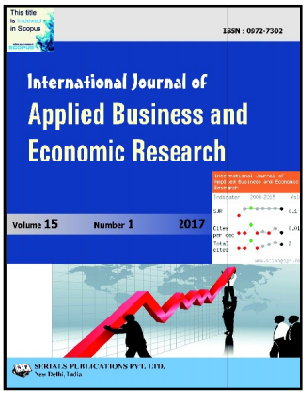

International Journal of Applied Business and Economic Research

ISSN : 0972-7302

available at http: www.serialsjournal.com

Volume 15 • Number 1 • 2017

Understanding Non-Deliverable Forward (NDF) Markets and NDF Volatility Spillover to On-shore Indian Rupee Markets

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Abstract: The Indian rupee (INR) depreciated approximately 20% in 2013, touching its historic low of 69.225 on 28th August 2013. A very significant report by RBI in December 2013 stating that Non Deliverable Forward (NDF) markets put excessive pressure on the onshore rupee raised an alarm and highlighted the need to look closely at NDF markets. By understanding why NDF markets exist, how they work and how they impact onshore Indian rupee rates, this paper explores the reasons for the growing NDF markets and the need to monitor cross-border volatility transmission from unregulated and non-transparent NDF markets to onshore markets. Development of transparent and robust onshore markets, combined with continued liberalization of non-resident participation in onshore markets and several measures to bring offshore markets onshore could reduce the importance of NDF markets over time and help manage undue volatility spillover from NDF to onshore rupee rates.

Key words: Non deliverable forwards, NDF, Offshore rupee, Dollar rupee market, Indian Rupee inter linkage, Indian Rupee depreciation, Indian Rupee volatility.

The INR depreciated approximately 20% in 2013, touching its historic low of 69.225 on 28th August 2013, the worst since the balance of payment crisis in 1991. The Indian rupee was not the only currency that depreciated sharply. Between May to September 2013, the exchange rates for Australian dollar, Indonesian rupiah, Turkish lira, South African rand, Brazilian real, Chilean peso and Mexican peso depreciated between 10-20%. Among other global factors like fears of U.S. financial tapering which led to the INR depreciation, a very significant report by RBI's Dept. of Economic & Policy Research in December 2013 stated that the Non Deliverable Forward (NDF) market put excessive pressure on the onshore rupee during the period. (Goyal, Jain, & Tewari, 2013).

This paper has been divided into five sections to address each of the following objectives:

1. Explain why NDF markets exist and work.

2. Understand why NDF markets are growing.
3. Understand the linkage between on-shore deliverable and off-shore NDF market.
4. Analyze the relevance and purpose of monitoring NDF markets.
5. Make few policy recommendation to contain undue volatility transmission between onshore and NDF markets.

NDF MARKETS

NDFs are off-shore, over-the-counter (OTC), foreign exchange derivatives which are only settled in cash (and not by delivery) in a foreign currency.

NDF contract are purely OTC contracts specifying a notional amount for a currency with convertibility restriction like the Chinese Yuan, Korean Won, Indian Rupee, Brazilian Real, Mexican Peso, Philippine Peso etc. against a convertible currency, typically the US dollar at a forward rate (called NDF rate) for a specific settlement date (maturity). There is no physical delivery of the non-convertible currency on maturity of the forward contract. Since the non-convertible currency is not delivered, the difference between the spot rate and forward rate is settled in cash in the convertible currency, typically the USD. The spot rate at which the settlement would be done varies by currency and jurisdiction. It could be the daily published central bank rate of the restricted-convertible currency or a reference benchmark rate consisting of an average rate derived from several banks and foreign exchange dealers.

NDF market originated in the early 1990's basically to facilitate foreign participants to hedge risk to emerging market currencies which had foreign exchange convertibility restrictions. Initially, the bulk of the demand was for Latin-American currencies like the Brazilian Real (BRL) and Mexico Peso (MXN) but the rapid globalization of Asian economies with capital controls has led to a multi-fold increase in NDF trade of Asian currencies, particularly the Chinese Yuan (CNY), S. Korean won (KRW) and the Indian rupee (INR).

NDF markets for emerging market currencies is growing as a result of their substantial cross-border investment and trade flows, currency convertibility restrictions and capital controls. In the last decade and half, NDF markets for currencies like the Brazilian Real, Chilean Peso, Chinese Yuan, Indian Rupee, Korean Won and the Taiwan Dollar have grown the most. London remains the overall largest market for NDF trading whereas New York dominates Latin American currency NDF's. Asian currency NDF's are most active in Singapore and Hong Kong. The Indian Rupee NDF market is very active in Singapore, London, Hong Kong and Dubai.

There are differences between onshore forward prices and NDF rates. These differences contain important information. With capital controls in place, the gap between domestic and offshore interest rates is affected by a number of factors, such as supply/demand conditions, market liquidity, market expectations of future rates, fear of changes in foreign exchange regulations, ease of access to onshore money markets, speculative positioning, and the relation between domestic currency forward and offshore forward markets (Park and Rhee, 2001; Ma *et al.,* 2004; Lipscomb, 2005). How NDF markets affects pricing in the domestic market is, therefore, of significant interest to market participants, central bankers and regulators. The existence of NDF markets comes from the needs of off-shore entities to trade,

hedge, speculate and arbitrage a currency which is strongly regulated and controlled. Therefore, it is valuable to be informed and monitor information flows between off-shore NDF and on-shore markets.

GROWING INTEREST IN NDF's

India's broad Foreign Exchange Policy

With full convertibility on the current account being in existence since 1994 and the Foreign Exchange Management Act (FEMA) having been enacted in 1999, RBI's major focus during the last two decades has been on capital account controls. The purpose of imposing controls and restraining the freedom of residents to transact with non-residents arises from the concern of addressing the structural imbalances in the balance of payments (Khan, 2014).

Since March 1993, India has been following a managed flexible regime. There are very few controls on capital account inflows from Foreign Direct Investment (FDI) in specific sectors and Foreign Portfolio Investments (FPI) in equities. However, there are controls on debt inflows because of concerns about external stability. The regulations are changed, although not frequently, depending on macroeconomic conditions and not with the intension to influence daily exchange rates or achieve any explicit or implicit target for the exchange rate. RBI's policy is more focused on managing undue volatility and maintaining orderly market conditions. Largely passive and flexible, with negligible intervention during normal market conditions, RBI's manages through active intervention as and when the market turns excessively volatile. These interventions are made to keep markets orderly, smooth and prevent ripple effects. The objective behind passive intervention could be to avoid appreciation whereas in case of active intervention, the objective is to avoid undue volatility (Sitikantha Pattanaik & Sahoo, 2003). RBI aims to manage a balance between the short-term risk of the INR spiraling downwards and the medium-term risk of a loss of confidence in meeting external obligations.

Popularity of INR NDF's

The increasing volume and interest in the NDF market could be attributed to the following factors:

i) Increasing global linkage of the Indian markets in trade, capital and financial integration.

ii) The INR not being fully convertible, multinational firms and international portfolio managers hedge their exchange rate risk overseas in the non-convertible INR.

iii) Inadequate or cumbersome access to overseas markets for foreign investors with INR exposure.

iv) Non-residents wishing to speculate on the NDF without any underlying exposure to the INR or India.

v) Arbitrageurs who attempt to exploit the differentials in the prices in the two markets by two offsetting transactions.

vi) Restrictions on booking, rebooking of cancelled contracts not suiting portfolio investors hedging strategy.

vii) Restrictive measures imposed on onshore OTC and Exchange Traded Derivatives (ETD) i.e. Futures e.g. ceilings on individual positions/open interest, restricting arbitrage between the OTC and ETD by banks and increase in margin imposed during time of volatility.

viii) In the absence of onshore forwards contracts beyond 12 months and onshore futures contracts beyond 3 months, investors who wish to hedge for longer positions may have no choice but to hedge their risk in NDFs.

ix) By separating currency risk from country risk, NDF markets enable investors to hold the currency without necessarily being exposed to the country and its associated political, legal, operational and regulatory risk.

MEASURES TAKEN DURING RUPEE WEAKENING

Lehman Bros.'s collapse in Sep 2008 led to a global financial crisis with the value of most currencies falling. The INR also started feeling pressure till RBI intervened. Several measures taken in 2011-2012 by RBI created constraints in the domestic forward market and therefore propelled market participants to take position in the NDF market. In August 2013, anticipating financial tapering in U.S., foreign portfolio investors were heavily unwinding their positions in Indian financial markets and covering by taking huge positions, worth billions of dollars, in NDF markets, thereby weakening the offshore rupee rates. As the rupee came under pressure, a few large companies and banks took arbitrage position and cashed in on the difference between the forward dollar rupee rate in India and NDF markets of Singapore, Hong Kong and London. In an attempt to stem the declining value of the INR, the RBI took several measures to reduce the outflow of foreign exchange and check speculation such, mainly:

- Reduced limit for Overseas Direct Investment (ODI) under automatic route from 400% of the net worth of an Indian Party to 100% of its net worth.
- Reduced limit for remittances made by Resident Individuals, under the Liberalized Remittance Scheme (LRS Scheme), from USD 200,000 to USD 75,000 per financial year.
- While restrictions on the use of LRS for prohibited transactions, such as, margin trading and lottery continued, RBI additionally disallowed the use of LRS for direct or indirect acquisition of immovable property outside India.
- Rebooking of cancelled rupee forward contracts booked by residents to hedge transactions was not permitted.
- Past performance facility which was available to importers was reduced to 25% of the average of actual import/export turnover of the previous three financial years or the actual import/export turnover of the previous year, whichever was higher.
- Transactions undertaken by Authorised Dealers (ADs) on behalf of clients were limited to actual remittances/delivery only and could not be cancelled/cash settled.
- Rebooking of cancelled forward contracts booked by FIIs was not permitted.
- The Net Overnight Open Position Limits (NOOPL) and intra-day open position/daylight limit of AD banks was reduced.
- Positions taken by banks in currency futures/options could not be offset by undertaking positions in the OTC market.
- The NOOPL of the banks as applicable to the positions involving the rupee as one of the currencies would not include positions taken by banks on the exchanges.

The restrictions were removed in June 2014 when the rupee stabilized.

Linkage between on-shore deliverable and off-shore NDF market

In the Indian context there are only few studies on the INR NDF market. Sangita Misra and Harendra Behera (2006) found out that NDF markets are generally influenced by volatility spillover from onshore markets to NDF market. The research, however, found that the extent of volatility spillover from NDF to spot market was marginal (Misra & Behera, 2006).

Behera *et al.* (Behera & Murty, 2006) empirically explored the impact of RBI's intervention in the Indian foreign exchange market and found that RBI intervention is effective in reducing volatility in the Indian foreign exchange market. They concluded that NDF rate is influenced by interventions done by RBI to curb volatility and on various macroeconomic shocks such as global financial crisis (Behera & Murty, 2006).

Guru (Guru, 2009) also finds somewhat similar evidences of INR NDF and onshore market relationship. The study additionally found that offshore markets had undergone a change with the introduction of the currency future market in 2008 and for the first time pointed to returns in NDF markets influencing domestic spot as well as forward market.

Sharma (Sharma, 2011) while analyzing the relationship between volatility in the exchange rate in the spot and futures market between 2007 and 2010, found that there is a two-way causality between the volatility in the two markets.

Research on inter linkages and spillover effects emanating from volatilities in major foreign currencies to the volatility in the exchange rate of the Indian Rupee are relatively limited. There are two significant RBI papers which have studied the inter linkages and volatility spillover of the Indian Rupee between the onshore and offshore markets.

The first paper by Satyananda Sahoo (Sahoo, 2012) analyzes volatility spillovers from the Brazilian Real (BRL), the Russian Ruble (RUB), the South Korean Won (KRW), the Singapore Dollar (SGD), the Japanese Yen (JPY), the Swiss Franc (CHF), the British Pound Sterling (GBP) and the Euro (EUR) to the Indian Rupee (INR) during the period 2005–2011. The findings supported the view that volatilities observed in these currencies lead to volatility in the INR. However, the volatility in the exchange rate of the Indian Rupee is driven more by domestic macroeconomic and global factors than the spillover.

RBI's working paper series on the "Non Deliverable Forward and Onshore Indian Rupee Market: A Study on Inter-linkages" (WPS(DEPR): 11/2013 dated December 2013 (Goyal, Jain, & Tewari, 2013) concluded that 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. They found that till the Asian crisis of 1997, interest in NDF trading had increased significantly, as devaluation in local currencies was widely expected in the market. Countries whose currencies are actively traded in the offshore NDF market are Argentina, Brazil, Chile, China, Guatemala, Indonesia, India, Columbia, Korea, Malaysia, Philippines, Peru, Russia, Taiwan, Venezuela and Vietnam. The report further stated that 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.

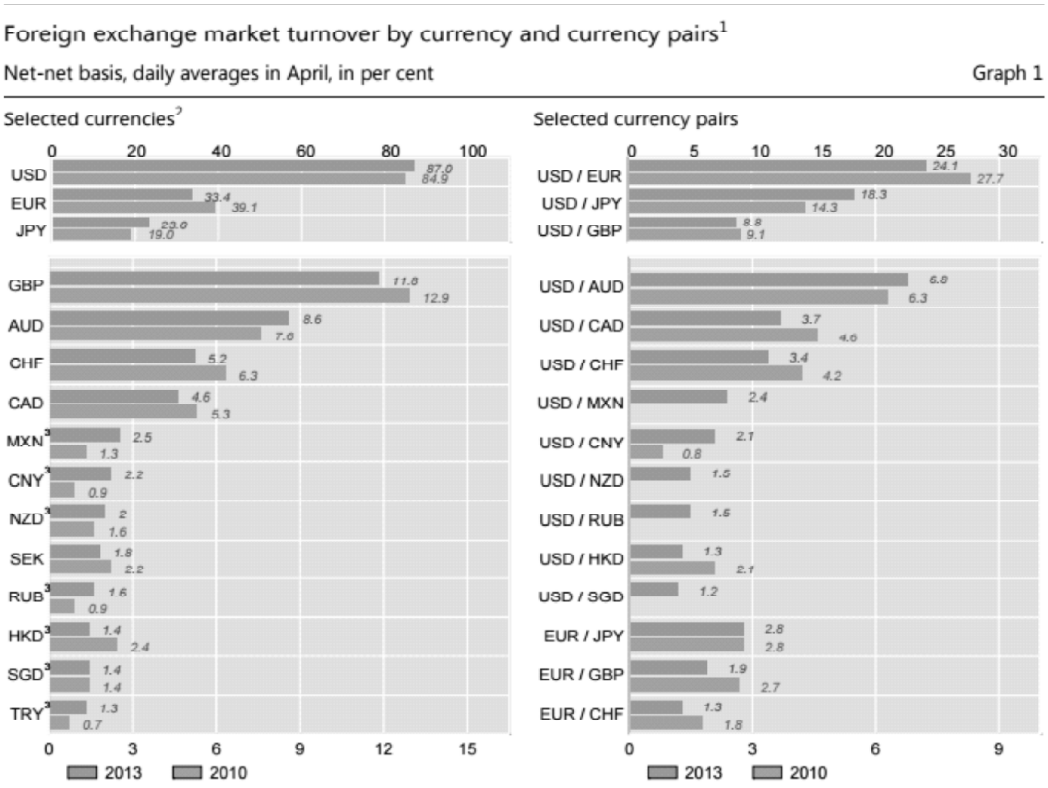
Besides these factors, NDF prices can also be affected by speculation, market perceptions about changes in foreign exchange regulations, changes in local onshore interest rate markets and dynamic inter-linkages between offshore and onshore currency forward markets (Lipscomb, 2005). Moreover, NDF could be a useful tool for gauging market expectations on a currency relevant for its pricing as supply and demand factors may not get fully manifested in onshore pricing of local currency in a country with capital controls. Goyal, et al. (Goyal, Jain, & Tewari, 2013) empirically established that for INR, there exists a long term relationship between onshore and NDF markets and the relationship is bidirectional as both markets adjusts to any deviation from equilibrium state. However, bidirectional relationship turns unidirectional from NDF to onshore during the period when rupee comes under downward pressure.

MONITORING NDF MARKETS

Global Forex Trading

According to the Triennial Central Bank Survey of foreign exchange turnover in April 2013 (BIS, Feb, 2014), total global trade in foreign exchange markets averaged $5.3 trillion per day in April 2013. This was up from $4.0 trillion in April 2010 and $3.3 trillion in April 2007. Fx swaps were the most actively traded instruments in April 2013, at $2.2 trillion per day, followed by spot trading at $2.0 trillion. US dollar remained the dominant vehicle currency accounting for approx. 43.5% (87% on one side of all trades), followed by the Euro accounting for 16.5% (33.4% on one side) and the Japanese Yen at number

Exhibit 1 - Foreign Exchange Turnover by currency & currency pair – April 2013



Source: BIS Triennial Central Bank Survey, Sep 2013

three position with 11.5% (23% on one side of all trades) and Great British Pound at number fourth position with approx. 6% (11.8% on one side) according to the Triennial Survey (BIS, Feb, 2014). The 2013 report found that U.K, U.S.A., Singapore and Japan centers accounted for 71% of foreign exchange trading. (BIS, Sep, 2013). Several emerging market currencies like the Mexican Peso and Chinese Yuan entered the list of the top 10 most traded currencies. The offshore Chinese Yuan market is the largest and segmented into deliverable and non-deliverable parts. Acknowledging the relevance of China, the IMF recently approved the inclusion of the Chinese Yuan (CNY) to join the euro, yen, pound and dollar in the IMF's reserve basket of currencies called Special Drawing Rights (SDR). The Yuan will have 11% weighting in the basket from October next year – leapfrogging sterling and the yen, which will be reduced to 8% each. The euro will be the biggest loser in percentage terms, dropping six points to 31%, while the dollar's share will remain broadly unchanged at 42%.

India's Forex Trading

According to the Triennial Central Bank Survey data on global foreign exchange market turnover in 2013 published by BIS in February 2014, the daily average foreign exchange volume of trade in India has increased from 23.6 billion U.S. dollars in 2007 to 52.8 billion U.S. dollars in 2013. This daily average foreign exchange (fx.) volume of approx. USD 53 billion accounts for approx. 1% of world trade and the INR ranked as the 17th most traded currency pair globally (BIS, Feb, 2014) .

Exhibit 2 - India's Fx. turnover by instrument in USD bill – April 2013

	Total (USD bill)
Spot	15
Outright Forwards	25
Foreign exchange swaps	10
Options	3
Total Fx contracts	53

Source: BIS Triennial Survey 2013 - Feb 2014

Growing Size and interest of global NDF market

NDFs are used by a large number of market participants including, mainly:

- Corporations hedging onshore investments or earnings.
- Investors hedging or making directional investments.
- Dealers and others managing exposure between NDFs and onshore markets and providing market making services.
- Speculators & Arbitrageurs.

Although popular in Emerging Markets (EM), NDFs comprise a small portion of the overall foreign exchange market. According to the Bank for International Settlements triennial turnover survey, the global NDF market traded $127 billion per day in April 2013, roughly 20% of all forwards trading but only 2% of the $5.3 trillion that traded across all products.

Six currencies account for two-thirds of the current volume: Brazilian Real, Chinese Renminbi, Indian Rupee, Korean Won, Russian Ruble, and Taiwan Dollar. The vast majority of trading in these currencies is against the US dollar as the counter currency. The most actively traded tenors are up to three months, although maturities can go up to several years. Liquidity gets lower with longer maturities. London trades nearly one-third of the global NDF volume with the major Asian centers in Singapore, Hong Kong and Dubai also being active.

The NDF market grew faster than the forward market or the foreign exchange market as a whole from April 2008 to April 2013. During the five years, NDF turnover doubled its share to 2.4% of overall turnover and 23% of forwards. They have however decreased after April 2013 in anticipation of a reduction in U.S. monetary easing. The turnover in Asian NDFs has grown the most. It is estimated to have grown by at least 10 times the turnover from the early 2000s (McCauley, Shu, & Ma, 2014).

Exhibit 3 - Avg. daily volume of NDF in USD bill – 2008 - 2013

NDF trading in London[1]

Average daily volume, in billions of US dollars — Table 3

	NDFs	All forwards[2]	NDFs as % of all forwards	All FX	NDFs as % of all FX	*Memo: Tokyo NDF*[3]
Apr 2008	23	200	11.5	1,832	1.3	*2.4*
Oct 2008	19	230	8.3	1,699	1.1	...
Apr 2009	16	162	9.9	1,356	1.2	*0.3*
Oct 2009	26	191	13.6	1,522	1.7	...
Apr 2010	25	186	13.4	1,687	1.5	*0.3*
Oct 2010	37	188	19.7	1,787	2.1	...
Apr 2011	42	192	21.9	2,042	2.1	*1.6*
Oct 2011	37	192	19.3	2,038	1.8	...
Apr 2012	36	192	18.8	2,014	1.8	*1.4*
Oct 2012	45	211	21.3	2,017	2.2	*1.9*
Apr 2013	60	265	22.6	2,547	2.4	*2.4*
Oct 2013	43	205	21.0	2,234	1.9	*1.9*

[1] Adjusted for local and cross-border inter-dealer double-counting. [2] Non-deliverable forwards and outright forwards. [3] Transactions in Asian and other emerging market currencies.

Sources: London Foreign Exchange Joint Standing Committee; Tokyo Foreign Exchange Market Committee.

Source: BIS Triennial Survey 2013

The BIS Triennial Central Bank Survey 2013 showed that NDFs constitute only a fifth of the global foreign exchange market in outright forwards (McCauley, Shu, & Ma, 2014). As can be seen from the exhibit below, the 2013 survey reported daily NDF turnover to be $127 billion.. This represented 19% of all forward trading globally and 2.4% of all currency turnover. Almost two thirds took place in six currencies

against the dollar. These six currencies were 1) Brazilian Real (BRL) 2) Chinese Yuan (CNY) 3) Indian Rupee (INR) 4) Korean won 5) Russian Rouble (RUB) and 6) New Taiwan Dollar (TWD). Globally, the NDF market for these 6 currencies accounted for a daily turnover of USD 127 Billion, of which the USD dominated as the counter currency at USD 119 billion. After the KRW and CNY, the INR remained the 3rd largest NDF market. On a net-net basis, the daily turnover of the INR NDF was around USD 17 billion.

Exhibit 4 - Daily Global & London Turnover in USD mill – April 2013

Global and London NDF turnover

Daily turnover in millions of US dollars, April 2013 Table 1

	USD								EUR	JPY	Other	Total
Global	BRL	CNY	INR	KRW	RUB	TWD	Other	Total				
Net-net[1]	15,894	17,083	17,204	19,565	4,118	8,856	36,790	119,510	1,642	973	4,438	126,563
Net-gross[2]	19,928	23,696	22,678	29,086	4,975	12,131	45,309	157,803	1,916	1,156	5,478	166,353
London[2]	12,315	5,970	10,471	8,735	4,225	...	16,530	58,246	1,260	...	5083	60,019
Memo: Oct 2013	*8,141*	*4,453*	*6,014*	*6,807*	*2,291*	...	*13,794*	*41,500*	*1,044*	...	*414*[3]	*42,959*

BRL = Brazilian real; CNY = Chinese renminbi; EUR = euro; INR = Indian rupee; JPY = Japanese yen; KRW = Korean won; RUB = Russian rouble; TWD = New Taiwan dollar; USD = US dollar.

[1] Adjusted for local and cross-border inter-dealer double-counting. [2] Adjusted for local inter-dealer double-counting. [3] Includes sterling.

Sources: Bank of England; Triennial Central Bank Survey; authors' calculations.

Source: BIS Triennial Survey 2013

The forward rate difference between deliverable forward and NDF rates was the largest for the CNY and the INR, as well as the Indonesian Rupiah and Philippine Peso. The RUB, being more liberalized, had a much narrower differentials. As can be seen from the exhibit below, the difference widens during periods of stress, thereby, making arbitrage profitable.

Perceived benefits of NDF market

The offshore markets play a very important role in the major reserve currencies such as the USD. In fact, it has been argued that without the offshore markets, the current dominant position of the USD would not have been possible in international trade and payments.

While the NDF markets have at times presented challenges to policymakers and even though onshore market transaction cost is lower due to lower bid-ask spreads, market participants still choose to trade actively in offshore markets due to several reasons. The NDF market is increasing also because it fulfills gaps in the onshore markets and offers certain perceived benefits to the users like:

1. Liquid NDF markets serve international portfolio investors by affording them an otherwise unavailable means to hedge foreign exchange risk.

Exhibit 5 – Difference between Onshore & Offshore Forward premia- 2005-13

Onshore less offshore foreign exchange forward premia[1]

Average of absolute value as a percentage of spot price, for three-month contracts — Table 4

	Full sample	Non-crisis	Global financial crisis	Taper fears (May–Aug 2013)
CNY	0.43	0.41	0.59	0.48
INR	0.44	0.35	1.17	0.57
IDR	0.82	0.56	2.37	2.53
KRW	0.30	0.23	0.90	0.25
MYR	0.29	0.26	0.51	0.26
PHP	0.44	0.31	1.62	0.24
TWD	0.39	0.38	0.59	0.10
BRL	0.22	0.18	0.60	0.17
RUB	0.08	0.08	0.08	0.10

BRL = Brazilian real; CNY = Chinese renminbi; IDR = Indonesian rupiah; INR = Indian rupee; KRW = Korean won; MYR = Malaysian ringgit; PHP = Philippine peso; RUB = Russian rouble; TWD = New Taiwan dollar.

[1] Daily data for the forward premium gap are calculated as the difference between onshore forward and offshore NDF rates as a percentage of the spot price. Full sample = January 2005–December 2013; global financial crisis = September 2008–July 2009; non-crisis = rest of sample period.

Sources: Bloomberg; CEIC; authors' calculations.

Source: BIS Quarterly Review – March 2014

2. The NDF market offers an alternative hedging tool for foreign investors with local currency exposure or a speculative instrument for them to take positions offshore in the local currency. Participants choose to trade actively in offshore markets due to better liquidity. Many onshore players are also important counterparties in the NDF market and arbitrage between the two markets.
3. As NDFs trade outside, their pricing need not be constrained by domestic interest rates.
4. Availability of longer maturity forward contracts in NDF than available in the onshore market is particularly important for long term borrowers and investors. In the case of INR, onshore forwards contracts are available for a period of one year and exchange traded future contracts exist for only up to 3 months. In the absence of a robust liquid onshore forward market beyond that, a long-term borrower of foreign currency or MNC bringing in FDI may tap the NDF market for long term positions.
5. NDFs are devoid of country or local market risk of the local currency. Depositors always seek low-risk venues with low political risk.
6. NDFs are outside the purview of central banks regulatory intervention and documentary compliances. This may suit some market participants.

7. There is no bid/offer spread on maturity as contracts are normally settled against a fixing rate like the RBI reference rate.
8. NDFs are "non-cash products" and hence "off the balance sheet". This suits many entities.
9. As NDFs are only cash-settled, they have much lower counterparty risk.
10. NDFs can be used for arbitrage and speculation, in addition to hedging.
11. NDFs offer benefit of diversification of financial and global risk.
12. The regulatory environment, accounting standards, language and time zone of the location of the offshore markets may make them more convenient than the onshore markets to some market participants.
13. As the ability to hedge currency risk is particularly important for offshore bond investors, Jiang & McCauley concluded that NDF markets could potentially facilitate foreign investment in Asia's expanding local currency bond markets and thereby add diversity and liquidity to them (Jiang & McCauley, 2004). The NDF market may be particularly appealing to investors in Rupee bonds issued outside India. Much like the Chinese yuan-denominated "dim sum" bonds and Japanese yen-denominated "samurai" bonds, they have been termed by World Bank's International Finance Corporation as "masala bonds". Low interest rates and easy liquidity from developed countries is expected to attract investments in masala bonds as India emerges as the world's fastest growing large economy. They can also help the rupee go global.
14. Multinationals using transfer pricing and having centralized treasury overseas may prefer to hedge off-shore.

As a result of the above, the NDF market no longer caters to foreign investors but has emerged into a market where even large Indian companies with cross-border presence participate.

Tracking NDF markets

Empirical evidence established by various researchers confirming inter-linkages and spillover effect between onshore deliverable and offshore NDF markets warrant monitoring the INR in the overseas NDF market due to several reasons:

1. As India grows rapidly, presumably without full-convertibility in the near future, NDFs are expected to gain even more in volume and significance. Like the Chinese Yuan and S. Korean Won, in the absence of full-convertibility in the immediate future and more foreign investor participation, the INR NDF market will continue to grow significantly.
2. NDF and onshore rates have inter-linkages and a spillover effect because of arbitrage opportunities. NDF volatility is higher than that of the domestic spot and forward markets because of the lack of official intervention by central banks and because of more speculative positions in the NDF markets.
3. Since NDF's are OTC, lacking transparency in operations and reporting, there is a risk that participants may manipulate NDF spot rates in order to make gain while settling NDFs carried on their books (Okongwu and Bruegger, 2012).

4. NDF markets, being offshore, are outside the RBI's purview. However, the differences between offshore NDF and onshore forward prices contain important information, e.g., market expectations and supply/demand conditions, which cannot be fully reflected in onshore forward prices because of capital controls. NDF prices and the behavior of NDF market players give important market signals. NDF rates capture more information about currency fundamentals than onshore market rates since NDF are determined in "open markets" and reflect market expectations.
5. Onshore forwards market can diverge significantly from the offshore NDF curve as offshore rates, to a large extent, reflect restrictions on onshore foreign exchange trading and barriers to cross-border movements. The principal of "Covered Interest Parity" often does not hold in the INR and NDFs reflect the same as well as other perceived political risk e.g. the perceived probability of change in foreign exchange regulations and controls being imposed on capital flows, political risk etc.
6. Both deliverable forwards and NDFs generally respond to global factors. However, McCauley *et al.*, 2014 suggest that global factors in particular seem to figure much more in the NDF rate for the Chinese Renminbi, Indian Rupee and Indonesian Rupiah. (McCauley, Shu, & Ma, 2014).

There are many studies available on the NDF market for Chinese Yuan and S. Korean Won but very few studies that investigate INR NDF and onshore market linkages. Perhaps, the difficulties of obtaining the data may be one of the reasons, since NDF are traded over-the-counter in offshore market, mainly in Singapore, Dubai, Hong Kong and London. A very significant study is RBI's working paper series on "Non Deliverable Forward and Onshore Indian Rupee Market: A Study on Inter-linkages" WPS (DEPR): 11/2013 (Goyal, Jain, & Tewari, 2013). This working paper which was published in December 2013 empirically concluded that for INR, there exists a long term relationship between onshore and NDF markets and the relationship is bidirectional as both markets adjusts to any deviation from equilibrium state. Bidirectional volatility spillover between the two markets during periods of appreciation was empirically established. The report however concluded that statistical evidence confirmed that the bidirectional relationship turns unidirectional from NDF to onshore during periods when rupee comes under downward pressure (Goyal, Jain, & Tewari, 2013).

CONCLUSIONS

Concerns

The growth of NDF market and its impact on on-shore market raises some serious and perplexing questions, namely:

- If price discovery is driven by offshore markets, particularly, during times of stress on the INR, can RBI interventions be effective and if so, at what cost?
- Does the non-transparent, OTC NDF market not increase the probability of price manipulation and its spillover to onshore markets?
- Do unregulated offshore markets with non-transparent trading and risk management systems not pose additional threats to global financial stability?

- Could RBI's overt/covert interventions, more restrictive onshore policies and attempts to control activity in offshore markets lead to more migration of price discovery to offshore markets?
- Should not more attempts be made to bring the offshore market onshore in order to add depth to our markets and generate income and employment?
- Since NDF markets affect the domestic markets through arbitrage, should domestic banks be allowed to participate in this market?

Recommendations

NDF markets for INR will continue to exist and grow faster than the foreign exchange market as long as capital convertibility restrictions remain and RBI tries to shield domestic financial markets from global market developments. As has been seen in the case of Brazil and South Korea, the best way to bring offshore market trading to onshore markets is to develop robust onshore forex markets which are deep, liquid, liberal, transparent, innovative, versatile and efficient. For this, RBI needs to think afresh from the perspective of the market participants.

Gradual easing of restrictions on non-residents, development of deeper and more liquid onshore markets, introduction of transparent, innovative and versatile forex derivative products in onshore markets can bring offshore activity onshore. Encouraging more participation in onshore and offshore exchange-traded INR futures and options could bring the much needed transparency in to currency trading. In the absence of exchange-traded derivatives, the risk of the OTC derivatives market cannot be hedged effectively. Exchange-traded derivatives are transparent because the information is available on public domain. Through the mechanism of settlement guarantees, they ensure better risk management and regulatory discipline. RBI needs to engage actively to bring on board professionals who have a deep knowledge and practical experience of global derivatives trading and risk management to develop the onshore exchange-traded derivative markets.

While some off-shore entities may have no other option but to go to NDF markets, even on-shore entities are forced to look at NDF markets in the absence of a void in the onshore deliverable market. Liquid onshore forwards are available only up to 12 months and futures are not traded beyond 3 months. In the absence of robust onshore forex derivatives for a longer tenure, NDFs could be the only alternative to onshore and offshore hedgers wanting to cover longer positions beyond what is available onshore. Hence NDF markets tend to perpetuate and grow due to this void. There is a need to offer versatile forex derivative products with longer maturity than what is currently available. A MNC making a FDI investment or a long-term borrower in USD should have access to longer-term forex hedging derivatives domestically. The RBI should particularly focus on developing the exchange traded futures and options market with longer delivery. Onshore exchange traded options are at a very nascent stage and need to be nurtured. Deep, liquid and versatile exchange traded derivative products which offer longer tenure will attract large markets participants to the onshore market. Till now, currency futures have been more popular with smaller market participants and the quantum jump from OTC forwards to exchange-traded futures by large corporates has not taken place. Well-developed currency futures and options markets have played a very leading role in onshore markets of countries like Brazil and Korea resulting in higher trading activity and in a transparent price discovery process.

Monitoring cross-border capital flows is just as important as monitoring cross-border risk flows. To overcome apprehensions of possibility of manipulation in NDF markets there is a need to bring more transparent trading in NDF operations. The largest NDF market for INR remains London, Singapore, Dubai and Hong Kong. The RBI will have to work along with Bank of England, Monetary Authority of Singapore, Central Bank of UAE and Hong Kong Monetary Authority to make regulatory reforms to develop financial mechanisms and risk management systems for reporting and monitoring the unregulated and non-transparent NDF markets.

Liberalization and removal of all restrictions on non-residents to freely buy and sell forwards domestically and full capital account convertibility may not be possible for India due to its current deficit and balance of payment pressures but a gradual removal of restrictions on non-residents investors who have exposure in INR to hedge their risk onshore should continue. This will improve liquidity in onshore market and boost investor confidence offshore.

Development of domestic and offshore exchange-traded currency futures and options markets, liberalizing participation of domestic financial institutions in onshore markets, synchronization of trading hours across onshore and offshore markets to minimize arbitrage lags and allowing domestic financial institutions to participate in offshore markets could reduce the importance of NDF markets over time. Further, given the lower cost advantage of doing business from India, RBI should work towards simplifying rules for conducting business within International Financial Service Centers (IFSC) like Gujarat International Finance Tec City (GIFT) to attract business, employment and expertise from offshore to onshore markets.

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