Tunisian and Indian Forex Markets: A Comparision on Forward Rate Unbiased Hypothesis

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Forward Rate Unbiased Hypothesis (FRUH) has been the subject of intensive scrutiny by researchers. Majority of the work has focused on the forward and the spot rate of the currency of a single country. Cross country FRUH comparison has been rare. This paper is an attempt to fill the lacuna by comparing the FRUH in the Indian and the Tunisian Forex Market. The dataset used in this study consists of 238 weekly observations of the Tunisian and Indian spot and forward exchange rates for the four-year period starting 01 April 2004 to 16 October 2008. Analysis shows that the FRUH does not hold in both the markets. However, FRUH seems to be more severe in the Indian markets than in the Tunisian markets. Furthermore, the slope coefficient's in the Indian case were negative as opposed to the Tunisian case suggesting that India is a more developed economy as compared to Tunisia. Based on our evidences, we highlight some reasons as to why the FRUH fails and suggest areas for further research.

Key words: *India, Tunsia, Foreign Exchange, Econometrics*
JEL Classification : *C01, C58, E44, F31, G15*

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1. Introduction

In the field of financial economics, the "Forward Rate Unbiased Hypothesis" (FRUH) has been the subject of intensive scrutiny by researchers. FRUH is based on the assumption that in the exchange rate market, individuals or business arrange in advance to buy or sell the foreign exchange at a pre-determined rate for making future international payments (Polito, 2001). This pre-determined rate of the future is assumed to reflect the collective wisdom of the market regarding the spot rate that would be prevailing in the future. Thus, a future exchange rate prevalent today can be looked upon as the spot rate of the future date. Under the assumption that the forex market is efficient or rational, the spot rate prevailing at the future date should match with the future rate for that date prevailing in the market today.

However, empirical evidences suggest that there are major differences between the spot rates and the forward rates and the findings have not been able to yield any concrete evidence that the forward exchange rate is an unbiased predictor of the future spot exchange rate.

In financial literature, majority of the work has focused on the forward rate and the spot rate of the currency of a single country. Cross country FRUH comparison has been rare. This paper is an attempt to fill the lacuna by comparing the FRUH in the Indian and the Tunisian Forex Market and to provide economic explanations for the divergences in findings.

2. Literature Review

There exists an enormous literature available on whether the forward exchange rate is an unbiased predictor of the future spot exchange rate. For the sake of brevity, we very briefly summarise the discussions as available in economic literature[1].

[1] For a detailed discussion see: Granger & Newbold 1974; Cornell, 1977; Frenkel, 1980; Bilson, 1981; Meese & Singleton, 1982; Fama, 1984; Engle & Granger, 1987; Meese, 1989;

The earliest studies regressed the future spot exchange rate (S_{t+k}) on the current forward exchange rate (F_t) giving rise to the traditional "Level Specification". It was believed that if the foreign exchange markets were truly efficient then the joint hypothesis of $\alpha = 0$ and $\beta = 1$ would hold simultaneously, provided that the error term was zero mean stationary (Cornell, 1977, Frenkel, 1980, Fama, 1984). However, the model was found to be weak as both the forward and the spot rates were shown to be non-stationary *I*(1) series which lead to the problem of unit root and spurious regression (Granger and Newbold 1974). To resolve the problem, the current spot rate (S_t) was subtracted from both sides of to arrive at the "Forward Specification". It was believed that forward specification results would be consistent and would yield $\alpha = 0$ and $\beta = 1$ that the future markets are efficient (Meese & Singleton, 1982, Meese, 1989, Isard, 1995). However, empirical tests have overwhelmingly output a coefficient that is significantly less than unity and frequently negative. This has been termed as the "Forward Premium Puzzle" in the economic literature (Bilson, 1981, Frenkel & Froot, 1989).

Subsequent theoretical developments showed that even if the variables have unit roots, regression would not lead to inconsistent parameter estimation provided the variables are cointegrated (Engle & Granger, 1987, Hamilton, 1994, Hai, Mark, and Wu 1997). These developments lead to a renewed interest in "level specification" as it was no longer necessary to focus only on "Forward Specification" to evaluate market efficiency (Chakraborty & Haynes, 2005).

Work in the area has taken many different form. Zellner (1962) used SUR to test the FRUH. He argued that since most of the exchange rates are measured in terms of the US Dollar, the disturbances in the foreign exchange markets would be correlated and hence the estimates from SUR would be more efficient. Since then, many a researchers

Frenkel & Froot, 1989; Hamilton, 1994; Isard, 1995; Hai, Mark, & Wu ,1997; Chakraborty & Haynes, 2005.

have found significant changes in empirical results when correlations across countries are controlled for in the model (Bilson, 1981, Bailey, Baillie, & McMohan, 1984, Cornell, 1989, Barnhart & Szakmary, 1991, Evans & Lewis, 1995).

A large number of explanation have been put forward to explain why the regression coefficient — in both level and forward form — deviates from unity. Explanations range from existance of time varying risk premium (Fama 1984), systematic forecast errors (Frenkel and Froot 1989), measurement errors (Cornell 1989), presence of transitory risk premium (Hai et al. 1997), small sample size (Baillie and Bollerslev 2000a) and non rationality of agents (Chakraborty and Haynes 2005).

Work has been undertaken on country specific basis by many authors to approve or disprove the FRUH in their countries. Studies in the Indian foreign exchange markets concluded that the FRUH does not hold in the Indian foreign exchange markets (Viz, 2002, Kumar & Mukherjee, 2007). Wesso (1999) analyzed the South African foreign markets and also rejected the FRUH. On the other hand, Bonga-Bonga (2009) concluded that FRUH holds in the South African Markets. O'Collaghan (2007) studied FRUH in ten post-crisis Asian and Australian countries and found that FRUH is rejected for all countries except for Thailand.

Thus, as can be seen, comprehensive work has been done on FRUH, both at the various levels - international and country specific. However, no work of significance has been undertaken to understand the FRUH in a comparative mode. We hope to address this lacunae in the paper by comparing the behavior of foreign exchange markets in Tunisia and India.

3. Comparison of the two Economies

Situated on the northernmost tip of the African continent, Tunisia is an export-oriented country, in the process of liberalizing its economy. It has close relations with the European Union, specially France, and with the Arab world. Tunisia has a diverse economy, with agriculture, mining, manufacturing, petroleum and tourism being the mainstay. The GDP in 2009, was $ 49 Billion or $ 83 Billion (PPP). It has the highest per capita GDP amongst the African and the Middle-East countries.

The European Union is the largest trading partner of Tunisia accounting for 73% of Tunisian Imports and 75% of Tunisian Exports. This huge reliance on European Union has significant impact on Tunisian foreign exchange policy. Since 2000, the Central Bank of Tunisia has systematically depriciated the Tunisian Dinar by 22% and reduced the interventions of the Central Bank. The total convertibility of the Tunisian Dinar is among the most important preoccupations of the policy makers of the country.

Located in South Asia, India is the seventh largest country in terms of geographical area and the second largest in terms of population. Since independence in 1947 till 1980's, India followed socialist inspired economic policies characterised by extensive regulation, protectionism, public ownership and bureaucratic hurdles. In 1991 India faced acute BOP crisis. Since then, India has liberalized it's economy and has moved towards a free market economy.

In 2009 India's GDP stood at $ 1.24 trillion or $ 3.56 trillion (PPP). India is heavily dependent on agricultural which accounts for 28% of the GDP. India's largest trading partners are the United States of America ($41 billion) and China ($38 billion). UAE, Saudi Arabia, Germany, Singapore, Hongkong, UK, Belgium, and Netherlands are other large trading partners of India. Petroleum, oils and lubricants are major import items which account for approximately 30% of all imports. In terms of exports Petroleum products, Engineering Goods,

Chemicals, Gems and Jewellery, Garments and Business Services (specially Information Technology) account for the bulk of Indian Exports earnings.

In 1992, India adopted "Liberalised Exchange Rate Management Systems"(LERMS) in which partial convertibility of the Rupee was introduced. Under this system, a dual exchange rate mechanism was adopted by which 40% of the foreign exchange was to be surrendered at the official rate and the balance could be converted at the market rate. In 1993, 100% conversion at market rate was allowed on trade accounts. Convertibility on current account was announced in 1994, however some restrictions were imposed. This systeme of "managed float" has continued to the present day (Misra & Puri, 2009).

The relationship between India and Tunisia have been cordial since 1963 (Ministry of External Affairs, 2010). Tunisia is a major source of Diammonium Phosphate (DAP) and Phosphorc Acid for India. Indian exports to Tunisia mainly consist of a wide range of finished products – significant among them being marine products, tea, pulses, raw tobacco, finished leather, fine chemicals, polyethylene, machinery, articles of iron and steel, electronic goods, yarn and human hair.

The Indian presence in the Tunisian market is negligible. Total Indian trade in 2007-08 was to the amount $ 414 billion, whereas the total trade with Tunisia in 2007-08 was of $ 795.41 million amounting to about 0.20% of Indian Trade basket. Trade between the two countries, though insignificant, is heavily in Tunisia's favour: Tunisia enjoys large trade surplus with India (Ministry of External Affairs, 2010).

Comparing the two economies, we find that both are developing economies and are gaining political and economic clout in their respective spheres. Both the countries have a well developed money and foreign markets, and a well regulated banking system. Both the markets have seen investor confidence. The World Economic Forum's Global Competitiveness Report 2010-11 has ranked Tunisia

32nd and India 51st amongst 139 countries of the world (World Economic Forum, 2010).

The Tunisian Dinar and the Indian Rupee are not fully floating, but are managed floats, where the central bank of both the countries keep an eye on the exchange rate and if necessary, intervene to maintain the exchange rate. India is classified as a country relying on "a managed floating with no pre-determined path for the exchange rate"; while Tunisia is classified as a country having "other conventional fixed peg arrangement" as per the monitory policy framework.

4. Analysis of Data

The dataset used in this study consists of 238 weekly observations of the TND-USD spot and one-month forward exchange rates and the INR-USD Spot and one-month forward exchange rates for the period starting 01 April 2004 to 16 October 2008 obtained from DataStream ™. The decision to restrict the data from 2004 was taken because prior to 2004 the Tunisian forward exchange market was in a rudimentary form and trading in financial derivative started from 2004. Analysis of data was done using the "Gnu Regression, Econometrics and Time-series" (gretl) software package (Cottrell & Lucchetti, 2010).

Given the fact that trade between the two countires is negligible in nature we expected the correlations between the spot and forward rates to be close to zero. However, the correlation figures show moderate correlation between the spot rates ($r = +0.4938$) and between the one-month forward rates ($r = +0.4985$) of the two countries. The only explanation for such a correlation would be that USD is a common currency of international trade is and the disturbances in USD impact the both currencies to some extent; thereby upholding the premises of Zellner (1962).

An inspection of the ACF and the PACF, using 52 lags, reaveled the presence of strong autocorrelation in both the currencies leading us to

test for unit root and cointegration. To test for unit root, we used the ADF and the KPSS tests (Dickey & Fuller, 1979, 1981, Kwiatkowski et al., 1992). To select a correct lag truncation order for these tests, we relied on the in-built functionality of gretl – which allows a user to test down for a maximum lag order. Both the test were conducted on "constant" only as the data did not suggest the presence of strong deterministic trend in the series. The results of the tests are presented in Table 1.

Table 1

Results of Unit Root Test

Currency	**Type**	**Lag-Order**	**ADF**	**ADF p-value**	**KPSS**	**KPSS p-value**
Indian Rupees	Spot	4	−1.3171	0.6239	1.8561	0.463 at 5% l.o.s.
Indian Rupees	Forward	4	−1.2358	0.6612	1.8113	
Tunisian Dinar	Spot	3	−1.5507	0.5079	1.6129	
Tunisian Dinar	Forward	3	−1.5708	0.4976	1.6617	

The p-values for ADF test show that the null hypothesis of unit root process is not rejected for the spot and forward rates for both the currencies. The critical value of KPSS test at 5% and 1% level of significance are 0.463 and 0.739 respectively which are much lower that the corrosponding test statistic values; leading to the rejection of the null hypothesis of stationarity and leading to the conclusion that the series are unit root processess.

In the presence of unit root, the level regression would only be consistent and unbiased if there exists cointegrating relationship between the spot rate and the forward rates. To test the cointegrating relationship we use the Johansen Trace and the λ-max test (Johansen, 1991, 1994, Johansen & Juselius, 1990). All the tests were performed under the assumption that the level data have linear trends but the

cointegrating equations have only intercepts – or Case III of Johansen (1995). The results are presented in Table 2.

Table 2

Tests for Cointegration

Tunisia	**Eigenvalue**	**Trace Test**	**p-value**	**L-max Test**	**p-value**
None *	0.0573	16.7815	0.0318	13.7440	0.0603
At most 1	0.0130	3.0375	0.0814	3.0375	0.0814

India	**Eigenvalue**	**Trace Test**	**p-value**	**L-max Test**	**p-value**
None *	0.0726	18.9578	0.0144	17.5492	0.0146
At most 1	0.0060	1.4086	0.2353	1.4086	0.2353

In the table, the p-values are at 5% level of significance. We see that in the case of Tunisia, the trace test indicates 1 cointegration equation, where as the λ-max test no cointegrating relation at the said level of significance. The level of significance is only about 6% in this case. For practical purpose, we have assumed that the Tunisian forex markets are cointegrated. In the Indian case, both the test indicate 1 cointegrating equation at 5% level of significance. Hence we can say that that the forex markets for both the countries are cointegrated.

To run the level and forward specifications, we took the natural logs of the data and suitably lagged the weekly spot rates and computed the forward premiums for both sets of currencies. The results of the level specification are presented in Table 3.

Table 3

Level Specification of the Exchange Rates

Tunisian Dinar	Coefficient	S.E.	p-value		R-Squared	DW
Constant	0.0138	0.0063	0.0297	**	0.8545	0.4851
Forward Rate	0.9395	0.0255	0.0000	***	0.8539#	

Indian Rupees	Coefficient	S.E.	p-value		R-Squared	DW
Constant	0.1667	0.0943	0.0784	*	0.8632	0.2293
Forward Rate	0.9557	0.0250	0.0000	***	0.8626#	

#: adjusted r-squared values

Comparing the output, we find some interesting results. The constant term for the Tunisian Dinar is much smaller than the Indian counterpart. The constant term in the Indian case is significant at 10% level, whereas it is significant at 5% level in the Tunisian case. On the other hand, the slope coefficient in the Indian as well as the Tunisian case is significant at 1% level. Wald's test of coefficient restriction with constant = 0 and slope = 1 yeilds the value of statistic as 3.2155 (p-value = 0.0419) in the case of Tunisian Markets and a statistic of 1.6777 (p-value = 0.1891) in the case of Indian Markets.

However, the low value of the DW test statistic and the high degree of fit leads to doubts about the efficiency of the regression equation in their level form. As such we present the results of forward regression in Table 4.

Table 4

Forward Specification of the Exchange Rates

Tunisian Dinar	**Coefficient**	**S.E.**	**p-value**		**R-Squared**	**DW**
Constant	−0.0022	0.0015	0.1556		0.0220	.5057
Forward Rate	2.0129	0.8820	0.0234	**	0.0177#	

Indian Rupees	**Coefficient**	**S.E.**	**p-value**		**R-Squared**	**DW**
Constant	0.0047	0.0019	0.0146	**	0.0218	0.2548
Forward Rate	−1.71243	0.7529	0.0239	**	0.0176#	

#: adjusted r-squared values

The results of the forward regression highlight some interesting aspects. The constant term in both the cases is close to zero; but the slope coefficients are markedly different. In the Tunisian context, the slope coefficient is positive; but in the Indian case, the slope coefficient is negative. Another interesting feature is that in the Indian context, the constant and the slope coefficients are both significant at 5% level, whereas in the Tunisian case only the slope coefficient is significant. Wald's test of coefficient restriction with constant = 0 and slope = 1 yeilds the value of statistic as 1.0404 (p-value = 0.3549) in the case of Tunisian Market and a value of 6.5966 (p-value = 0.0016) in the case of Indian Market.

In order to better understand the nature of the relationships between the spot and forward rate of the two countries and to take the advantages of the fairly high correlation between the currencies we estimate the forward specification on the basis of the SUR. The results are presented in Table 5.

Table 5

SUR Regression of Exchange Rates

Tunisian Dinar	**Coefficient**	**S.E.**	**p-value**		**R-Squared**
Constant	−0.0011	0.0015	0.4391		0.0174
Forward Rate	1.1520	0.8264	0.1647		0.0137#

Indian Rupees	**Coefficient**	**S.E.**	**p-value**		**R-Squared**
Constant	0.0062	0.0018	0.0006	***	0.0426
Forward Rate	−1.5828	0.4260	0.0003	***	0.0384#

#: adjusted r-squared values

The results of this regression gives proof in favor of the efficient gains obtained due to the SUR procedure. In both Tunisia and India, the constant term is closer to zero than it was under the OLS method and the slope coefficients are neatly smaller and converging progressively to the unity without reaching it. The slope coefficient remains positive and negative respectively in the Tunisian and Indian cases. However, neither the constant nor the slope coefficient are significant in the Tunisian context, whereas in the Indian case, both are significant at 1% level of significance. The joint hypothesis that constant = 0 and slope = 1 is rejected since the Wald P-value is equal to 0.0000 revealing that there is no empirical evidence in favor of Forward Rate Unbiasedness hypothesis.

These findings allow us to conclude that the forward premium bias is present both in India and Tunisia, but it is more prominent in the Indian foreign exchange markets than in the Tunisian foreign exchange markets. The forward rate appears hence a less unbiased predictor of the future spot rate in Tunisia than in India. The results, as such, corroborate the OLS's results analyzed previously.

5. Discussion

In this study, we have compared the Tunisian and the Indian forex markets in terms of the FRUH. To summarize the results — In the case of level specification we found that forward rate bias is present in both the Indian and the Tunisian foreign exchange market; with the Indian case being more severe of the two because of the higher significance of the constant term. In the case of forward specification we find that forward premium bias is present and is again more severe in the case of Indian foreign exchange markets. In case of SUR we find that the Forward Premium bias in the Indian markets is significantly more than that of the Tunisian market. The moot question is that why is the forward question more severe in the Indian markets than in the Tunisian markets?

Table 6

Ranking of India and Tunisia (2010 Select Parameters)

Parameter	Rank of India	Rank of Tunisia
GDP (PPP)	5th	70th
GDP (Real Growth Rate)	10th	109th
Exports	23rd	74th
Imports	13th	72nd
Stock of FDI (Home)	23rd	60th
Stock of FDI (Abroad)	26th	79th
Logistics Performance Index	47th	61th
Competetive Performance Index	54th	49th
Industrial Production Growth Rate	21st	138th

Source: (1) Industrial Development Report 2009 (UNIDO, 2010)
(2) CIA World Factbook (www.cia.gov)

Work by Frenkel and Poonawala (2010) have illustrated that emerging countries tend to have positive slope coefficients; whereas Industrialized countries have a negative slope coefficient. So do we conclude that Tunisia is less industrialized than India? We present some key indicators in tabular form in Table 6

On almost all the parameters, we see that India outranks Tunisia – except for the competetive performance index(CPI) – indicating that India may have a larger pie of the world trade markets as compared to Tunisia. Logistics performance index (LPI) is a measure of a country's export import infrastructure and it's logistics handling capabilities which in turn indicitaes the country's ability to interact with the world markets. This would indicate that Indian markets are more integrated with the world markets than Tunisia. Furthermore, total trade of Tunisia accounted for $ 33.50 Billions whereas total trade for India accounted for $ 432.70 Billions (CIA, 2010a, 2010b, 2010c). In other words, Indian Foreign Exchange Markets were 13 times more exposed to the International Fluctuations than the Tunisian Markets.

This leads to an interesting question – does the relative size of the economy matters in deciding the FRUH or does the integration of the country with the world markets play a role in deciding FRUH? We conjecture that size of the economy and the exposure to multiple currency trade may play a part in determining FRUH. This is an area which we propose to answer in the near future.

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