

An Analysis of Efficiency of the Foreign Exchange Markets in South Asia

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INTRODUCTION

- A market in which prices always “fully reflect” all available information is called “efficient”. (Fama, 1965)
- Further, market efficiency is divided into three categories (Fama 1991):
 - weak-form efficiency
 - semi-strong-form efficiency
 - strong-form efficiency
- There are mainly three indicators of market efficiency which are tested using different econometric procedures:
 - whether the spot exchange rate follows a random walk
 - whether the exchange rate of a currency is an unbiased predictor of the future exchange rate
 - whether there exists a co-integrating relationship among different currencies

- The study contributes to the existing literature in several ways:
 - This study extends the work of Noman and Ahmed (2008) in which the efficiency of South Asian countries is tested by applying variance ratio tests and random walk; by applying Johansen Cointegration technique, Granger causality and variance decomposition.
 - By using the most recent data of three of the strongest currencies.

LITERATURE REVIEW

- Fama (1984) examined the efficiency of nine exchange rates against the US dollar. OLS estimation was applied on monthly data, the results of which rejected the market efficiency hypothesis.
- Wickremasinghe (2004) tested the weak and semi-strong form efficiency of the foreign exchange market of Sri Lanka. The results of his study provided evidence in favour of weak-form efficiency but against semi-strong-form efficiency.

- Ahmed *et. al* (2005) found that the South Asian foreign exchange markets are not efficient in weak form, for the period 1999-2004.
- On the other hand, the study of Noman and Ahmed (2008), testing the weak-form efficiency of seven SAARC countries using monthly data, supported weak-form efficiency.
- Oh *et. al.* (2007) found higher market efficiency for the European and North American forex markets as compared to the developing countries. They also found that the efficiency of markets with a small liquidity such as Asian forex markets improved significantly after the Asian currency crisis.

OBJECTIVE OF THE STUDY

- The main aim of this study is to test for weak-form efficiency and semi-strong form efficiency for the foreign exchange markets of four major South Asian countries; namely, Pakistan, India, Bangladesh and Sri Lanka.
- This is done by carrying out Unit Root Tests (ADF and PP), Johansen's Co-integration and Granger Causality Test. Further, Variance Decomposition Analysis is used to detect causality beyond the sample period.

CONCEPTUAL FRAMEWORK

- As a first step, the ADF and PP unit root tests were performed on the foreign exchange rates to test for weak form efficiency. The null hypothesis, for both, is rejected if calculated statistic is less than the critical value.
- In the second step, co-integration regression is employed using the foreign exchange rates having the same order of integration. If the results indicate a long run stable relationship between the exchange rates then causality between them is tested by the error correlation model. On the other hand, if the variables are not co-integrated then the standard Granger causality test is appropriate.
- Finally, Variance Decomposition Analysis was carried out to draw conclusions about causality beyond the period of study.

SAMPLE AND DATA

- The data used in this study was obtained from www.forex.pk
- The exchange rates for the following currencies were employed; against Pak rupee (PKR), Indian rupee (INR), Sri Lankan rupee (LKR) and Bangladeshi taka (BDT); for the period January 1996- December, 2009:
 - US Dollar (USD)
 - UK Pound (BP)
 - Japanese Yen (JPY)
- The return of foreign exchange series is obtained by taking log first difference.

Descriptive Statistics

	Mean	Variance	Skewness	Kurtosis
Pakistan				
USD	0.019242	0.00253613	1.189154	3.750921
BP	0.018949	0.005828	12.40308	160.7324
JPY	2.160937	0.29521	0.277254	2.538605
India				
USD	0.023666	0.000910229	1.174337	3.528634
BP	0.014295	0.000518018	1.050551	3.276983
JPY	2.657037	0.136675872	0.166584	2.834856
Bangladesh				
USD	0.018612	0.000910229	0.465769	1.960597
BP	0.011346	0.136675872	0.072961	1.859938
JPY	2.109985	0.000518018	0.153625	2.103403
Sri Lanka				
USD	0.012348	0.00114921	0.732427	2.041247
BP	0.007563	0.000596825	0.548683	2.089957
JPY	1.400895	0.166824867	0.478795	1.888474

EMPIRICAL RESULTS

ADF Test Results

Currency	Level, constant, no trend	Level, constant and trend	1 st Difference, constant, no trend	1 st Difference, constant and trend
PKR				
USD	-1.426 (1)	-2.107 (1)	-8.857 (0)*	-8.856 (0)*
BP	-2.534 (5)	-2.901 (5)	-8.281 (6)*	-8.258 (6)*
JPY	2.713 (5)	-1.651 (5)	-7.819 (4)*	-8.608 (4)*
INR				
USD	-1.365 (4)	-1.929 (5)	-8.857 (0)*	-8.856 (0)*
BP	-1.488 (8)	-2.92 (4)	-7.991 (11)*	-8.692 (13)*
JPY	2.033 (12)	-0.923 (10)	-9.533 (13)*	-10.248 (17)*
LKR				
USD	-1.240(2)	-1.217 (2)	-10.608 (1)*	-10.659 (1)*
BP	-1.316 (1)	-1.697 (1)	-10.165 (0)*	-10.175 (0)*
JPY	-0.236 (1)	-3.154 (1)	-10.679 (0)*	-10.716 (0)*
BDT				
USD	-1.168 (3)	-0.787 (2)	-9.245 (6)*	-9.297 (7)*
BP	-0.762 (9)	-2.618 (2)	-11.313 (10)*	-11.317 (10)*
JPY	-0.526 (0)	-2.066 (1)	-8.905 (3)*	-8.870 (3)*

PP Test Results

Currency	Level, constant, no trend	Level, constant and trend	1 st Difference, constant, no trend	1 st Difference, constant and trend
PKR				
USD	-2.483 (3)	-1.163 (2)	-8.696 (3)*	-9.095 (1)*
BP	-1.919 (6)	-2.236 (3)	-10.005 (7)*	-10.148 (8)*
JPY	-1.827 (3)	-2.097 (2)	-8.322 (6)*	-8.302 (6)*
INR				
USD	-2.588 (3)	-1.586 (3)	-5.197 (2)*	-5.5470 (3)*
BP	-1.789 (2)	-2.009 (2)	-9.306 (1)*	-9.384 (1)*
JPY	-0.915 (5)	-2.330 (10)	-7.540 (4)*	-7.507 (4)*
LKR				
USD	-1.092 (2)	-0.401 (2)	-9.918 (1)*	-9.974 (1)*
BP	0.773 (0)	-2.599 (0)	-9.773 (1)*	-9.739 (1)*
JPY	-0.711 (1)	-2.358 (1)	-8.906 (0)*	-8.871 (0)*
BDT				
USD	-1.487 (9)	-1.364 (7)	-10.720 (12)*	-10.710 (13)*
BP	-1.199 (5)	-1.681 (5)	-10.129 (3)*	-10.135 (3)*
JPY	-0.041 (4)	-2.960 (3)	-10.461 (6)*	-10.457 (7)*

Co-Integration Test Results

Null Hypothesis	Trace Statistics	5% Critical Value	1% Critical Value	Maximal Eigen Value Statistics	5% Critical Value	1% Critical Value
PKR						
$0=r^*$	29.39	34.91	41.07	19.71	22.00	26.81
$1=r$	17.69	19.96	24.60	12.18	15.67	20.20
$2=r$	8.51	9.42	12.97	6.5052	9.42	12.97
INR						
$0=r^*$	28.21	42.44	48.45	14.77	25.54	30.34
$1=r$	13.40	25.32	30.45	9.53	18.96	23.65
$2=r$	3.91	12.25	16.26	3.91	12.52	16.26
LKR						
$0=r^*$	27.8	42.44	48.45	18.32	25.54	30.34
$1=r$	9.53	25.32	30.45	6.89	18.96	23.65
$2=r$	2.69	12.25	16.26	2.69	12.52	16.26
BDT						
$0=r^*$	26.3208	42.44	48.45	17.4578	25.54	30.34
$1=r$	8.8630	25.32	30.45	5.7898	18.96	23.65
$2=r$	3.0733	12.25	16.26	3.0733	12.52	16.26

Granger Causality Test Results

Null Hypothesis	F-Statistic	Probability
PKR		
BP does not Granger Cause USD	0.91476	0.40254
USD does not Granger Cause BP	0.42059	0.65733
JPY does not Granger Cause USD	0.72831	0.48418
USD does not Granger Cause JPY	3.25131	0.04110*
JPY does not Granger Cause BP	1.16745	0.31360
BP does not Granger Cause JPY	1.07460	0.34370
INR		
BP does not Granger Cause USD	0.76697	0.46659
USD does not Granger Cause BP	0.48955	0.61407
JPY does not Granger Cause USD	3.65273	0.02873*
USD does not Granger Cause JPY	2.00412	0.13909
JPY does not Granger Cause BP	0.62356	0.53769
BP does not Granger Cause JPY	1.11999	0.32953

Granger Causality Test Results contd...

Null Hypothesis	F-Statistic	Probability
LKR		
BP does not Granger Cause USD	0.86576	0.46092
USD does not Granger Cause BP	1.34492	0.26302
JPY does not Granger Cause USD	0.49176	0.68865
USD does not Granger Cause JPY	2.98794	0.03379*
JPY does not Granger Cause BP	0.91112	0.43782
BP does not Granger Cause JPY	2.19088	0.09256*
BDT		
BP does not Granger Cause USD	0.96650	0.38246
USD does not Granger Cause BP	1.10624	0.33313
JPY does not Granger Cause USD	0.21426	0.80735
USD does not Granger Cause JPY	4.53996	0.01198*
JPY does not Granger Cause BP	0.01764	0.98252
BP does not Granger Cause JPY	2.30015	0.10330

Variance Decomposition Analysis for PKR

Months	Relative variance in	Percentage of forecast variance explained by innovations in		
		Δ USD	Δ BP	Δ JPY
12	Δ USD	99.06019	0.819439	0.120367
24		97.76779	1.028143	1.204069
36		95.50652	1.148021	3.345464
48		92.60493	1.234707	6.160363
60		89.39449	1.301063	9.304446
12	Δ BP	3.501577	95.36322	1.135203
24		5.735830	91.84725	2.416917
36		7.708470	88.46301	3.828515
48		5.519468	85.14846	5.332072
60		11.22712	81.87451	6.898371
12	Δ JPY	26.36398	1.370513	85.15049
24		31.20779	1.501492	67.29072
36		34.67093	1.558542	63.77052
48		37.31497	1.592506	61.09252
60		39.37096	1.615214	59.01383

Variance Decomposition Analysis for INR

Months	Relative variance in	Percentage of forecast variance explained by innovations in		
		Δ USD	Δ BP	Δ JPY
	Δ USD			
12		97.30068	1.555201	1.144123
24		97.41755	1.629060	0.953386
36		97.16355	1.532738	1.303715
48		96.95681	1.450308	1.592886
60		96.85075	1.410564	1.738689
	Δ BP			
12		14.52139	74.97713	10.50148
24		18.05578	66.19021	15.75401
36		21.35376	61.22681	17.41942
48		23.55848	58.87527	17.56625
60		24.81028	57.80173	17.38799
	Δ JPY			
12		32.08884	1.126395	66.78477
24		36.38854	2.478862	61.13260
36		38.85135	3.464217	57.68444
48		40.24932	3.882079	55.86860
60		41.02467	4.005670	54.96966

Variance Decomposition Analysis for LKR

Months	Relative variance in	Percentage of forecast variance explained by innovations in		
		Δ USD	Δ BP	Δ JPY
12	Δ USD	95.30986	4.678611	0.011531
24		93.13836	6.760766	0.100876
36		91.60953	8.112748	0.277727
48		90.52380	9.004327	0.471869
60		89.75218	9.603439	0.644378
12	Δ BP	25.67404	68.42386	5.902100
24		42.44230	48.19097	9.366733
36		52.77402	38.04256	9.183420
48		58.70448	33.14505	8.150470
60		62.17193	30.53926	7.288807
12	Δ JPY	10.15087	1.284301	88.56483
24		24.92765	2.407549	72.66480
36		37.11204	3.678987	59.20897
48		45.28501	4.806763	49.90822
60		50.62845	5.713575	43.65798

Variance Decomposition Analysis for BDT

Months	Relative variance in	Percentage of forecast variance explained by innovations in		
		Δ USD	Δ BP	Δ JPY
12	Δ USD	99.62545	0.336770	0.037779
24		97.76048	1.732498	0.507021
36		95.11218	3.445246	1.442579
48		92.73170	4.750977	2.517324
60		90.86291	5.635985	3.501101
12	Δ BP	25.27310	69.64774	5.079161
24		30.57907	58.68376	10.73717
36		34.24349	51.85625	13.90046
48		36.97771	47.68812	15.33417
60		39.07156	45.03280	15.89564
12	Δ JPY	13.89017	0.959370	85.15049
24		23.76907	2.954718	73.27621
36		32.53735	5.070315	62.39234
48		38.75547	6.469819	54.77471
60		42.92073	7.259851	49.81942

CONCLUSION

- The results of both the Augmented Dickey Fuller and the Phillips Peron test for the four currencies, imply that the foreign exchange markets of Pakistan, India, Sri Lanka and Bangladesh support the weak form of Efficient Market Hypothesis.
- This led us to check for co-integration. The result of Johansen's multivariate co-integration showed no evidence of a co-integrating relationship amongst the three exchange rates for all four currencies, indicating that the foreign exchange markets of Pakistan, India, Sri Lanka and Bangladesh are all efficient of the semi-strong form.

CONCLUSION contd...

- Then, to test for the long-run association between the exchange rates Granger Causality test was applied. The results showed the existence of causal relationships for all four currencies, providing evidence against semi-strong form of the Efficient Market Hypothesis.
- The results of the Variance Decomposition analysis for all four currencies indicate that the forecast variance of one exchange rate is explained by others; revealing causal relationships between currencies. These results do not support the semi-strong form of the Efficient Market Hypothesis for the countries under consideration; namely, Pakistan, India, Sri Lanka and Bangladesh.

Policy Implications

- The participants of the foreign exchange market can not benefit by devising trading rules or strategies to make huge amounts of profits from transactions in the foreign exchange market.
- This knowledge can also be useful when trading between countries. For example, If USD does not granger cause BP and JPY, then Pakistan should extend trade with Britain and Japan since that would not be affected by the risks associated with USD.

Future Research Extensions

- Add the remaining three South Asian countries.
- Exchange rates for other currencies can be employed.
- Test the effect of exchange rate efficiency on trade.
- Test the correlation between the currencies of the countries included in the study.

THANK YOU