

Do Exchange Traded Currency Derivatives (Futures and Options) Provide a Better Hedging alternative compared to Currency Forwards (OTC product)?

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Abstract

Indian business entities had ushered in to new era post liberalization in 1990's. This brought challenges and opportunities both. The cross border trade and currency flows across international borders increased substantially. Traditionally, the Indian exporters and importers relied on conventional products like Currency Forwards to hedge their foreign currency risk arising out of trade transactions. A need was felt to enlarge the choice of hedging instruments available and then exchange traded currency derivatives were introduced to provide a cost effective and transparent alternative by RBI. This study examines whether the objective of providing the exchange traded currency derivatives viz. Futures and Options was served. This study is based on the effective exchange rates realized using the conventional Forwards and then comparing the same with the rates realized using exchange traded currency derivatives. It was found that the exchange traded currency derivatives provide a significantly (statistically) better rates compared to traditional Currency Forwards.

Introduction

Business entities involved in overseas trade are exposed to fluctuations in foreign currency exchange rates. If the domestic currency strengthens an importer gains and the exporter is at a disadvantage (with regard to the expected future transactions designated in foreign currency). However, if the foreign currency strengthens and the domestic currency weakens then the importer stands to lose and exporter may gain. To avoid uncertainty in cash flows (Profit) the businesses may go for hedging their foreign currency exposure. Derivatives like the Currency Futures, Currency Forwards and Currency Options are available to hedge currency exposure arising out of import or export transactions. A brief explanation on them is in order.

Currency Forward – It is an agreement to buy or sell a stated amount of foreign currency at a future date. The price (exchange rate) of the foreign currency is fixed at the time of entering into the contract. The rate fixed is referred to as Forward rate. Banks in India offer these kinds of contracts to importers and exporters.

Currency Futures - Futures are similar to Forwards in terms of definition. However the major difference is that they are standardized contracts traded on recognized exchanges and hence transparency and price discovery may be better.

Currency Options: These are agreements which give the buyer of the option, the right (choice) to either buy the foreign currency or sell the foreign currency.

Call Option on foreign currency – The holder of the Call option has the right to buy (but no obligation), a stated amount of foreign currency on or before a

stated date in future (exercise date/ strike date) for a stated price/exchange rate (Strike price / exercise price). For this the Call Option buyer has to pay a price called the Premium to the Call Writer (seller).

Put option on Foreign Currency - The holder of Put Option gets the right to sell the foreign currency at Strike price by /on Strike date. For this the Put holder pays the price called Premium to Put Writer (seller)

1.1 Currency Derivatives in India

In India, the business entities have traditionally relied upon Currency Forwards offered by the commercial banks (Authorized Dealers). These Forwards are subject to the provisions of Foreign Exchange Management Act (FEMA), 1999. FEMA requires that an entity entering into a Forward contract should have an underlying foreign currency exposure. There is some relaxation for small and medium enterprise (SME) in terms of not having to go through rigorous documentation before entering into a Forward. With the advent of liberalization and cross border flows becoming prominent it was felt that there should be a wider array of hedging choices available to Indian exporters and importers. The Reserve Bank of India (RBI) constituted an internal working group, in 2007, to study the introduction of Currency Futures and Currency Options which are exchange traded products unlike Forwards which are over-the-counter (OTC) products. It was felt that this enhanced choice of hedging instruments would supplement the existing currency derivative market, increase the depth of the foreign currency market in India and help in better price discovery of foreign exchange rates. It was expected that these exchange traded products would benefit smaller players like SME's in providing a cost effective means of hedging. The L.C. Gupta committee which has dealt with recommendations for Financial Derivatives at large also opined that

introduction of exchange traded derivatives is aimed at providing effective and cost efficient hedging mechanism for risk. The exchange traded currency derivatives have since been introduced in India. SWAPS are also a form of currency derivative however they are seldom used for managing transaction exposure risk. They are not part of this research. The exchange traded currency derivatives have grown manifold since its introduction. This is evidenced by the fact that the average daily turnover on the National Stock Exchange (NSE has grown from Rs. 1167.43 crores in 2008-09 to Rs. 18,602.83 crores in 2015-16. Till 2015-16 the volumes were dominated by Currency Futures. The Options are gradually catching up in 2016-2017.

Rationale for the study

One of the objectives of introducing Currency Futures in India was to provide a cost effective hedging alternative in addition to the extant Currency Forwards especially to the benefit of smaller players like the SME's. The larger players are in position to bargain for beneficial Forward rates unlike their smaller counter parts. With exchange traded Futures being made available to market participants it is expected that the hedging cost should be lowered. Has this really happened? The motivation behind this study is to explore answer to this question. Could the exporters/importers that have traditionally used Forwards (OTC) from banks benefit more by using exchange traded derivatives? The benefit or effectiveness of hedging via exchange traded derivatives can be gauged by comparing the effective exchange rate realized using these vis-à-vis exchange rates realized using Forwards as hedging tool.

Review of Literature

Instruments of corporate hedging in India were examined (Anuradha S, and Runa S) with special reference to Foreign exchange

risk management. The research paper was exploratory in nature and relied on the published financial data of 2006-2007 for companies like Maruti Suzuki Ltd., Ranbaxy, Mahindra and Mahindra, Reliance Industries and others. It was found that these Indian Companies relied heavily on Forwards and Options (both OTC) for hedging their short term foreign currency risk, arising out of import or export transactions. Currency Swaps were mainly utilized for long term currency risk that emanates from Foreign Currency Debt. Based on research conducted by others, it mentioned that there is conclusive evidence to suggest that firms with larger size, R&D expenditure and exposure to exchange rates through foreign sales and foreign trade are more likely to use derivatives. (Allayanis and Ofek, 2001). Currency Futures have not been considered in this paper as they were introduced in second half of 2008 in India. However the paper does highlight the need for exchange traded derivatives in the form of Futures contract. The question whether introduction of currency futures increase the volatility in the spot currency market was studied in RBI Working Paper Series by Somnath Sharma (Sharma, 2011). This paper also reviewed the work done on this topic earlier and found that there is no conclusive evidence to suggest that index futures increase the volatility in the spot market. The effect of use of foreign currency derivatives on value of the French firms was studied by Clark and Mefthe (Clark and Mefthe, 2010). The study was conducted on 176 large firms in France. Published annual reports for the year 2004 were relied upon for data on financials and derivatives. Multivariate analysis was used to study the effect of use of derivatives on value of the firm. Other variables like Size of the Firm, Current ratio were also studied for their impact on the value of the firm. Tobin's Q was considered a proxy for the value of the firms and was the dependent variable. The study concluded that use of derivatives was a positive and significant determinant of the

Tobin's Q (value of firm). The research also high-lighted that use of derivatives by larger firms had a greater impact on the value of the firm compared to the impact on value of smaller firms.

Objective Based on the Research Gap Identified

Post liberalization in the 1990's, the flow of foreign capital across the Indian border has significantly increased. There is also a substantial rise in the cross border trade. This expansion in trade has been welcomed by the industry, but with this it has posed certain challenges too. One of them has been to manage the risk due to foreign exchange rate fluctuations for those entities that have a foreign currency payable or receivable. Traditionally the Indian businesses relied upon the OTC products i.e. Currency Forwards for hedging transaction exposure. A need was felt to expand the portfolio of hedging products and exchange traded currency derivatives were introduced. Initially, NSE started with Currency Futures on USD-INR pair in 2008. Therefore these can be said to be of a relatively recent origin for India. The exchange traded derivatives were aimed at providing a transparent and cost effective hedging alternative especially for the small and medium sized players. The objective of this research is to see if this has really been achieved. The review of the literature does not bring up any specific studies done for comparison of Currency Forwards versus Currency Futures and Options in India. This shows a research gap. A comparison of OTC and exchange traded products may provide pointers to the business entities regarding the use of exchange traded derivatives. It is pertinent to note here that still a majority of hedging is undertaken through the Forwards in the currency market. The turnover in the Futures and Options has increased over the year but still is only a small percentage of currency derivatives turn over.

Hypotheses Formulation

To compare the effectiveness of the hedge, the realized foreign exchange rate is compared for all three hedging alternatives. The following questions can be formulated:

Q1) Does hedging with Currency Futures (exchange traded) provide better realization of the exchange rate compared to Forwards (OTC product) for hedging US\$ exposure for an exporter ?

H0: The mean difference in the exchange rate realized under the Futures hedge and the Forwards for hedging US\$ exposure for exporter is zero.

H1: The mean difference in the exchange rate realized under the Futures hedge and the Forwards for hedging US\$ exposure for exporter is greater than zero.

Alternatively stated,

$$\mu_{\text{diff-Fut-Forw-US\$-expo}} = 0$$

$\mu_{\text{diff-Fut-Forw-US\$-expo}} > 0$ where $\mu_{\text{diff-Fut-Forw-US\$-expo}}$ is the mean difference between the exchange rate realized using the Futures hedge and the Forwards hedge for an exporter planning to hedge US\$ exposure.

Q2) Does hedging with Options provide better realization of the exchange rate compared to Forwards for hedging US\$ exposure for an exporter?

H0: The mean difference in the exchange rate realized under the Options hedge and the Forwards for hedging US\$ exposure for exporter is zero.

H1: The mean difference in the exchange rate realized under the Options hedge and the Forwards for hedging US\$ exposure for exporter is greater than zero.

Alternatively stated,

$$\mu_{\text{diff-Opt-Forw-US\$-expo}} = 0$$

$\mu_{\text{diff-Opt-Forw-US\$-expo}} > 0$ where $\mu_{\text{diff-Opt-Forw-US\$-expo}}$ is the mean difference between the exchange rate realized using the Options hedge and the Forwards hedge for an exporter planning to hedge US\$ exposure.

Q3) Does hedging with Futures provide better realization of the exchange rate compared to Forwards for hedging US\$ exposure for an importer?

H0: The mean difference in the exchange rate realized under the Futures and the Forwards for hedging US\$ exposure for importer is zero.

H1: The mean difference in the exchange rate realized under the Futures and the Forwards for hedging US\$ exposure for importer is less than zero.

Alternatively stated,

$$\mu_{\text{diff-Fut-Forw-US\$-impo}} = 0$$

$\mu_{\text{diff-Fut-Forw-US\$-impo}} < 0$ where $\mu_{\text{diff-Fut-Forw-US\$-impo}}$ is the mean difference between the exchange rate realized using the Futures hedge and the Forwards hedge for an importer planning to hedge US\$ exposure.

Q4) Does hedging with Options provide better realization of the exchange rate compared to Forwards for hedging US\$ exposure for an importer?

H0: The mean difference in the exchange rate realized under the Options and the Forwards for hedging US\$ exposure for importer is zero.

H1: The mean difference in the exchange rate realized under the Options hedge and the Forwards for hedging US\$ exposure for importer is less than zero.

Alternatively stated,

$$\mu_{\text{diff-Opt-Forw-US\$-impo}} = 0$$

$\mu_{\text{diff-Opt-Forw-US\$-impo}} < 0$ where $\mu_{\text{diff-Opt-Forw-US\$-impo}}$ is the mean difference between the exchange rate realized using the Options hedge and the Forwards hedge for an importer planning to hedge US\$ exposure.

Q5) Does hedging with Futures provide better realization of the exchange rate compared to Forwards for hedging Euro exposure for an exporter?

H0: The mean difference in the exchange rate realized under the Futures hedge and the Forwards for hedging Euro exposure for exporter is zero.

H1: The mean difference in the exchange rate realized under the Futures hedge and the Forwards for hedging Euro exposure for exporter is greater than zero.

Alternatively stated,

$\mu_{\text{diff-Fut-Forw-Euro-expo}} = 0$

$\mu_{\text{diff-Fut-Forw-Euro-expo}} > 0$ where, $\mu_{\text{diff-Fut-Forw-Euro-expo}}$ is the mean difference between the exchange rate realized using the Futures hedge and the Forwards hedge for an exporter planning to hedge Euro exposure.

Research Methodology

The idea of hedging, a transaction exposure, is to bring in certainty for the exchange rate for the currency that will be paid or received in the future. An importer prefers to lock in an exchange rate for buying the currency at a future date. This will provide a safeguard against loss arising out of domestic currency weakening against the foreign currency. So his objective is to get the best possible lower rate for buying foreign exchange. As a corollary the exporter is faced with a weakening of foreign currency and looking to lock in the best possible rate to sell his future receivable in overseas currency. Traditionally the importers and exporters have used forwards.

The ultimate test of effectiveness of a hedge

in a foreign currency is evidenced by the actual exchange rate realized at the end of the hedging period. This is the parameter that this research is based upon. In order to compare the hedging effectiveness of exchange traded products with the traditional OTC products data on Forward rates provided by the banks is required. The Forward rates provided by banks to SME exporter or importer forms the basis of comparison. Data from exporter over horizon of three years has been collected. The method of comparison is explained below.

An exporter who has shipped goods overseas is expecting a payment in future, say two months. To hedge this he would have sold the currency in the Forward market to the bank at the certain rate provided by the bank. In this research, a simultaneous notional hedge in exchange traded derivatives is formed. In this case, Currency Futures contract would be sold on the same day (as that of the Currency Forwards) at the settlement price of the Futures as available on NSE. The expiry of the contract would be selected such that it would cover the time period (tenure) provided by the Forward. An Options notional hedge would also be set up by buying a Put option with a strike price near the Forward exchange rate offered. While Forwards do not involve any upfront payment there are certain bank charges to be paid. For the currency Futures an upfront margin as prescribed by the exchange/broker is required to be deposited to set up the hedge. For buying a Put Option a 'Premium' is required to be paid. After the hedge is set up, for Currency Futures daily 'mark-to-market' is done. This means that the position in the Futures contract is compared with the movement in the daily prices and if there is loss on the position a margin call is issued to restore the margin deposit to the original level. In case there is profit on the Futures position the excess amount (over and above the margin requirement) is transferred to the clients account. This implies that for setting up a Futures hedge there is cost of

financing the margin. There are other costs like brokerage and transactions tax which are applicable to the Options hedge too.

On the date of receipt of actual foreign currency the same will be delivered to the bank under the Forward contract with attendant charges. The realized rate will be recorded. For Currency Futures, the hedge will be lifted by squaring of the original position. So an exporter is assumed to sell the Futures on the date of receipt of foreign currency at the settlement rate of that day. The foreign currency so received is converted to domestic currency at the prevailing spot rate. The spot rate for buying foreign currency is taken from a widely used website for this purpose, www.xe.com. This website provides rate very close to the inter-bank rates. Spot rate is assumed with a difference of five paisa from the rate available on the website for that date (i.e. date of lifting hedge). Therefore the Spot rate for selling foreign currency is assumed to be Five paisa less than the rate available at [xe.com](http://www.xe.com) and for buying foreign currency the Spot is rate is assumed to be Five paisa plus the rate available on www.xe.com. Therefore the actual rate realized in the Currency Futures hedge, for exporter, would be equal to: [Spot rate + (-) gain (loss) on Futures position – charges – interest cost on financing the margin].

The hedge using Options is set up by buying a Put Option. The exporter would buy the Put with a strike price that is near the Forward rate offered by the bank. A Put would be bought on NSE with a price equal to settlement price/premium for the date on which the Forward contract is bought. The expiry of the Option would be selected such that the tenure covers the period in which the foreign currency is expected to be received. On the date of actual receipt of the currency the Put would be squared off by selling it at the settlement price of that date. The currency would be

sold in the spot market. In this case the rate realized would be equal to: [Spot rate + (-) gain (loss) on Options position – charges – cost of financing the premium]. The gain or loss on the Put is equal to the price at which the Option is sold minus the price at which the option is bought. It is pertinent to note that currently only USD-INR options are traded on NSE.

An importer would buy a Forward cover in order to hedge against foreign currency appreciation. To set up a hedge in the exchange traded derivatives the importer would buy the Currency Futures with an expiry such that it extends till the date on which the foreign currency is to be bought. In this case too, the importer would have to post a margin for setting up the long position in the Futures market. On the date of payment the currency will be bought from the Spot market and Futures position will be squared off. The exchange rate realized using the Futures hedge would be equal to: [Spot rate + (-) loss (gain) on Futures position + charges + cost of financing the margin].

For setting up hedge using Options the importer would buy a Call Option on the foreign currency with a strike price near to exchange offered in the Forward. On the date of payment, the Call would be sold at the prevailing settlement price. The effective exchange rate realized would be equal to: [Spot rate + (-) loss (gain) on Call Option position + charges + cost of financing the premium].

Data Collection

The comparison of Forwards hedge with Futures hedge requires data on the rate offered by banks to SME's in the OTC market. This data is not published and therefore not available in the public domain. The researcher approached SME's and they have

provided data on forwards. Data on Forward rates offered by a leading public sector bank and a private sector bank was obtained. These included rates for two currencies viz. US\$ and Euro. The bank offers Forward contracts to the SME for period. This means that the bank provided a Forward quote to the SME exporter in such a manner that the exporter could sell the foreign currency on any date within the prescribed period (as offered by a bank). This is a deviation from a routine Forward contract where the bank provided only one date on which the exporter could remit the foreign currency at the Forward rate provided by the bank. The data on bank charges was collected from the exporter.

For setting up the notional hedge via Futures, the data was collected from NSE's website www.nseindia.com. To initiate the hedge the settlement rate of that day (on which Forward hedge is set up by) for a Futures contract with requisite expiry is recorded. On the date of lifting the hedge on Futures, the settlement rate of that day is used to square off the hedge. The brokerage charge on Futures lot is taken to be Rs. 10 per contract. This is based on prevailing brokerage rates based on interaction with intermediaries and also advertisement floated in the media.

The Options hedge is set by buying an Option with the same expiry as that of the Futures Contract. The settlement price/premium on the day of initiating the hedge is taken as the buying price for the Option. An exporter will buy a Put option and importer would buy a

Call option. It is pertinent to note that in India Options are available only on USD-INR pair. The realized exchange rate formula has already been mentioned supra.

Charges setting up Forward hedge include the bank charges and commission. Based on the information received from the exporter it has been taken to be Rs. 1700 per transaction/contract. Besides this, the bank charges 0.015% of the conversion value on the date of actual receipt of foreign currency. For the exchange traded derivatives, Securities Transaction Tax (STT) is not applicable to currency derivatives (unlike equity derivatives). Transaction charges are applicable to exchange traded currency derivatives. This is taken to be 0.0016% of the transaction value. It is based on the average of transaction charges information available from <http://www.chittorgarh.com> for five brokers/intermediaries. The transaction charges include the exchange turnover and clearing charges. SEBI charges a turnover fee of 0.0002% (Rs. 20 per crore of turnover). The stamp duty is taken at 0.002% of the transaction value. The service tax (pre GST period) is taken at 15%.

Data Analysis

To test the hypotheses above data was collected and a paired t-test was carried out for exchange rates realized using the Currency Forwards (OTC) and exchange traded currency derivatives. The data and results are as follows:

Sr. No.	Hypothesis	t-observed	t-critical (one tail) $\alpha=0.05$	Result
1	$\mu_{\text{diff-Fut-Forw-US\$-expo}} = 0$ $\mu_{\text{diff-Fut-Forw-US\$-expo}} > 0$ (Data from Table – 1)	3.90081	1.6828	Null hypothesis is rejected ; the Currency Futures hedge provides a better (higher) rate, compared to Currency Forwards for the exporter for US\$ exposure

2	$\mu_{\text{diff-Opt-Forw-US\$-expo}} = 0$ $\mu_{\text{diff-Opt-Forw-US\$-expo}} > 0$ (Data from Table-2)	2.3472	1.6909	Null hypothesis is rejected ; the Currency Option hedge provides a better (higher) rate, compared to Currency Forwards for the exporter for US\$ exposure
3	$\mu_{\text{diff-Fut-Forw-US\$-impo}} = 0$ $\mu_{\text{diff-Fut-Forw-US\$-impo}} < 0$ (Data from Table – 3)	-11.074	-1.7138 (for left-tailed test)	Null hypothesis is rejected ; the Currency Futures hedge provides a better (lower) rate, compared to Currency Forwards for the importer for US\$ exposure
4	$\mu_{\text{diff-Opt-Forw-US\$-impo}} = 0$ $\mu_{\text{diff-Opt-Forw-US\$-impo}} < 0$ (Data from Table – 4)	-10.5784	-1.7138	Null hypothesis is rejected ; the Currency Option – Call hedge provides a better (lower) rate, compared to Currency Forwards for the importer for US\$ exposure
5	$\mu_{\text{diff-Fut-Forw-Euro-expo}} = 0$ $\mu_{\text{diff-Fut-Forw-Euro-expo}} > 0$ (Table-5)	7.0756	1.6955	Null hypothesis is rejected ; the Currency Futures hedge provides a better (higher) rate, compared to Currency Forwards for the exporter for EURO exposure

Conclusion

The data analyzed highlights the fact that the exchange traded currency derivatives viz. Currency Futures and Currency Options provide better realization of exchange rates vis-à-vis the OTC products i.e. the Currency Forwards. The t-test carried out shows better (higher) effective realization of US\$ receivable for the Currency Futures and Currency Options hedge for an exporter when compared with traditional hedging through Forwards. For the importer too a better exchange rate (lower) is realized using the Futures and Options compared to Forwards. For the receivable in EURO too the exchange rate realized in the Futures and Options is better than the rate realized in EURO forwards. So, in effect the exchange traded currency derivative score over the traditional Forwards. This is pointer to the fact that business entities who are still largely using the traditional

OTC products should consider exchange traded currency hedging products as part of their risk management strategy (involving foreign currency risk). The objective of RBI in introducing the exchange traded products in India seems to meet their objective of providing a transparent and cost effective hedging alternative to the traditional products.

Limitation(s)

- The data has been collected from the business entities in and around Vadodara only, so there has been a geographical limitation.
- The data on EURO Forwards for importer were not available at the time of doing this research.
- Currency Options are available only on US\$-INR pair, therefore comparison for EURO Forwards can only be done

with EURO Futures (and not Options)

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Appendix

Table-1 US\$ receivable exposure for exporter (Currency Futures v/s Currency Forwards)

Foreign Currency Bill Receivable (US \$ Amount)	Date of Initiating the hedge	Date of Lifting the hedge	Rate realized in Forwards hedge	Rate realized in Futures Hedge
80,000	7-Apr-14	25-Apr-14	59.91476	60.38806
80,000	7-Apr-14	5-May-14	59.91476	60.44871
47,000	12-Jun-14	4-Jul-14	59.22494	59.2684
40,000	1-Aug-14	22-Aug-14	60.98834	61.28261
40,000	1-Aug-14	25-Aug-14	60.98834	61.27931
40,000	1-Aug-14	1-Sep-14	60.98834	61.35525
20,000	8-Aug-14	10-Oct-14	61.9232	61.82686
19,000	16-Oct-14	22-Oct-14	61.30632	61.94371
20,000	8-Aug-14	27-Oct-14	61.9232	62.03344
20,000	8-Aug-14	12-Nov-14	62.36063	62.16156
19,000	16-Oct-14	13-Nov-14	61.30632	62.16909
20,000	8-Aug-14	18-Nov-14	62.36063	62.32825
20,000	8-Aug-14	21-Nov-14	62.36063	62.27458
20,000	8-Aug-14	2-Jan-15	62.73808	62.699
50,000	3-Nov-14	2-Jan-15	61.85172	61.85315
20,000	8-Aug-14	5-Jan-15	62.73808	62.86057
50,000	3-Nov-14	9-Jan-15	61.85172	61.8467
20,000	8-Aug-14	29-Jan-15	63.248	63.25023
20,000	8-Aug-14	13-Feb-15	63.65794	63.17838
20,000	8-Aug-14	20-Mar-15	64.03788	63.47436
50,000	16-Oct-15	2-Nov-15	64.82627	64.89805
28,000	21-Jan-16	11-Feb-16	67.8291	68.26071
30,000	21-Jan-16	24-Mar-16	68.1631	68.05786
30,000	21-Jan-16	24-Mar-16	68.1631	68.49128
55,000	22-Jan-16	27-Apr-16	68.5588	68.53822
35,000	18-Apr-16	11-May-16	66.57393	66.69636
35,000	18-Apr-16	13-May-16	66.57393	67.00488
35,000	18-Apr-16	19-May-16	66.57393	67.06168
42,000	25-May-16	30-Jun-16	67.56938	67.73959
42,000	25-May-16	19-Jul-16	67.56938	67.96946
40,000	25-May-16	2-Aug-16	67.99729	68.04172
67,000	25-May-16	4-Aug-16	67.87694	67.90929
67,000	25-May-16	5-Aug-16	67.87694	68.16412
67,000	25-May-16	12-Aug-16	67.87694	68.15717
40,000	25-May-16	16-Aug-16	67.99729	68.3846
50,000	29-Mar-17	6-Apr-17	64.78628	64.9009

50,000	29-Mar-17	7-Apr-17	64.78628	64.89901
50,000	29-Mar-17	10-Apr-17	64.78628	64.88518
50,000	29-Mar-17	11-Apr-17	64.78628	65.10861
50,000	29-Mar-17	12-Apr-17	64.78628	65.04008
50,000	29-Mar-17	13-Apr-17	64.78628	65.04553
50,000	29-Mar-17	17-Apr-17	64.78628	64.89496

Table-2 US\$ receivable exposure for exporter (Currency Option – PUT v/s Currency Forwards)

Foreign Currency Bill Receivable/ Payable (US\$ Amount)	Date of Initiating the hedge	Date of Lifting the hedge	Rate realized in Forwards hedge	Rate realized in Options Hedge
47,000	12-Jun-14	19-Jun-14	59.22494	59.6662
47,000	12-Jun-14	17-Jun-14	59.22494	59.84731
80,000	7-Apr-14	21-Apr-14	59.91476	60.38767
40,000	1-Aug-14	3-Sep-14	60.98834	60.52642
40,000	1-Aug-14	19-Aug-14	60.98834	60.72149
40,000	30-Sep-14	23-Oct-14	61.61825	61.14704
40,000	1-Aug-14	7-Aug-14	60.98834	61.20445
40,000	30-Sep-14	30-Oct-14	61.61825	61.257
40,000	30-Sep-14	3-Nov-14	61.61825	61.28321
40,000	30-Sep-14	5-Nov-14	61.61825	61.29082
19,000	16-Oct-14	7-Nov-14	61.30632	61.32898
19,000	16-Oct-14	27-Oct-14	61.30632	61.42749
19,000	16-Oct-14	3-Nov-14	61.30632	61.46973
19,000	16-Oct-14	17-Nov-14	61.30632	61.595
50,000	3-Nov-14	2-Dec-14	61.53426	61.60154
50,000	3-Nov-14	10-Dec-14	61.53426	61.93865
50,000	3-Nov-14	23-Dec-14	61.53426	63.18745
16,000	30-Mar-15	18-May-15	62.67683	63.2066
16,000	30-Mar-15	13-May-15	62.67683	63.42543
33,000	15-Oct-15	27-Oct-15	64.66878	64.87553
33,000	15-Oct-15	21-Oct-15	64.66878	64.993
50,000	16-Oct-15	13-Nov-15	64.82627	65.78963
33,000	15-Oct-15	9-Nov-15	64.66878	66.10739
35,000	18-Apr-16	27-Apr-16	66.57393	66.5121
60,000	8-Jan-16	27-Jan-16	66.81414	67.55813
28,000	21-Jan-16	27-Jan-16	67.8291	67.85527
28,000	21-Jan-16	29-Jan-16	67.8291	67.86483
28,000	21-Jan-16	11-Feb-16	67.8291	68.20804
47,000	12-Jun-14	30-Jun-14	59.22494	59.49318
47,000	12-Jun-14	15-Jul-14	59.22494	59.52713
80,000	7-Apr-14	6-May-14	59.91476	59.76598
40,000	1-Aug-14	27-Aug-14	60.98834	60.49865

80,000	7-Apr-14	22-Apr-14	59.91476	60.50636
40,000	1-Aug-14	1-Sep-14	60.98834	60.53003
40,000	1-Aug-14	26-Aug-14	60.98834	60.53665

Table-3 US\$ payable exposure for importer (Currency Futures v/s Currency Forwards)

Foreign Currency Bill Payable (US\$ Amount)	Date of Initiating the hedge	Date of Lifting the hedge	Rate realized in Forwards hedge	Rate realized in Futures Hedge
158,000	9-Dec-16	16-Dec-16	67.83093	67.61165
75,000	12-Jan-17	27-Jan-17	68.34291	68.15139
49,000	12-Jan-17	30-Jan-17	68.37494	68.17166
145,000	12-Jan-17	6-Feb-17	68.39198	68.39397
104,000	12-Jan-17	21-Feb-17	68.54662	68.56433
50,000	29-Mar-17	31-Mar-17	65.63384	64.9541
50,000	29-Mar-17	3-Apr-17	65.63384	65.04083
50,000	29-Mar-17	5-Apr-17	65.63384	65.09675
50,000	29-Mar-17	6-Apr-17	65.63384	65.04796
50,000	29-Mar-17	7-Apr-17	65.63384	65.04156
50,000	29-Mar-17	10-Apr-17	65.63384	65.02999
50,000	29-Mar-17	11-Apr-17	65.63384	65.25342
50,000	29-Mar-17	12-Apr-17	65.63384	65.1849
50,000	29-Mar-17	13-Apr-17	65.63384	65.18585
50,000	29-Mar-17	17-Apr-17	65.63384	65.042
50,000	29-Mar-17	18-Apr-17	65.63384	65.11053
50,000	29-Mar-17	19-Apr-17	65.63384	65.25218
50,000	29-Mar-17	20-Apr-17	65.63384	65.21974
50,000	29-Mar-17	21-Apr-17	65.63384	65.22876
50,000	29-Mar-17	24-Apr-17	65.63384	65.2206
50,000	29-Mar-17	25-Apr-17	65.63384	65.23381
50,000	29-Mar-17	26-Apr-17	65.63384	65.19598
50,000	29-Mar-17	27-Apr-17	65.63384	65.24762
50,000	29-Mar-17	28-Apr-17	65.63384	65.21664

Table-4 US\$ payable exposure for importer (Currency Option - Call v/s Currency Forwards)

Foreign Currency Bill Payable (US\$ Amount)	Date of Initiating the hedge	Date of Lifting the hedge	Rate realized in Forwards hedge	Rate realized in Options Hedge
158,000	9-Dec-16	16-Dec-16	67.83093	67.91035

75,000	12-Jan-17	27-Jan-17	68.34291	68.38028
49,000	12-Jan-17	30-Jan-17	68.37494	68.17548
145,000	12-Jan-17	6-Feb-17	68.39198	67.90914
104,000	12-Jan-17	21-Feb-17	68.54662	67.72022
50,000	29-Mar-17	31-Mar-17	65.63384	64.95324
50,000	29-Mar-17	3-Apr-17	65.63384	65.15066
50,000	29-Mar-17	5-Apr-17	65.63384	65.12067
50,000	29-Mar-17	6-Apr-17	65.63384	64.80187
50,000	29-Mar-17	7-Apr-17	65.63384	64.50747
50,000	29-Mar-17	10-Apr-17	65.63384	64.74969
50,000	29-Mar-17	11-Apr-17	65.63384	64.91819
50,000	29-Mar-17	12-Apr-17	65.63384	64.9724
50,000	29-Mar-17	13-Apr-17	65.63384	64.7484
50,000	29-Mar-17	17-Apr-17	65.63384	64.66852
50,000	29-Mar-17	18-Apr-17	65.63384	64.81213
50,000	29-Mar-17	19-Apr-17	65.63384	64.95893
50,000	29-Mar-17	20-Apr-17	65.63384	64.91804
50,000	29-Mar-17	21-Apr-17	65.63384	64.93964
50,000	29-Mar-17	24-Apr-17	65.63384	64.79656
50,000	29-Mar-17	25-Apr-17	65.63384	64.65476
50,000	29-Mar-17	26-Apr-17	65.63384	64.43187
50,000	29-Mar-17	27-Apr-17	65.63384	64.49867
50,000	29-Mar-17	28-Apr-17	65.63384	64.60278

Table-5EURO receivable exposure for exporter (Currency Futures v/s Currency Forwards)

Foreign Currency Bill Receivable (EURO Amount)	Date of Initiating the hedge	Date of Lifting the hedge	Rate realized in Forwards hedge	Rate realized in Futures Hedge
15,000	1-Aug-14	22-Sep-14	82.36679	82.57575
15,000	1-Aug-14	1-Oct-14	82.36679	82.94804
15,000	1-Aug-14	10-Oct-14	82.36679	82.5781
15,000	1-Aug-14	13-Oct-14	82.36679	82.69548
15,000	1-Aug-14	16-Oct-14	82.36679	83.20269
15,000	1-Aug-14	20-Oct-14	82.36679	82.90916
22,500	8-Aug-14	28-Oct-14	83.13946	83.6067
78,500	8-Aug-14	25-Nov-14	84.87811	84.32098
78,500	8-Aug-14	15-Dec-14	84.87811	85.03786
32,000	30-Jan-15	5-Feb-15	69.99137	70.17744
32,000	30-Jan-15	11-Feb-15	69.99137	70.59605
32,000	30-Jan-15	18-Feb-15	69.99137	70.19424
13,000	4-Jun-15	9-Jun-15	71.90092	72.71422
13,000	4-Jun-15	18-Jun-15	71.90092	72.59057

13,000	4-Jun-15	30-Jun-15	71.90092	72.6415
13,000	4-Jun-15	2-Jul-15	71.90092	72.87174
13,000	4-Jun-15	3-Jul-15	71.90092	72.87776
40,000	30-Mar-15	8-Apr-15	67.46737	67.64066
40,000	30-Mar-15	22-Apr-15	67.46737	67.99614
40,000	30-Mar-15	24-Apr-15	67.46737	68.46531
40,000	30-Mar-15	29-Apr-15	67.46737	69.31053
25,000	16-May-15	28-May-15	71.97619	72.8644
25,000	16-May-15	12-Jun-15	71.97619	73.54449
25,000	16-May-15	22-Jun-15	71.97619	73.23789
42,000	1-Jul-15	9-Sep-15	71.32382	71.81093
42,000	1-Jul-15	22-Sep-15	71.32382	71.56428
42,000	1-Jul-15	28-Sep-15	71.32382	72.36014
50,000	29-Jan-16	28-Apr-16	74.97225	74.93386
50,000	29-Jan-16	2-May-16	74.97225	75.35399
50,000	29-Jan-16	4-May-16	74.97225	75.27408
50,000	29-Jan-16	11-May-16	74.97225	75.52677
50,000	29-Jan-16	19-May-16	74.97225	75.6739

t-Test: Paired Two Sample for Means (Table-1 data)		
	Futures Rate	Forwards Rate
Mean	64.47789304	64.31462075
Variance	7.877759362	7.830610177
Observations	42	42
Pearson Correlation	0.995320323	
Hypothesized Mean Difference	0	
df	41	
t Stat	3.900817901	
P(T<=t) one-tail	0.000174389	
t Critical one-tail	1.682878003	
P(T<=t) two-tail	0.000348779	
t Critical two-tail	2.019540948	

t-Test: Paired Two Sample for Means (Table 2 -data)		
	Options Rate	Forwards Rate
Mean	62.4895539	62.28390796
Variance	7.365262933	6.665579254
Observations	35	35

Pearson Correlation	0.982075045	
Hypothesized Mean Difference	0	
df	34	
t Stat	2.347275304	
P(T<=t) one-tail	0.012436397	
t Critical one-tail	1.690924198	
P(T<=t) two-tail	0.024872794	
t Critical two-tail	2.032244498	

t-Test: Paired Two Sample for Means (Table- 3 data)		
	Futures Rate	Forwards Rate
Mean	65.7790088	66.18876345
Variance	1.610850856	1.233957343
Observations	24	24
Pearson Correlation	0.99724049	
Hypothesized Mean Difference	0	
df	23	
t Stat	-11.07412815	
P(T<=t) one-tail	5.39159E-11	
t Critical one-tail	1.713871517	
P(T<=t) two-tail	1.07832E-10	
t Critical two-tail	2.068657599	

t-Test: Paired Two Sample for Means (Table - 4 data)		
	Options Rate	Forwards Rate
Mean	65.47083217	66.18876345
Variance	1.827252662	1.233957343
Observations	24	24
Pearson Correlation	0.9825189	
Hypothesized Mean Difference	0	
df	23	
t Stat	-10.57849766	
P(T<=t) one-tail	1.3091E-10	
t Critical one-tail	1.713871517	
P(T<=t) two-tail	2.6182E-10	
t Critical two-tail	2.068657599	

t-Test: Paired Two Sample for Means (Table -5 data)		
	Futures Rate	Forward Rate
Mean	75.31548919	74.72518457
Variance	30.15817393	32.34920762
Observations	32	32
Pearson Correlation	0.997049503	
Hypothesized Mean Difference	0	
df	31	
t Stat	7.075627075	
P(T<=t) one-tail	3.00462E-08	
t Critical one-tail	1.695518742	
P(T<=t) two-tail	6.00924E-08	
t Critical two-tail	2.039513438	

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