Chapter 3 – Research Methodology

3.1 Objective

Post liberalization in the 1990s, the flow of foreign capital across the Indian border significantly increased. There is also a substantial rise in cross border trade. This expansion in trade has been welcomed by the industry, but with this have emerged certain challenges too. One of them has been to manage the risk arising from 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 menu of hedging products and consequently, 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 the cost effective alternative has indeed materialized. The review of 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 clues to business entities regarding the relative efficacy of exchange-traded derivatives. It is pertinent to note here that a majority of hedging is still undertaken through Forwards in the currency market. The turnover in the Futures and Options has increased over the years, but still is only a small percentage of currency derivatives turnover.

3.2 Methodology

The idea of hedging a transaction exposure is to bring in certainty about the exchange rate for the currency that will be paid or received in the future, so as to achieve control over cash flows. 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. In contrast, the exporter is faced with the risk of a weakening foreign currency and looks 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 work 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 are required. The Forward rates quoted by banks to SME exporters or importers forms the basis of comparison. Data from exporters over horizon of three years has been collected. The method of comparison, especially the design of notional hedges, is explained below.

An exporter who has shipped goods overseas is expecting a payment in future, say two months hence. To hedge this, he would have sold the currency in the Forward market to a bank at the rate quoted by the bank. The data on Forward transactions undertaken by the business entity were collected. Since a firm is very likely to hedge a specific receipt or payment with one particular type of a derivative contract,the approach in this research endeavour, is to construct a concurrent notional hedge in exchange-traded derivatives, in orderto facilitate comparison with actual outcome involving forwards. That is, it is assumed that a 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 span the same time period (tenure) of the Forward. An Option's 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 MTM 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, then the deficit is assumed to be paid in order to restore the margin deposit to the original level. In case there is a profit on the Futures position the excess amount (over and above the margin requirement) is deemed transferred to the client's account. This implies that, for setting up a Futures hedge, there is carrying 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 the 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 off 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 rates very close to the inter-bank rates. The spot rate assumed is with a difference of five paise 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 paise less than the rate available at xe.com and five paise more for buying foreign currency. This adjustment is made to reflect the difference that exists between the inter-bank rates and retail rates. Therefore the effective rate notionally realized in the Currency Futures hedge, for exporters, would be equal to: [Spot rate + (-) gain (loss) on Futures position – charges (brokerage, SEBI turnover charges, stamp duty, transaction charges, and service tax) - interest cost on financing the margin].

The parallel 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 the 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 at the end of which the foreign currency is expected to be received. On the date of 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 effective rate notionally realized would be equal to: [Spot rate + (-) gain (loss) on Options position – charges (brokerage, SEBI turnover charges, stamp duty, transaction charges, and service tax) – 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.

An importer would buy Forward cover in order to hedge against foreign currency appreciation. To set up a comparable hedge in exchange-traded derivatives, the importer would buy the Currency Futures with an expiry which coincides with 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 the 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 (brokerage, SEBI turnover charges, stamp duty, transaction charges, and service tax) + cost of financing the margin].

For setting up a hedge using Options the importer would buy a Call Option on the foreign currency with a strike price near to exchange rate contracted 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 (brokerage, SEBI turnover charges, stamp duty, transaction charges, and service tax) + cost of financing the premium].

The foregoing methodology requires operative definition of terms used there in. These terms are explained below:

Expiry of Futures and Options: The expiry date refers to the last day on which the derivative contract would be traded on the exchange. The expiry for setting up the notional hedge is selected in such a way that it covers the receipt/payment date. For e.g., if the exporter is expecting a foreign currency receipt on say, May 29 and Currency Futures expiry for the May contract is earlier, say, May 27, then the Futures hedge would be set up using the June Futures.

Margin: Before taking a position in the Currency Futures segment, a deposit of money is required to be made to the exchange. This is called the margin. It is prescribed as percentage of the exposure collected by the exchange. In this research work, the margin is reckoned to be 5% of the exposure. This is based on feedback received from the brokers who offer Futures trading. A margining system constitutes the safety mechanism for a derivatives exchange against default by participants.

Cost of financing the margin: The funds utilized for initiating a derivatives position come at a cost. This is taken to be equal to the interest cost of availing working capital finance for the SME. Based on the discussion with the accounts personnel in an SME this is imputed at 12.5% p.a.

Mark-to-market: After the initial position is created, it is monitored on a daily basis by comparing the opening price to settlement prices of the day. For the long Futures position if the settlement price for the day is less than the Futures price, there is a loss on the position. This loss has to be made good and the margin restored to the initial level. Similarly for a short position in Futures there would be a MTM loss if the settlement price is above the

Futures price. This loss is to be made good by depositing additional money. In case the there is profit in the MTM position the same gets transferred to the hedger who has gained.

3.3 Hypotheses Formulation

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

Q1) Does hedging with Futures yield a better exchange rate compared to Forwards used for hedging US$ exposures by an exporter ?

H_0: The mean difference in the effective exchange rate realized by an exporter under the Futures hedge and Forward contracts for hedging US$ exposures is nil.

H_1: The mean difference in the exchange rates realized by an exporter hedging US$ exposures with Futures and Forward contracts is positive.

Alternatively stated,

H_0: $\mu_{\text{diff-Fut-Forw}}$ (US$ receivable) $= 0$

H_1: $\mu_{\text{diff-Fut-Forw}}$ (US$ receivable) > 0

$\mu_{\text{diff-Fut-Forw}}$ (US$ receivable) is the mean difference between the exchange rate realized using the actual Forward hedge and the notional Futures hedge for US$ receivable.

Q2) Does hedging by an exporter with Options compared to Forwards for US$ exposures yield a better exchange rate?

H_0: The mean difference in the exchange rates realized by an exporter hedging US$ exposures with Options and Forward contracts is nil.

H_1: The mean difference in the exchange rates realized by an exporter under the Options hedge and the Forwards for hedging US$ exposures is positive.

Alternatively stated,

H_0: $\mu_{\text{diff-Opt-Forw}}$ (US\$ receivable) $= 0$

H_1: $\mu_{\text{diff-Opt-Forw}}$ (US\$ receivable) > 0

$\mu_{\text{diff-Opt-Forw}}$ (US\$ receivable) is the mean difference between the exchange rate realized under the actual Forward hedge and the notional Option hedge for US\$ receivable.

Q3) Does hedging with Futures yield a better exchange rate compared to Forwards for an importer hedging US\$ exposures?

H_0: The mean difference in the exchange rates realized by an importer hedging US\$ exposures with Futures and Forward contracts is nil.

H_1: The mean difference in the exchange rates realized under the Futures and Forward contracts hedges on US\$ exposures by an importer is negative.

Alternatively stated,

H_0: $\mu_{\text{diff-Fut-Forw}}$ (US\$ payable) $= 0$

H_1: $\mu_{\text{diff-Fut-Forw}}$ (US\$ payable) < 0

$\mu_{\text{diff-Fut-Forw}}$ (US\$ payable) is the mean difference between the exchange rate realized using the notional Futures hedge and the actual Forward hedge for US\$ payable.

Q4) Does hedging with Options yield a better exchange rate compared to Forwards for hedging US\$ exposure for an importer?

H_0: The mean difference in the exchange rates realized by an importer on US\$ exposures hedged with Options and Forwards is nil.

H_1: The mean difference in the exchange rate realized by an importer under the Options hedge and Forward contracts for hedging US\$ exposures is negative.

Alternatively stated,

H_0: $\mu_{\text{diff-Opt-Forw}}$ (US\$ payable) $= 0$

H_1: $\mu_{\text{diff-Opt-Forw}}$ (US\$ payable) < 0

$\mu_{\text{diff-Opt-Forw}}$ (US\$ payable) is the mean difference between the exchange rate realized using a notional Call Option hedge and the actual Forwards hedge for US\$ payable.

Q5) Does hedging with Futures yield a better exchange rate compared to Forwards for hedging inward export receipt Euro exposures?

H_0: The mean difference in the exchange rates realized under the Futures and Forward hedges for hedging inward Euro exposures is nil.

H_1: The mean difference in the exchange rates realized under the Futures hedge and Forward hedges for inward Euro exposures is positive.

Alternatively stated,

H_0: $\mu_{\text{diff-Fut-Forw}}$ (Euro receivable) $= 0$

H_1: $\mu_{\text{diff-Fut-Forw}}$ (Euro receivable) > 0

$\mu_{\text{diff-Fut-Forw}}$ (Euro receivable) is the mean difference between the exchange rate realized using the Futures hedge and Forwards hedge for Euro receivable.

3.4 Data Collection

The comparison of Forwards hedges with Futures hedges requires data on the rate offered by banks to SMEs in the OTC market. These data are not published and therefore not available in the public domain. The researcher approached a few SMEs and four of them have provided data on forwards. The turnover of these SMEs is in the range of Rupees ten to twelve crores per annum. Data on Forward rates offered by a leading public sector bank and a private sector bank were obtained. The data span the period from 2014 to 2017. Nine hundred and fifteen observations were recorded based on the data collected. These included rates for two currencies viz., US$ and Euro. 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 involving Futures, the data were collected from NSE's website www.nseindia.com .   To initiate the hedge, the settlement rate on a Futures contract on the same day as which the Forward hedge was set up with the requisite expiry, is recorded. On the date of lifting the hedge on Futures, the settlement rate of that day is used to notionally square off the hedge. The brokerage charge on the Futures lot is taken to be Rs. 10 per contract.

The Options hedge is set by notionally 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 on the foreign currency and an importer would buy a Call option. The realized exchange rate formula has already been mentioned supra.

Charges for setting up a Forward hedge include bank charges and commission. Based on the information received from the exporter it has been taken at Rs. 1700 per transaction. Besides

this, the bank charges 0.015% of the conversion value on the date of actual receipt of the 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 for which information was obtained 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 Rs. 10 million of turnover). The stamp duty is taken at 0.002% of the transaction value. The service tax (pre GST period) is taken at 15%.

An illustration is provided for calculation of exchange rate realized by an exporter.The related data are in Appendix – 1. The details of transaction at observation no. 2 in Table 1A - 1 are:

The exporter has 40,000 US$ receivable on 30-09-14. To hedge this, the bank has offered a Forward with rate of US$1 = Rs. 61.67. The exporter can sell 40,000 US$ to the Bank at the Forward rate on any day between 10-10-2014 and 10-11-2014 (both days included). The exporter booked this Forward contract bearing no. 0506314FP0000299 on 30-09-14. As informed by the exporter, the bank charges Rs. 1700 per transaction. This includes charges for booking the contract, commission, and stamp duty. In addition the bank charges 0.015% of the contract value i.e. 0.015% of Rs. 24, 66,800 (40,000US$ * 61.67) = Rs. 370.02. The amount on INR realized by the exporter would be Rs. 24, 66,800 – 1700 – 370.02 = Rs. 24,64,729.98. Therefore the exchange rate realized by exporter using Forward hedge is Rs. 24,64,729.98 / 40,000 US$ = Rs. 61.6182 / US$. This rate would be realized on any day between 10-10-2014 and 10-11-2014 (both days included) under the Forward hedge.

For setting up the notional parallel hedge with Futures, data were collected from NSE's website www.nseindia.com .   To initiate the hedge, the settlement rate of a Futures contract (on the date on which the Forward hedge is set up) 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 the Futures lot is taken to be Rs. 10 per contract. This is

based on the then prevailing brokerage rates information based on interaction with intermediaries. The website of a leading broker 5paisa.com also mentions a brokerage of Rs. 10 per order. For the above mentioned transaction 40 Futures contracts (each with lot size of 1000 US$) and expiring 26-Nov-14 are sold at a price of Rs. 62.4875 / US$ on 30-Sep-2014. Initial margin at 5% of contract value for Rs. 1, 24,975 (5% * 40,000 * 62.4875) is posted with the exchange. The short Futures hedge is lifted on 10-Nov-2014. The cost of financing the margin is taken to be the cost of working capital finance. As informed by the exporter it is 12.5% p.a. The working of mark-to-market and margin finance cost is provided in Appendix 4. The cost of financing margin from 30-Sep-2014 till 10-Nov-2014 is worked out at Rs. 1426.93. The Futures are squared off at price of Rs. 61.6925. This leads to gain of Rs. 31,800 [(62.4875 – 61.6925) * 40,000]. Brokerage is Rs. 400 (Rs. 10 per Lot * 40). Other charges are:

- Transaction Charge levied at 0.0016% of turnover. This is Rs. 79.475 [(0.0016% * (62.4875+61.6925) * 40,000)]

- SEBI Turnover Charges levied at 0.0002% on turnover. The charge is Rs. 9.934 [(0.0002% * (62.4875+61.6925) * 40,000)]

- Stamp Duty levied @ 0.002% on turnover i.e. Rs. 99.34 [(0.002% * (62.4875+61.6925) * 40,000)]

- Service Tax @ 15% on brokerage, transaction charges and SEBI Turnover charges. Service Tax amounts to Rs. 73.411 [(15% * (400+79.475 +9.934)]

On 10-11-2014, 40,000 US$ are received and converted to INR at the spot rate of Rs. 61.5305 per US$ totaling Rs. 24, 61,220. The exchange rate realized per US$ is Rs. 62.2732 [(24, 61,220 + 31800 – 400 - 79.475 - 9.934 - 99.34 - 73.411 - 1426.93) / 40,000].

The notional Option's hedge is set up by buying Put 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. Considering the details of the transaction above, a Put option with a Strike of Rs. 61.00 / US$ expiring 26-Nov-2014 is bought at price of Rs. 0.14 per US$ with total premium being Rs. 5,600 (40,000US$ * 0.14). The lot size is 1000 US$ and

therefore forty contracts (40,000US$/1000 US$) of the Put Option are bought. On 10-11-2014, 40,000 US$ are received and converted to INR at the spot rate of Rs. 61.5305 per US$ totaling Rs. 24, 61,220. The Put option position is squared off by selling forty contracts at a premium of Rs. 0.0425 / US$ on 10-11-2014. The loss on the Put hedge is Rs. 3,900 [(0.0425 – 0.14) * 40,000 US$]. Brokerage is Rs. 400 (Rs. 10 per contract * 40). Other charges are:

- Transaction Charge levied at 0.0016% of Premium (Sell + Buy). This is Rs. 0.1168 (0.0016% * (0.14+0.0425) * 40,000)

- SEBI Turnover Charges levied at 0.0002% on turnover. The charge is Rs.0.0146 [(0.0002% * (0.14+0.0425) * 40,000)]

- Stamp Duty levied @ 0.002% on Buying Premium i.e. Rs. 0.146 [(0.002% * (0.14+.0425) * 40,000)]

- Service Tax @ 15% is applicable on brokerage, transaction charges and SEBI Turnover charges. Service Tax amounts to Rs. 60.01 [(15% * (400+0.1168+0.0146)]

Besides these charges cost of financing the premium is considered. For buying the Put options Rs. 5600 is required. The interest/finance cost for forty two days (from 30-9-2014 till 10-11-2014) is Rs. 80.547 (12.5% * 5600 * 42/365). The exchange rate realized per US$ is Rs. 61.4194 [(24, 61,220 - 3,900 – 400 - 0.1168 - 0.0146 - 0.146 - 60.01 - 80.547) / 40,000].

3.5 Data Analysis

Paired t-test is used to test the hypotheses. The difference in the exchange rates realized using an actual Forward hedge and a notional Futures hedge for each transaction is an observation for paired t-test. One-tailed test is applied as the hypotheses are directional. The difference in exchange rates realized using the actual Forward hedge and a notional Option hedge for each transaction is an observation for the paired t-test. For an exporter the alternative hypothesis states that exchange rate realized with a Futures hedge is more than exchange rate realized in with a Forwards hedge. The alternative hypothesis for the exporter also states that the exchange rate realized using an Option hedge is more than the exchange rate realized using a Forward hedge. An importer is at an advantage when the exchange rate realized using a foreign currency hedge is lower. The alternative hypothesis, therefore, states that the exchange rate realized using a Futures hedge compared to a Forward hedge is lower. The alternative hypothesis for the Option hedge states that the exchange rate realized using an Option hedge is lower than that with a Forward hedge.