases indicate stationarity in the series. For sub-sample 2, interest rate series with trend appears to be stationary but after removing trend, the series show presence of unit roots. Similar results are found for inflation series.

Although the presence of unit roots in the sub-samples is not very clear, cointegration techniques in sub-samples have been applied. The results are surprising for sample 1. DF and ADF show presence of unit roots in residuals that implies that there is no cointegration between these variables over the period 1957–1973. But CRDW statistics reject the presence of unit roots in all cases. For sample 2, the results are very clear. All statistics reject presence of unit roots in the residuals and hence indicate cointegration between interest rate and inflation in the long-run. The cointegration regressions and the appropriate test statistics for the two sub-periods are reported in Table 3.

Wald Test

Wald test has been used to test the significance of coefficient of π_t^e . The estimate differs significantly from zero and from one. This clearly rejects both the inverted FH (that there is no relationship between nominal interest rate and inflation or that there exists a negative relationship between real interest rate and inflation) and the conventional FH (that there is one to one relationship between nominal interest rate and inflation or there exists no relationship between real interest rate and inflation) in favour of the partial FH (that nominal interest rate does not fully or accurately anticipate inflation). The estimate suggests that a one percent increase in expected inflation rate results in a 0.48 percent increase in the nominal interest rate (or a 0.52 percent decrease in the real interest rate). Moreover, introduction of lagged dependent variable as an explanatory variable does not affect the conclusion.

Table 2
Unit Root Test for Sub-samples

Statistic	Interest Rate Series		Inflation Rate Series	
	With Trend	Without Trend	With Trend	Without Trend
Sub-sample 1				
DF	-3.70	-1.83	-3.24	-3.14
ADF(1)	-4.67	-2.26	-4.05	-3.96
ADF(2)	-2.35	-1.47	-5.28	-5.10
ADF(3)	-3.06	-1.49	-5.63	-5.87
ADF(4)	-2.98	-1.44	-4.73	-5.07
Sub-sample 2				
DF	-4.24	-2.74	-3.76	-1.49
ADF(1)	-4.11	-2.59	-6.01	-3.76
ADF(2)	-3.50	-2.01	-4.73	-2.71
ADF(3)	-3.68	-2.29	-4.75	-2.67
ADF(4)	-3.89	-2.56	-4.52	-2.43

Notes: Sub-sample periods are from 57Q1 to 73Q4 and 74Q1 to 92Q2 for sub-samples 1 and 2 respectively. The 5 percent critical values with trend and without trend are -3.48 and -2.91 respectively.

Table 3
Test for Cointegration

Dependent Variable	r	π	i	CRDW	DF	ADF	R ²	DW
Full Sample							0.56	0.54
i	3.40	0.48		1.59	-4.99	-5.42		
π	-2.17		1.36	1.58	-4.35	-4.45		
Sub-sample 1							0.18	0.39
i	3.76	0.21		1.71	-2.42	-3.02		
π	-0.10		0.85	1.53	-3.59	-4.43		
Sub-sample 2							0.36	0.65
i	6.29	0.22		1.78	-4.31	-4.07		
π	-3.86		1.58	1.75	-2.11	-2.25		

Notes: The 5 percent critical values for CRDW, DF and ADF are 0.386, -3.37 and -3.78 respectively. The statistics are obtained by running the regression on cointegrating residuals in way mentioned in the theory.

Table 4
OLS Estimates for Error Correction Model

Regressor	Coefficient	<i>t</i> -ratio
INPT	0.07	0.19
First Difference Expected Inflation Rate	0.04	0.94
Error Correction Term	-0.05	-2.20
R ²	0.03	
D-W	1.84	

Notes: Dependent variable is Δi_t .

To verify the results obtained from cointegration regression (residual-based approach), Johenson's Full Information Maximum Likelihood (FIML) approach was used. The results confirmed the previous conclusion of cointegration between interest rate and inflation. (See Table 5.)

For further verification of above results, an augmented model, including money supply (M1) with I(0) was tested. The results reported in Table 6 show that the introduction of money supply did not affect cointegration.

Table 5
Test for Cointegration: Johenson ML Approach

Case	Statistic	95%	90%
Non-trended	19.29	15.67	13.75
Trended with no Trend in DGP	19.27	14.90	12.91
Trended with Trend in DGP	19.27	14.07	12.07

Notes: Cointegrating vector includes i_t and π_t^* . Null hypothesis is no cointegration.

Table 6
Test for Cointegration: An Augmented Model

Case	Statistic	95%	90%
Non-trended	19.03	15.67	13.75
Trended with no Trend in DGP	18.95	14.90	12.91
Trended with Trend in DGP	18.95	14.07	12.07

Notes: Cointegrating vector includes i_t and π_t^* with additional I(0) variable M1. DGP is Data Generating Process.

b. Rational Expectation Approach

In this section, the Rational Expectation model is used for the formation of inflationary expectation. The idea of Rational Expectation due to Muth (1961), which states that subjective expectations held by economic agents will be the same

as the conditional mathematical expectations based on the ‘true’ probability model of the economy.⁶ In simple words, it states that individual economic agents use past and current available and relevant information in forming their expectations. The procedure adopted in this section is as follows:

Firstly, rational expectations are incorporated into the model and instrumental variable estimation is carried out. Secondly, three forms of the Fisher Hypothesis using Wald test are tested and finally, error correction model is used to find out long-run equilibrium relationship between nominal interest rate and inflation.

The model in the present case is as follows;

$$i_t = r + \alpha\pi_t^* + \sum_{i=0}^s \gamma_i x_{t-i} + u_t \quad \dots \quad \dots \quad \dots \quad \dots \quad (6)$$

where x_t is the $k \times 1$ vector of explanatory variables and u_t is the unobservable disturbance term. This model is called Linear Rational Expectation (LRE) model without future expectations.⁷ The variables used in the information set are lags of inflation, money supply and interest rates. Furthermore, to test the sensitivity of the results to the specification of information set, two sets are formed, one with larger and the other with fewer lags terms. Estimates of equation are presented in Tables 7 and 8 respectively. The similarity in the estimates of Tables 7 and 8 indicate that the results are not sensitive to small changes in the specification of the information set.

Table 7
Instrumental Variable Estimation with Larger Information Set

Regressor	Coefficient	t-ratio
INPT	0.603	2.96
i_{t-1}	0.849	24.97
π_t	0.060	4.01
M_t	0.001	0.71
R^2	0.890	
D-W	2.130	

Notes: Dependent variable is i_t . Instrumental variables are π_{t-1} , π_{t-2} , M_{t-1} , M_{t-2} .

⁶Pesaran (1987).

⁷See *op. cit.*

Table 8

Instrumental Variable Estimation with Smaller Information Set

Regressor	Coefficient	t-ratio
INPT	0.522	2.55
i_{t-1}	0.860	24.77
π_t	0.061	3.84
M_t	0.002	0.785
R^2	0.880	
D-W	2.050	

Notes: Dependent variable is i_t . Instrumental variables are π_{t-1} , i_{t-1} , M_{t-1} .

Now investigate the relationship between rate of inflation and rate of interest, the Instrumental Variable (IV) method has been used for estimation for the following reason.

It is known that when one or more regressors are correlated with the disturbance term, the method of OLS is no more applicable due to consistency problems. For the errors-in-variables model, the model in which actual values of unobservable variables are used, both the methods of Maximum Likelihood and OLS fail, one in absolute terms and the other in its inconsistency. No estimation method is known to author that satisfactorily handles this problem. Thus, the following model has been used and Instrumental Variable technique of estimation has been applied.

$$i_t = r + \alpha_0 \pi_t^* + \alpha_1 i_{t-1} + \alpha_2 m_t + u_t \quad \dots \quad \dots \quad \dots \quad \dots \quad (7)$$

where m_t is an exogenous variable ($M1$) and π_t^* is the value of π_t expected at time $t-1$ to prevail at time t . Expectations are formed rationally, so

$$\pi_t^* = (z_t | \Omega_{t-1})$$

where, Ω_{t-1} denotes relevant information available as of time $t-1$. To test orthogonality, Wu-Hausman test has been carried out using IV estimation method in the following regression.

$$i_t = r + \alpha_0 \pi_t^* + \alpha_1 i_{t-1} + \alpha_2 M_t + \alpha_3 M_{t-1} + u_t \quad \dots \quad \dots \quad \dots \quad (8)$$

The instrumental variables used are π_{t-1}^* , π_{t-2}^* , M_{t-1} , M_{t-2} , i_{t-1} , i_{t-2} . First π_t^* and M_t were regressed on instrumental variable and the residuals obtained from these two regressions were then used as regressors in the above equation and OLS estimation was carried out. The F -statistic obtained from this regression is equal to Wu-Hausman statistic. (See Table 9.)

Table 9

Test for Exogeneity/Orthogonality

$$i_t = r + \alpha_0 \pi_t^* + \alpha_1 i_{t-1} + \alpha_2 M_{t-1} + \alpha_3 M_{t-2} + \alpha_4 R\pi_t + \alpha_5 RM_t + \varepsilon_t$$

Statistic		Value
Wu-Hausman Statistic	F(2,128)	0.989
Lagrange Multiplier	Chi-square(2)	2.053
Likelihood Ratio	Chi-square(2)	2.069

Notes: Regression has been estimated using variable addition test (OLS case). $R\pi_t$ and RM_t are residuals obtained by the regression of π_t and M_t on instrumental variables respectively.

Wald Test

The conventional FH, the Inverted FH and the partial FH have been tested using Wald test. The former two hypotheses have been strongly rejected and this provides sufficient evidence to accept the later hypothesis.

Error Correction Model

Cointegration between interest rate and inflation has been tested by estimating ECM using Instrumental Variable method. The estimation of ECM shows that the two variables are cointegrated as the ECT is found to be negative and significant (see Table 10). Moreover, stationary residuals from ECM also indicate cointegration between these variables. Since the cointegration technique could not be applied directly to Instrumental Variable estimation method, we made use of relationship between cointegration concept and error correction mechanism, and used error correction model to find out long-run relationship between nominal interest rate and inflation rate.

Table 11 presents a brief comparison of Adaptive and Rational Expectation Models that were used for expectation formation.

Table 10

IV Estimates for Error Correction Model

Regressor	Coefficient	t-ratio
INPT	-0.033	-0.414
First Difference Inflation Rate	0.021	0.334
Error Correction Term	-0.055	-3.487
R ²	0.094	
D-W	2.145	

Table 11

Comparison of Adaptive and Rational Expectation Models

Expectation Model	π_t^* Estimates	R ²	D-W
Adaptive Expectation Model	0.48	0.56	0.54
Rational Expectation Model	0.42	0.89	2.13

Notes: In case of rational expectation model, the estimates for π_t^* are computed by $\alpha_0/1-\alpha_1$ where α_0 is the coefficient of π_t^* and α_1 is the coefficient of lagged dependent term on right hand side. OLS and IV estimation methods are used for adaptive and rational expectation models respectively.

On the basis of above results, the following conclusions are drawn:

- (1) The long-run relationship between nominal interest rate and inflation has been confirmed both by adaptive expectation model and rational expectation model. The comparison of adaptive and rational expectations formation reveals that the model better fits for rational expectation on account of high coefficient of determination.
- (2) Conventional Fisher Hypothesis (the weak-form) and Inverted Fisher Hypothesis have been rejected in favour of accepting Partial Fisher Hypothesis.

IV. SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS*

This paper has been an attempt to test the validity of the Fisher Hypothesis (FH) in Pakistan by investigating the long-run relationship between interest rate and inflation rate applying cointegration analysis. The inflationary expectation has been modelled using adaptive and rational expectation approaches and the sensitivity of results to expectation formation has been compared. The results of the paper are summarised as follows along with policy recommendations.

- (1) The acceptance of partial Fisher Hypothesis (that the nominal interest rate rises by less than the rate of inflation and therefore the real rate of interest falls during inflation) suggests that interest rate does not fully cover inflation, which implies that bank deposits deteriorate over time. This fact will encourage depositors/investors to seek alternatives like foreign currency, equity markets, real estate or indexation of long-term contracts, etc. The lottery schemes by some of the commercial banks indicate an ad hoc measure to attract the attention of depositors in such a situation. They may be successful in the short-run but in the long-run it has serious drawbacks for the economy.

*These conclusions are based on the data up to 1991 but they are still valid for the periods thereafter marked by financial liberalisation and deregulation.

- (2) Monetary policy may not be effective in such a situation because inflation nullifies the impact of low interest rate by raising the prices and hence interest rate. This increase in interest rate crowds out new investment.
- (3) A low or negative real interest rate may affect households' saving behaviour; they would prefer present consumption to future consumption and therefore lowering the savings rate.
- (4) The acceptance of partial Fisher Hypothesis in case of rational expectation suggests that the rate of interest does not reflect all relevant information. Moreover, the rejection of Fisher neutrality hypothesis shows that real interest rate, which matters in an inflationary economy, does not exhibit random walk behaviour. These results show that the market (banking sector) is inefficient.
- (5) The optimistic aspect of the whole situation is that there would be more capital formation and hence economic growth due to falling real interest rate. But it is only possible when investors get sufficient funds in this situation which are not likely due to low savings.
- (6) The failure of interest rate to perform its role as a hedge against inflation and as a predictor of inflation necessitates innovation and financial engineering for better alternatives specially in the banking sector.
- (7) The dismal character of interest rates and existence of large number of defaulters, puts in doubt the integrity of credit and credibility of debtors. The growth of debt in this situation will aggravate economic and financial instability and further distort income distribution. It is proposed that a dynamic, healthy equity market which is essential for economic efficiency and growth, should replace debt-biased market. The tax structure should be designed in such a way that encourages equity rather than debt in the economy. More importantly, the credit-based traditional banking should be replaced by investment/trade-based banking in order to cater to emerging needs in the coming years.
- (8) For further research, rates on different types of financial instruments could be used to test the efficiency of their relevant markets.

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