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OPTIMAL HEDGE RATIO AND HEDGE EFFECTIVENESS OF EQUITY AND CURRENCY FUTURES CONTRACTS: EVIDENCE FROM NSE

Mandeep Kaur*, Kapil Gupta**

Abstract *The present study attempts to examine hedging effectiveness of equity and currency futures contracts traded at the National Stock Exchange of India, by taking a sample size of three benchmark indices of equity futures market (NIFTY50, NIFTYIT, and BANKNIFTY) and four currency futures contracts (USD, YEN, EURO, and GBP). For estimating optimal hedge ratios, five constant hedge ratio models and three time-varying hedge ratio models have been used. For estimating hedging effectiveness, two approaches have been used, i.e., variance reduction approach and risk-return approach. The findings of the study indicate that hedging effectiveness is higher in equity futures contracts (more than 96 per cent); in currency futures contracts, it is less than 40 per cent. Another significant finding is that constant hedge ratio models generate superior hedging effectiveness, irrespective of the approach used for estimating hedging effectiveness. Hence, the present study is also an addition to the existing literature that supports superiority of constant hedge ratios over time-varying hedge ratios.*

Keywords: *Hedge Effectiveness, GARCH, Constant Hedge Ratios, Currency Futures, Equity Futures*

JEL Classification: *C22, D82, G14, N25, O16*

INTRODUCTION

Financial risk is an inevitable feature of most of the financial investments, and hedging provides a mechanism whereby financial risk can be mitigated to a large extent. One of the key characteristics of both spot and futures market is that they observe strong covariance in prices due to the presence of the cost-of-carry relationship. Hence, the arrival of new information in the financial market causes contemporaneous change in both cash and futures prices. Hedging involves taking opposite positions in both cash and futures markets simultaneously. Thus, loss from one market is offset by gain in another market, thereby giving protection against price risk. Hence, the ability to cover price risk lies in the fact that there is a presence of strong covariance between cash and futures market, which becomes the essence of efficient hedging.

One of the modern approaches for computation of optimal hedge ratio is the Portfolio Hedging Theory proposed by Johnson (1960) and Stein (1961), which assumes that the hedger prefers a portfolio that optimises his level of risk and return; thus, optimal hedge ratio is the one that minimises portfolio variance. The portfolio hedging theory received a lot of appreciation and was further extended by Ederington (1979), who proposed the first mathematical approach to estimate optimal hedge ratio by regressing cash returns upon futures return using ordinary least square regression. The optimal hedge ratio obtained is known as Minimum-Variance Hedge Ratio (MVHR) and has received huge appreciation by a large body of literature[1] because of its simplicity in applying and understanding.

[1] Malliaris and Urrutia (1991), Deaves (1994), Lien et al. (2002), Lien (2005), Bhargava and Malhotra (2007), Moon et al. (2009), Mandal (2011), and Bonga and Umoetok (2016).

* Assistant Professor (Finance), Department of Management and Hospitality, I. K. Gujral Punjab Technical University, Punjab, India. Email: kaur_mandeep13@ymail.com
** Assistant Professor, Department of Management, I. K. Gujral Punjab Technical University, Punjab, India. Email: kapilfutures@gmail.com

Further, with more advancement in knowledge of characteristics of financial time series, improved models have been suggested by literature to best fit different characteristics of time-series. For instance, Ghosh (1992) observes a co-integrating relationship between cash and future price in the long run, and therefore suggested the VECM method. Similarly, to capture the dynamic and time-varying relationship between spot and futures markets, various models like GARCH, EGARCH, MGARCH, and so on, have been suggested. A plethora of literature[2] observe superior performance of dynamic hedge ratios over constant hedge ratios. Contrary to this, numerous studies (see Lien (2005), Bhargava and Malhotra (2007), Maharaj et al. (2008), Rao and Thakur (2008), Lee and Chien (2010), and Awang et al. (2014)) have found better performance of constant hedge ratios over dynamic hedge ratios. Hence, these studies do not favour the use of highly complicated econometric modelling for estimating optimal hedge ratios.

Furthermore, on the basis of portfolio theory approach, Ederington (1979) proposed a measure of hedging effectiveness according to which hedging effectiveness is computed as a proportionate reduction in standard deviation of returns from hedged portfolio. Ederington's measure to estimate hedging effectiveness is simple to compute and understand, and therefore has been highly appreciated by various empirical studies. However, some studies like that of Howard and D'Antonio (1984) suggests a more realistic approach to estimate hedging effectiveness that also considers expected returns on a hedged portfolio. According to this approach, hedging effectiveness is measured in terms of the ratio of excess expected return on a hedged portfolio to the standard deviation of its returns.

Overall, it is observed that most of the studies have compared constant hedge ratios with time-varying hedge ratios, with the objective of examining their superiority relatively. The results obtained from these studies are mixed. As discussed above, on one hand, voluminous literatures support time-varying hedge ratios, whereas on the other hand, numerous studies have found superior hedging performance of constant hedge ratios. Therefore, one of the objectives of this study is to investigate which optimal hedge ratio model, i.e., constant or time-varying model, is superior in Indian equity and currency futures market. Additionally, the study also attempts to examine hedging effectiveness using two different approaches to hedge, i.e., variance reduction approach and risk-return approach.

[2]See Lypny and Powalla (1998), Moschini and Myers (2002), Choudhary (2003), Floros and Vougas (2004), Yang and Allen (2004), Choudary (2004), Floros and Vougas (2006), Lee and Yoder (2007), Srinivasan (2011), Bekkerman (2011), Kim et al. (2014), Basher and Sadorsky (2016), and Kumar and Bose (2019).

Furthermore, an important motivation of the study is the global market leadership of the National Stock Exchange of India (NSE) in the derivatives segment. Since 2019, NSE has emerged as the world's largest derivative exchange[3]. However, despite explosive trading of currency futures contracts in India, not much extensive literature in this area is available[4]. The focus of a majority of studies in India is to examine hedge effectiveness of equity and currency futures contracts. Therefore, the present study also examines hedging effectiveness of currency futures contracts, in addition to equity futures contracts.

DATABASE AND RESEARCH METHODS

The sample of the study comprises near-month futures contracts of three equity futures being traded on benchmark indices (namely, NIFTY50, NIFTYIT, and BANKNIFTY) and four currency futures (namely, USD, GBP, YEN, and EURO). High liquidity and consistency in trading history have been considered while selecting the sample of the study. The sample period of study has been taken from January 1 2011 to 31 December 31 2018. The sample data has been taken from the official website of the National Stock Exchange of India (i.e., www.nseindia.com).

Research Methods for Estimating Optimal Hedge Ratio

To examine optimal hedge ratios, two frameworks have been used, i.e. constant and dynamic. Under constant hedging framework, optimal hedge ratio has been estimated using five methods, i.e., Naïve, OLS, ARMA-OLS, VAR, and VECM. Under dynamic hedging framework, three methods have been used to estimate optimal hedge ratio, i.e., GARCH, EGARCH, and TARCH. Thus, a total of eight econometric models have been used for estimating optimal hedge ratio. These methods are discussed below:

- *Traditional (Naïve) Hedge Ratio*: It assumes perfect correlation between spot and futures prices. Hence, efficient hedge effectiveness can be achieved by making the same amount of investments in both the markets.
- *Ordinary Least Squares (OLS) Method:* In this method, cash market returns are regressed upon futures returns to estimate optimal hedge ratio (Ederington, 1979).

[3]https://www.thehindubusinessline.com/markets/nse-is-largest-global-exchange-for-derivatives-trading-for-third-year/article64910892.ece

[4]To the best of the researcher's knowledge, only Lingareddy, T. (2013) and Kharbanda and Singh (2020) attempt to examine hedging effectiveness of currency futures contracts in India.

This method is the most widely used for estimating optimal hedge ratio because it is the simplest. It is specified in equation (1):

$$Rs,t = \alpha 0 + \beta 1Rf,t + \mu t \quad (1)$$

In the regression equation (1), Rs,t is the spot returns, Rf,t is the futures returns, α0 is the intercept term, β1 is the optimal hedge ratio, and μt is the residual.

- *Autoregressive Moving Average Ordinary Least Squares (ARMA-OLS):* The optimal hedge ratio obtained as per equation (1) will be biased if the cash and futures returns exhibit serial correlation. Therefore, as per ARMA-OLS model, equation (1) will be modified by incorporating the autoregressive terms of spot market returns, and the resultant equation (2) is as follows:

$$\mathrm{R}_{\mathrm{s,t}} = \alpha_0 + \sum_{i=1}^{p} \alpha_i R_{s,t-i} + \beta_1 R_{f,t} + \varepsilon_t \quad (2)$$

In equation (2), Rs,t-i represents autoregressive terms of cash returns whose order is selected by SIC criteria. Lower the value of SIC, better is the model fit.

- *Vector Autoregression (VAR):* OLS model fails to capture autocorrelation of the error term. This limitation is overcome by the VAR method as it captures autocorrelation of the error term. Thus, optimal hedge ratio estimated by VAR model is considered to be more robust. The equations are as follows:

$$\mathrm{R}_{\mathrm{s,t}} = \sum_{i=1}^{M} \alpha_i R_{s,t-i} + \sum_{j=1}^{N} \beta_j R_{f,t-j} + \varepsilon_{st} \quad (3)$$

$$\mathrm{R}_{\mathrm{f,t}} = \sum_{k=1}^{O} \alpha_k R_{s,t-k} + \sum_{l=1}^{P} \beta_1 R_{s,t-1} + \varepsilon_{ft} \quad (4)$$

- *Vector Error Correction Method (VECM):* Fails to capture long-term cointegration between spot-future prices; however, in reality, when spot-future prices observe long-term cointegration, the optimal hedge ratio tends to be underestimated (Ghosh, 1993). Therefore, the VAR model with an error correction term (known as VECM) is used to capture long-run co-integrating relationship, in addition to capturing short-run lead-lag relationship. The VECM model is specified as follows:

$$\mathrm{R}_{\mathrm{f,t}} = \alpha_{0f} + \sum_{i=1}^{p} \alpha_{if} (F_{t-i} - S_{t-i}) + \sum_{j=1}^{q} \beta_f R_{f,t-j} + \sum_{k=1}^{m} \beta_f R_{s,t-k} + \varepsilon_{ft} \quad (5)$$

$$\mathrm{R}_{\mathrm{s,t}} = \alpha_{0s} + \sum_{i=1}^{p} \alpha_{is} (F_{t-i} - S_{t-i}) + \sum_{l=1}^{n} \beta_s R_{s,t-l} + \sum_{h=1}^{o} \beta_s R_{f,t-h} + \varepsilon_{st} \quad (6)$$

The optimal hedge ratio using VECM can be estimated as a ratio of covariance of μs,t and variance of μft, as computed in the case of the VAR model above.

- *Generalised Autoregressive Conditional Heteroscedasticity (GARCH):* A large body of literature (example, Engle, 1982; Bollerslev, 1987; Myers, 1991; Floros and Vougas, 2004) has found that stock returns exhibit heteroscedasticity, i.e., variance of error term is not constant. Hence, the hedge ratio estimated through the ordinary least square (OLS) method will be invalid. Therefore, Bollerslev (1986) suggested a GARCH (p,q) model that captures the time-varying nature of the returns series. It is presented in equation (7):

$$\mathrm{h}_{\mathrm{t}} = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j} + \upsilon_t \quad (7)$$

In equation (7), ht is the conditional volatility, αi is the coefficient of ARCH term with order i to p, and βj is the coefficient of the GARCH term with order j to q.

- *Exponential Generalised Autoregressive Conditional Heteroscedasticity (EGARCH (p,q)):* The EGARCH model, proposed by Nelson (1991), takes into consideration the asymmetric effects of negative and positive returns and is expressed as follows:

$$\mathrm{h}_{\mathrm{t}} = \gamma_1 + \gamma_2 \left| \frac{\varepsilon_{t-1}}{h_{t-1}} \right| + \gamma_3 \frac{\varepsilon_{t-1}}{h_{t-1}} + \gamma_4 h_{t-1} \quad (8)$$

In equation (8), h_t represents the conditional variance; and γ_1, γ_2, γ_3, and γ_4 represent the constant parameters. If γ_3 is negative and different from zero, it implies that negative shocks generate higher volatility than positive shocks.

- *Threshold Autoregressive Conditional Heteroscedasticity (TARCH (p,q)):* This model tends to segregate the impact of good and bad news to estimate optimal hedge ratio, because a strand of literature (Karpoff (1987) and Veronesi (1999)) finds that the reaction of the investors varies with the type of information received in the market, which generates different levels of volatility. Therefore, the GARCH (p, q) model has been modified to TARCH (p, q) by incorporating the dummy variable in variance equation (7); the resultant equation (9) is as follows:

$$\mathrm{h}_{\mathrm{t}} = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \alpha_k \varepsilon_{t-1}^2 \xi_{t-i} + \sum_{j=1}^{p} \beta_j h_{t-j} + \upsilon_t \quad (9)$$

Thus, optimal hedge ratios shall be estimated using the abovementioned eight optimal hedge ratio models for each of the seven futures contracts understudy.

Research Method for Estimating Hedging Effectiveness

After estimating the optimal hedge ratio(s) using the above-discussed models, their effectiveness has been tested using two different approaches.

Approach 1: Variance Reduction Approach (Ederington, 1979)

According to this approach, hedging effectiveness is measured as a proportionate decline in the variance of hedged portfolio to the unhedged portfolio. Higher the variance reduction, better the hedging effectiveness. Hence, the optimal hedge ratio that reduces the portfolio variance to the maximum extent is considered an efficient hedge ratio. Hedging effectiveness is estimated as follows:

$$\text{Hedge effectiveness} = \frac{\text{Var (U) - Var (H)}}{\text{Var (U)}} \tag{10}$$

Where,

$\text{Var (U)} = \sigma_s^2$

$\text{Var (H)} = \sigma_s^2 + h^{*2}\sigma_f^2 - 2h^*\sigma_{s,f}$

Approach 2: Risk-Reduction Approach (Howard & D'Antonio, 1984)

The approach suggested by Howard and D'Antonio (1984) addresses one of the limitations of the variance reduction approach, that is, it ignores the return component on the hedged/unhedged portfolio. Thus, it suggested a comprehensive measure of hedging effectiveness (λ), which incorporates the return component and computes hedging effectiveness as presented in the following equation:

$$\text{Hedging Effectiveness} = \theta \Big/ \frac{\bar{r}_s - i}{\sigma_s} \tag{11}$$

Where,

$$\theta = \frac{\bar{R}_p - i}{\sigma_p}$$

R_p = expected return from hedged portfolio

σ_s = standard deviation of returns from unhedged portfolio

σ_p = standard deviation of returns from hedged portfolio

i = risk-free rate of return

rs = expected return from unhedged portfolio

ANALYSIS AND DISCUSSION

Descriptive Statistics

The present study involves the analysis of financial time-series to achieve its objectives. Therefore, diagnosing the presence of unit-roots becomes a primary step in the analysis. For this, ADF unit-root test has been applied, and as expected, the price series was found to be non-stationary. Therefore, log of first difference of prices was calculated, and the resultant return series is found to be stationary[5].

The descriptive statistics of returns of spot and futures contracts for all the seven futures contracts under study is presented in Table 1. Overall, the results indicate that returns are not normal, as all futures contracts show excess kurtosis and their coefficient of skewness is negative. These results are further confirmed by the Jarque-Bera test, which indicates that both cash and futures market returns are not normal.

[5]The results of the ADF unit root test have not been reported in the paper, but are available on demand.

Table 1: Descriptive Statistics of Cash and Futures Returns

Market	Symbol	Variables	Count	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
Equity	NIFTY50	Futures	1980	0.000287	0.009970	−0.198879	4.939804	323.4868*
		Cash	1980	0.000287	0.009727	−0.197010	4.861382	298.6495*
	NIFTYIT	Futures	1980	0.000332	0.012448	−0.636017	12.02611	6854.814*
		Cash	1980	0.000331	0.012609	−0.700567	12.27489	7258.906*
	BANKNIFTY	Futures	1980	0.000422	0.014164	0.047986	5.424267	485.8635*
		Cash	1980	0.000421	0.013937	0.090758	5.432967	491.3110*
Currency	USD	Futures	1933	0.000229	0.004702	0.360850	7.786474	1887.187*
		Cash	1933	0.000231	0.005808	0.808434	104.9759	837769.7*
	GBP	Futures	1933	0.000129	0.006115	−0.774306	14.53845	10916.14*
		Cash	1933	0.000126	0.011456	0.506934	436.9271	15165496*
	YEN	Futures	1933	7.43E−05	0.007504	0.295561	6.466128	995.7742*
		Cash	1933	7.23E−05	0.008782	0.697715	67.21654	332291.7*
	EURO	Futures	1933	0.000207	0.009480	16.45255	533.9318	22790982*
		Cash	1933	0.000153	0.008311	0.551575	153.7850	1831303*

*Significant at 1% level of significance.

Optimal Hedge Ratios

The results of optimal hedge ratio are reported in Table 2; they indicate that in equity futures market, coefficients of optimal hedge ratio are not significantly different across different models. The highest coefficient is as suggested by the naïve model, which implies equal investment in both cash and futures market to achieve the most efficient hedge. Further, in the case of equity futures contracts, the coefficient of optimal hedge ratio, estimated using other seven hedge ratio models is more than 95 per cent. In addition, the value of the coefficients is close to each other, which indicates that there lies no significant difference between investments made in futures contracts to achieve efficient hedge using different models.

In the case of currency futures contracts, the coefficient of optimal hedge ratio varies significantly across different models. Apart from the naïve model, highest optimal hedge ratio is suggested by the ARMA-OLS for all four currencies, whereas the lowest optimal hedge ratio is suggested by the VAR for two currency futures contracts (USD and GBP), OLS for YEN, and GARCH for EURO.

Table 2: Optimal Hedge Ratios

Market	Symbol	Optimal Hedge Ratio Models							
		Naive	OLS	ARMA OLS	VAR	VECM	GARCH	EGARCH	TARCH
Equity	**NIFTY50**	1H	0.960812L	0.974874	0.9648321	0.9669077	0.978575	0.983291	0.97920
	NIFTYIT	1H	0.999513	0.998133	0.9994151	0.999079 L	0.999758	0.999046	0.997626
	BANKNIFTY	1 H	0.973164 L	0.983997	0.9771773	0.9771728	0.987283	0.986864	0.986115
Currency	**USD**	1H	0.651657	0.887193	0.6255544 L	0.6283243	0.797373	0.786991	0.835943
	GBP	1H	0.689781	0.947104	0.6744763 L	0.6752571	0.858581	0.884927	0.926793
	YEN	1H	0.736365 L	0.940347	0.7477514	0.74758491	0.860067	0.753515	0.87347
	EURO	1H	0.250565	0.29099	0.2426034	0.2711070	0.228568 L	0.217027	0.222697

L = Lowest Optimal Hedge Ratio, H = Highest Optimal Hedge Ratio

Hedging Effectiveness

Hedging effectiveness is measured under two frameworks: variance reduction framework (suggested by Ederington, 1979) and risk-return framework (suggested by Howard & D'Antonio, 1984).

Under variance-reduction framework, the hedging effectiveness estimated by eight optimal hedge ratios (see Table 3) and the findings indicate that ordinary least square (OLS) hedge ratio provides maximum variance reduction in hedged portfolio. These results are true for all futures contracts (except NIFTYIT) comprising the sample of our study. These are NIFTY50, BANKNIFTY, USD, GBP, YEN, and EURO. The only exception to these results is NIFTYIT, for which the VAR and VECM models provide maximum variance reduction in the hedged portfolio. These results imply that the simple OLS model generates higher hedging effectiveness compared to more sophisticated time-varying models which are difficult to understand and apply. These results are consistent with the findings of Lien et al. (2002), Lien (2005), Bhargava and Malhotra (2007), Moon et al. (2009), Mandal (2011), and Bonga and Umoetok (2016). Further, an important observation is that the efficiency of hedge is greater in equity futures market than currency futures market, as reduction in variance is more than 96 per cent in equity futures market, whereas in the case of the currency futures market, it is less than 40 per cent. These findings indicate that there lies a significant difference in the hedging ability of both equity and currency futures market, even if the latter has higher liquidity than the equity futures market.

Table 3: Hedging Effectiveness under Variance Reduction Framework

Market	Symbol	Hedging Effectiveness							
		Naive	OLS	ARMA OLS	VAR	VECM	GARCH	EGARCH	TARCH
Equity	NIFTY50	0.967358L	0.969011H	0.968789	0.968990	0.968966	0.968662	0.968458	0.968638
	NIFTYIT	0.972648L	0.972648L	0.972648	0.972649H	0.972649H	0.972648L	0.972649	0.972647
	BANKNIFTY	0.976416L	0.97718H	0.977055	0.977177	0.977172	0.976966	0.976979	0.977001

Market	Symbol	Hedging Effectiveness							
		Naive	OLS	ARMA OLS	VAR	VECM	GARCH	EGARCH	TARCH
Currency	USD	0.198359^{L}	0.278045^{H}	0.241579	0.277610	0.277698	0.264064	0.265981	0.255704
	GBP	0.107939^{L}	0.135422^{H}	0.116504	0.135358	0.135364	0.127269	0.124532	0.119368
	YEN	0.344625^{L}	0.395523^{H}	0.365027	0.395422	0.395424	0.384280	0.395298	0.381720
	EURO	−0.649344^{L}	0.081592^{H}	0.079453	0.081513	0.081036	0.080970	0.080140	0.080591

L = Lowest Optimal Hedge Ratio, H = Highest Optimal Hedge Ratio

Further, Table 4 presents the findings of hedging effectiveness under risk-return framework. The results clearly indicate that in all three equity futures contracts, traditional naive hedge ratio generates the highest hedging effectiveness. The results for the currency futures contracts are somewhat mixed. In the case of GBP and YEN, the OLS hedge ratio generates the highest hedging effectiveness. In the case of USD, naive hedge ratio generates the highest hedge effectiveness, whereas in the case of EURO, the GARCH model outperforms. Another significant finding is that the difference between the coefficients of hedging effectiveness estimated by all models is very small. These results are similar to the variance reduction approach. Moreover, negative coefficients for hedging effectiveness have been observed for GBP and EURO futures contracts, which may be attributed to the fact that their market returns is less than the risk-free returns.

Overall, these results indicate that the constant hedge ratio model generates superior hedging effectiveness, irrespective of the approach used for hedging effectiveness. This can be clearly seen from the fact that OLS performs best in equity futures market, whereas naïve performs best in currency futures market. These findings imply that simple and less complicated models give better results compared to complicated and sophisticated models, for estimating hedging effectiveness. These results are consistent with the findings of Alexander et al. (2013).

Table 4: Hedging Effectiveness under Risk-Return Framework

Market	Symbol	Hedging Effectiveness							
		Naive	OLS	ARMA OLS	VAR	VECM	GARCH	EGARCH	TARCH
Equity	**NIFTY50**	1.82497^{H}	1.80876^{L}	1.81465	1.81045	1.81132	1.81619	1.81814	1.81645
	NIFTYIT	1.52695^{H}	1.52682	1.52645	1.52679	1.52670	1.52688	1.52669	1.52632^{L}
	BANKNIFTY	1.33567^{H}	1.33117^{L}	1.3330	1.33162	1.33173	1.33355	1.33348	1.33335
Currency	**USD**	4.48095^{H}	3.67110	4.25109	3.59707	3.60503^{L}	4.04728	4.02242	4.13722
	GBP	−6.17039^{L}	−4.37399^{H}	−5.8891	−4.27579	−4.28082	−5.3961	−5.54586	−5.77857
	YEN	−0.03108^{L}	0.15265^{H}	0.00663	0.14373	0.14386	0.06078	0.13925	0.05146
	EURO	−6.28912^{L}	−1.8338	−2.2218	−1.75502	−2.0336	−1.6140	−1.49628^{H}	−1.55435

L = Lowest Optimal Hedge Ratio, H = Highest Optimal Hedge Ratio

CONCLUSION

The present study attempts to examine hedging effectiveness of equity and currency futures contracts by selecting a sample of seven near-month futures contracts, including three benchmark equity indices (NIFTY50, NIFTYIT, and BANKNIFTY) and four currency futures contracts (USD, GBP, YEN, and EURO) being traded at the National Stock Exchange of India.

To achieve the objectives of the study, optimal hedge ratio has been estimated using five constant hedge ratio models (naive, ordinary least square, autoregressive moving average ordinary least square, VAR, and VECM) and three time-varying hedge ratio models (GARCH, EGARCH, and TARCH). The difference in the coefficients of optimal hedge ratio across all eight models is found to be very insignificant in equity futures market, whereas in currency futures market, the coefficient varies significantly across different models.

Furthermore, hedging effectiveness has been estimated using two approaches, i.e. variance-reduction approach suggested by Ederington (1979) and risk-return approach suggested by Howard and D'Antonio (1984). The results of the variance-reduction approach suggest that the OLS model performs best in providing the highest hedging effectiveness. It implies that the investors can reduce the variance of their hedged portfolio to the maximum extent by using the simple and less-complicated OLS model for hedging financial risk. Furthermore, using the risk-return approach, traditional naïve hedge ratio leads to the highest hedging effectiveness in the case of all three equity futures contracts; for GBP and YEN, OLS hedge ratio generates the highest hedging effectiveness, whereas in the case of USD and EURO, naive hedge ratio and EGARCH models outperform, respectively. All in all, these results indicate that traditional hedge ratio models generate superior hedging effectiveness over time-varying models that are more complex and difficult to understand.

Overall, the study finds effective hedging in equity futures market as variance could be reduced to a large extent (more than 96 per cent), whereas in currency futures market, variance reduction is less than 40 per cent. Hence, hedge effectiveness in equity futures market is superior to that in currency futures market. Moreover, the present study finds superior hedging effectiveness of less-complicated constant hedge ratio over highly complicated econometric models estimating dynamic hedge ratios.

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