ForeX Risk Management Stratergies - Rutvij Gondkar

DATA & METHODOLOGY

This study deals with the impact of currency fluctuations on cash flows of IT service providers (who would be receiving foreign currencies), and explores various strategies for managing transaction exposure from this viewpoint. The cash flows for the study have been taken from a sample of one hundred and seventy-three selected projects of different IT companies. The effects of hedging foreign exchange risk using forward currency contracts, currency options, and cross-currency hedging on each of these cash flows were calculated and compared. The objective of the study was to identify which of these strategies not only hedged against foreign exchange risk, but also yielded good returns.

The data for the study was collected through database and financial websites. The research period chosen was Jan. '07 to Dec. '07. The reference date was taken to be 1st January, 2007, and the USD/INR spot rate on the reference date was taken as Rs. 44.20/$.

The following foreign exchange risk management strategies were considered:

Without hedging: This represents the base series of cash flows in INR, when the transaction is not hedged. This is the most risky way of handling international financial exposure. According to this strategy, transactions will take place at the corresponding spot exchange rate. The corresponding spot USD/INR exchange rates in the research period are presented in Table 1.

TABLE 1[1]: Spot USD/INR exchange rates in the research period

Date	USD	EURO
2-Jan-07	44.20	58.53
2-Feb-07	44.10	57.44
1-Mar-07	44.30	58.53
2-Apr-07	43.10	57.64
3-May-07	41.20	56.07
1-Jun-07	40.50	54.51
2-Jul-07	40.70	55.05
1-Aug-07	40.60	55.35
3-Sep-07	40.90	55.79
1-Oct-07	39.70	56.63
1-Nov-07	39.30	56.90
3-Dec-07	39.60	58.04
31-Dec-07	39.40	58.12

Hedging with forward currency contacts: According to this strategy, the trader will enter into forward currency contracts at the beginning of the planning period to hedge the expected cash flows. The forward rates were calculated giving equal weight to Interest Rate Parity and Purchasing Power Parity. Interest rate parity was calculated using the (one month) inter-bank offering rates of MIBOR and LIBOR as at the beginning of the research period, while purchasing power parity was calculated by using inflation rates in India and USA as at the beginning of the research period. The interest rates and inflation rates used for the calculations are shown in Table 2.

TABLE 2: Interest rates and inflation rates in the research period

Date	1 Month LIBOR[2]	1 Month MIBOR[3]	Inflation (India[4])	Inflation (US[5])
1-Jan-07	5.32%	13.70%	6.37%	2.08%
1-Feb-07	5.32%	7.90%	6.69%	2.42%
1-Mar-07	5.32%	6.11%	6.20%	2.78%
1-Apr-07	5.32%	14.42%	5.94%	2.57%
1-May-07	5.32%	8.77%	6.01%	2.69%
1-Jun-07	5.32%	0.78%	5.15%	2.69%
1-Jul-07	5.32%	1.68%	4.42%	2.36%
1-Aug-07	5.32%	0.17%	4.70%	1.97%
1-Sep-07	5.77%	6.12%	3.72%	2.76%
1-Oct-07	5.12%	6.12%	3.36%	3.54%
1-Nov-07	4.71%	6.11%	3.11%	4.31%
1-Dec-07	5.24%	7.88%	3.89%	4.08%
31-Dec-07	4.63%	7.02%	3.83%	4.08%

Hedging with currency options: According to this strategy, the trader will enter into a currency options contract at the beginning of the planning period to hedge the expected cash flows. A series of outflows of foreign currencies can be hedged by buying currency call options, while a series of inflows of foreign currencies can be hedged by buying currency put options. The Black-Scholes model was used to calculate the call/put price using the following formulae:

$$C = -Xe^{-r(T-t)}N(d_2) + Se^{-r_f(T-t)}N(d_1) \text{ and } P = Xe^{-r(T-t)}N(-d_2) - Se^{-r_f(T-t)}N(-d_1),$$

where S represents the spot price, X represents the strike price, $T - t$ represents the time remaining until expiration (expressed as a percent of one year), r represents the continuously compounded risk-free rate of interest for the domestic currency, r_f represents the continuously compounded risk-free rate of interest for the foreign currency, σ represents the annual volatility of spot price (defined as the standard deviation of the short-term returns over one year), $N(.)$ represents the standard normal cumulative distribution function, and d_1 and d_2 are given by the formulae: $d_1 = \frac{\ln\left(\frac{S}{X}\right) + \left(r - r_f + \frac{1}{2}\sigma^2\right).(T-t)}{\sigma.\sqrt{(T-t)}}$ and $d_2 = d_1 - \sigma.\sqrt{(T-t)}$. The strike prices used in the study were set at the exchange rate at the beginning of the planning period. For the purpose of the calculations, the risk-free rates were taken to be 8% (Indian) and 5% (USA), and the standard deviation of the USD/INR spot rate was assumed to be 82.39%.

Cross-currency hedging: According to this strategy, the trader will enter into a contract at the beginning of the planning period specifying that the transactions are to be in a third currency, correlated to the foreign currency. For the purpose of the study, the EURO was chosen as the third currency, as the EURO/INR rates have been less volatile than USD/INR rates in the last few years. The EURO/USD spot rate on the reference date was taken as € 0.757748 /$. The corresponding spot EURO/INR exchange rates in the research period are presented in Table 1.

The realized net cash flows in INR were calculated for each of the sample cash flows, under each of the above risk management strategies. For inflows a profit resulted if the actual receipts were more than expected (i.e. the cash flow which would have resulted if the transaction took place at the spot rate on the reference date), while a loss resulted if the actual receipts are less than expected, whereas for outflows a profit resulted if the actual payments made were less than expected, while a loss resulted if the actual payments made were more than expected. This was applied for each of the sample cash flows under each strategy, and the mean returns and

standard deviation of returns were found out for each strategy. Finally, the different risk management strategies were compared by performing paired-samples t-tests for equality of mean returns.

The sample projects were of two types: fixed-price projects (FPP) and time & materials (T&M) projects. Fixed price projects refer to projects whose cash flows are milestone-based, while time & materials projects refer to projects with fixed regular (monthly) cash flows. It would be expected that FOREX hedging would work better for T&M projects than for FPP projects. In fact, for FPP projects, the calculations and comparisons were performed assuming that the cash flows were received at the expected times of different project milestones.

The sample projects were also categorized into application development (AD) projects and application support (AS) projects. Application development (AD) projects generally tend to be shorter-term projects, with the size of the project varying considerably over the life-cycle of the project (e.g. the team size starts small at the initiation stage, and increases in the development stage and especially the testing stage). Application support (AS) projects are maintenance projects, generally with more regular (monthly) cash flows. Again, it would be expected that FOREX hedging would work better for AS projects than for AD projects.

DATA ANALYSIS & INTERPRETATION

The descriptive statistics of the project-wise cash flows (in INR) under the different FOREX risk management strategies are shown in Table 3.

TABLE 3: Descriptive statistics of the cash flows (in INR) under different risk management strategies

	Minimum	Maximum	Mean	Std. Dev.
Without Hedging	(1,652,262)	19,958,871	2,780,730	3,743,421
Forward Currency Hedging	**(1,732,085)**	**21,921,192**	**3,001,955**	**4,040,890**
Currency Option Hedging	(1,730,310)	21,920,775	2,975,929	4,015,837
Cross-Currency Hedging	(1,671,072)	21,049,890	2,898,370	3,899,867

It was found that the forward currency hedging strategy yielded the highest mean cash flows (in INR), followed by the currency options hedging strategy, and the cross-currency hedging strategy. Paired-samples t-tests showed that the differences in mean cash flows (in INR) between different strategies were statistically significant: the forward currency hedging strategy yielded significantly higher mean cash flows (in INR) than all other strategies, and all of the strategies yielded significantly higher mean cash flows (in INR) than the unhedged strategy. It was also found that there were considerable negative cash flows (for about 5% of the projects), which represented projects which were cancelled and refunded at a subsequent point in time; the decreasing trend in the USD/INR exchange rate (as shown in Chart 1) meant that this resulted in an overall loss for the project.

The descriptive statistics of the project-wise cash flows (in INR) under the different FOREX risk management strategies for different project types are shown in Table 4.

TABLE 4: Descriptive statistics of the cash flows (in INR) under different risk management strategies for different project types

Project Type		Without Hedging	Forward Currency Hedging	Currency Option Hedging	Cross-Currency Hedging
FPP	**Mean**	2,811,455	**3,027,346**	3,011,573	2,933,114
	Std. Dev.	4,365,912	**4,708,947**	4,692,717	4,553,621
T&M	**Mean**	2,751,731	**2,977,990**	2,942,288	2,865,578
	Std. Dev.	3,067,493	**3,316,609**	3,278,433	3,188,582
Total	**Mean**	2,780,730	**3,001,955**	2,975,929	2,898,370
	Std. Dev.	3,743,421	**4,040,890**	4,015,837	3,899,867

It was found that the forward currency hedging strategy yielded the highest mean cash flows (in INR), followed by the currency options hedging strategy, and the cross-currency hedging strategy, for both FPP and T&M projects. Further, the mean cash flows and the variation in cash flows were found to be higher under each of the strategies for FPP projects than for T&M projects, but these differences were not statistically significant.

The descriptive statistics of the project-wise cash flows (in INR) under the different FOREX risk management strategies for different project categories are shown in Table 5.

TABLE 5: Descriptive statistics of the cash flows (in INR) under different risk management strategies for different project categories

Project Category		Without Hedging	Forward Currency Hedging	Currency Option Hedging	Cross-Currency Hedging
AD	Mean	2,305,817	**2,496,391**	2,478,837	2,488,998
	Std. Dev.	3,245,791	**3,528,599**	3,517,032	3,525,282
AS	Mean	5,729,151	**6,140,662**	6,062,041	6,130,083
	Std. Dev.	5,144,961	**5,482,321**	5,428,390	5,488,033
Total	Mean	2,780,730	**3,001,955**	2,975,929	2,994,120
	Std. Dev.	3,743,421	**4,040,890**	4,015,837	4,039,090

It was found that the forward currency hedging strategy yielded the highest mean cash flows (in INR), followed by the currency options hedging strategy, and the cross-currency hedging strategy, for both AD and AS projects. Further, the mean cash flows and the variation in cash flows were found to be higher under each of the strategies for AS projects than for AD projects, and that these differences were statistically significant.

The descriptive statistics of the percentage gains in the project-wise cash flows (in INR) under the different FOREX risk management strategies over the unhedged strategy are shown in Table 6.

TABLE 6: Descriptive statistics of the % gains under different risk management strategies

	Minimum	Maximum	Mean	Std. Dev.
Forward Currency Hedging	**(4.83%)**	**13.63%**	**4.38%**	27.81%
Currency Option Hedging	(4.72%)	**13.63%**	2.63%	**30.12%**
Cross-Currency Hedging	(1.14%)	11.79%	1.70%	25.28%

It was found that the forward currency hedging strategy yielded the highest mean percentage gain, followed by the currency options hedging strategy, and the cross-currency hedging strategy. Paired-samples t-tests showed that the forward currency hedging strategy yielded significantly higher mean percentage gain than the other strategies, but there was no significant difference between the percentage gain yielded by the currency option hedging strategy and the cross-currency hedging strategy.

The descriptive statistics of the percentage gains in the project-wise cash flows (in INR) under the different FOREX risk management strategies over the unhedged strategy for different project types are shown in Table 7.

TABLE 7: Descriptive statistics of the % gains under different risk management strategies for different project types

Project Type		Forward Currency Hedging	Currency Option Hedging	Cross-Currency Hedging
FPP	Mean	**5.87%**	4.94%	3.23%
	Std. Dev.	5.60%	**6.86%**	4.26%
T&M	Mean	**2.98%**	0.44%	0.25%
	Std. Dev.	38.44%	**41.47%**	35.04%
Total	Mean	**4.38%**	2.63%	1.70%
	Std. Dev.	27.81%	**30.12%**	25.28%

It was found that the forward currency hedging strategy yielded the highest mean percentage gain, followed by the currency options hedging strategy, and the cross-currency hedging strategy for both FPP and T&M projects. Further, the mean percentage gain was found to be higher under each of the strategies for FPP projects than for T&M projects, and that these differences were statistically significant. Also, the variation in percentage gain was found to significantly higher for T&M projects than for FPP projects.

The descriptive statistics of the percentage gains in the project-wise cash flows (in INR) under the different FOREX risk management strategies over the unhedged strategy for different project categories are shown in Table 8.

TABLE 8: Descriptive statistics of the % gains under different risk management strategies for different project categories

Project Category		Forward Currency Hedging	Currency Option Hedging	Cross-Currency Hedging
AD	Mean	**3.80%**	1.95%	1.27%
	Std. Dev.	29.91%	**32.39%**	27.21%
AS	Mean	**7.98%**	6.82%	4.35%
	Std. Dev.	3.23%	**4.03%**	2.68%
Total	Mean	**4.38%**	2.63%	1.70%
	Std. Dev.	27.81%	**30.12%**	25.28%

It was found that the forward currency hedging strategy yielded the highest mean percentage gain, followed by the currency options hedging strategy, and the cross-currency hedging strategy for both AD and AS projects. Further, the mean percentage gain was found to be higher under each of the strategies for AS projects than for AD projects, and that these differences were statistically significant. Also, the variation in percentage gain was found to significantly higher for AD projects than for AS projects.

CHART 1: USD/INR exchange rate trend in the research period