Non Deliverable Forward and Onshore Indian Rupee Market


This working paper examines the inter-linkages of onshore segments of India’s foreign exchange market with Non-Deliverable Forwards (NDF) market for Indian rupee (INR) for a sample period of June 6, 2006 to April 3, 2013.

Non-Deliverable Forwards (NDF) are foreign exchange forward contracts traded in the over-the-counter market at offshore destinations and do not need physical delivery of currencies at the time of maturity. NDF contract is typically cash settled in international currency on a specified future date and are outside the regulatory purview of the local authorities. An NDF market generally grows when the onshore forward market is either under-developed or its access for market participants is restricted. NDF markets allow market agents, facing regulatory restrictions in the onshore market, to hedge their exposures and speculators to take a position on future movements in domestic currency. Another reason for growing NDF currency markets could be that carry trades for currencies with NDF contracts perform better compared to carry trades for currencies with deliverable forward contracts. The major participants in NDF market could include foreign investors, hedgers, commercial and investment banks, currency speculators and other participants with access to both onshore and offshore forward markets.

Experience shows that NDF market is generally more active when movements in exchange rate are uncertain and market players expect significant adjustment in the local currency exchange rate regime. Theoretically, standard onshore forward exchange contracts are priced based on interest rate parity calculations (interest rate differential and current spot exchange rate) while many other factors such as volume of trade flows, liquidity conditions, and counterparty risk can also determine the pricing. Besides these factors, NDF prices can also be affected by the likely changes in foreign exchange regime, speculative positioning, conditions in local onshore interest rate markets and dynamic inter-linkages between offshore and onshore currency forward markets (Lipscomb, 2005).

There are two major offshore markets for Indian rupee, viz., Singapore and London. Authors attempted an exercise to examine inter-linkages between NDF and onshore markets which may vary depending upon the market conditions. Probably, during the period of rupee depreciation, the dynamics of inter-linkages between these markets might be different from appreciating phase. Thus, for empirical purpose, authors analyzed 4 sub-periods capturing different phases (appreciation and depreciation) in the foreign exchange market. Period 1: June 6, 2006 to January 2008. Period 2: January 2008 to March 2009. Period 3: March 2009 to August 2011. Period 4: August 2011 to April 3, 2013.

They used Augmented Dickey Fuller (ADF) tests to verify the presence of unit root in series on INR spot, INR forward and IND NDF rate. In addition, Johansen cointegration test is performed to check the long-run relationship between onshore and NDF rates. Various lag length criteria based on vector autoregression (VAR) model are used for selecting the lag length for Johansen test. After confirming long-term relationship, author used vector error correction (VEC) model for finding causal relation between onshore and offshore NDF
rates. The VEC has cointegration relations built into the specification under which long-run components of the variables follow equilibrium constraints, while the short-run components have a flexible dynamic specification. Further, ARCH/GARCH models are extensively used for modelling and forecasting volatility in financial data series.

ADF test revealed that all the INR exchange rate series viz., spot, 1-month forward and NDF market are non-stationary and are integrated of order 1. The co-integration test confirmed presence of long term relationship between onshore and offshore INR markets. However, the adjustment behaviour of both onshore and NDF exchange rate of INR towards long-term equilibrium varies across sub-periods. The bidirectional relationship was found between spot/forward rate and NDF rate of INR during the period of rupee appreciation. In contrast, during the period of rupee depreciation, only onshore segments adjust to previous day's movements in NDF segment. This implies that information flow from offshore NDF market to onshore foreign exchange market becomes more important for movements in both spot and forward segments.

To get an idea on the nature of spillovers across both markets, the authors performed ARCH/GARCH analysis and found that currency series are skewed and leptokurtic with respect to the normal distribution. The JacqueBera normality test rejects the null hypothesis of a normal distribution while the LjungBox Q (10 lags) statistics for serial correlation of the spot, forward and NDF rate changes are statistically significant implying the presence of serial correlation. This further suggests the presence of autoregressive conditional heteroskedasticity, i.e., volatility clustering. GARCH models also suggest bidirectional spillovers, either through mean or volatility or both, between onshore and offshore markets during rupee appreciation. However, when rupee came under downward pressure, there is an evidence of unidirectional volatility spill-over from NDF to onshore market, while the same from spot to NDF is not found to be statistically significant.

The findings of this paper suggest that there exists a long term relationship between spot/forward and NDF markets for INR, it can be inferred that these markets co-move in the long-run. However, there is considerable difference in terms of direction of relationship within the full sample period. During the period of rupee depreciation, only spot and forward markets seem to be responding to deviation from long-term equilibrium while in the period of rupee appreciation, both onshore as well as offshore markets show adjustment towards long-term equilibrium. Thus, with increasing depth of NDF market, rupee is likely to become more prone to shocks emanating from overseas markets as results indicate.

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