Optimal Hedge Ratio and Hedge Efficiency: An Empirical Investigation of Hedging in Indian Derivatives Market

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Abstract

Risk is omnipresent, and hedging has been motivated by *the desire to reduce risk*. An essential feature of hedging is that the trader synchronizes his/her positions in two markets. One is generally the “cash" or "spot" market (the market for immediate delivery), while the other is the derivatives market (Johnson, 1960). Studies of hedging carried out in developed markets like the United States and Europe have finally arrived in emerging markets such as China, India, Brazil, Russia and many other Asian countries. Spyros (2005) has presented a brief account of contemporary studies in this area. Among emerging markets, India has a considerably large derivatives market supported by prudent risk management systems and a growing economy. However, hedging one’s stock position through futures and options in the Indian context is still the road less travelled. Even if it is done, the techniques used have been too naïve and primitive. This paper tries to explore Indian futures and options market as a market for hedging by equity holders. We have tried to examine optimal hedge ratio and hedge efficiency, and to provide empirical evidence from India.

An extensive literature review has enabled us to appreciate the advances in HKM (Herbst, Kare and Marshall, 1993) methodology in comparison to JSE (Johnson, 1960; Stein, 1961; and Ederington, 1979) methodology. JSE methodology has two limitations. It fails to follow basic tenets of econometrics. For example, residuals from JSE estimation of optimal hedge ratio are serially correlated. Therefore, a Box-Jenkins autoregressive, integrated moving average (ARIMA) technique should be used to estimate the minimum risk hedge to account for the serial correlation of error terms (Herbst, Kare and Caples, 1989). The JSE model fails to appreciate the fact that futures prices converge to their spot/cash market price on the maturity date. HKM methodology take cares of these two very basic but most serious lacunae in the JSE model. In case of option pricing, two problems exist in the Black-Scholes model.

Many studies have established that returns are not normally distributed as they were found to have fat tails. This implies that use of high frequency data will help in estimation of more accurate central measures. The second problem leads to long-range dependence. According to Efficient Market Hypothesis (EMH), all information is reflected in current asset prices, and hence it is reasonable to assume a Markovian process. However, this is only true when the market is efficient in strong form, which may not be valid in reality. Traders have been using long-term memory strategies to outperform the market. This motivated a series of research studies further purporting the existence of a non-Markovian process (Lo and MacKinlay, 1993). A few stochastic models have been developed that can produce quasi long-range dependence. However, these models are very complex as they use high-dimensional partial differential equations with variable coefficients.

Fractional Brownian motion (fBM) deals with the second problem while still assuming a Gaussian process. Nevertheless, it offers the promise of giving simple, tractable solutions to pricing financial options and presents a natural way of modelling long-range dependence, measured by Hurst parameter “H.” We have estimated the optimal hedge ratio based on HKM methodology using the JSE model as the benchmark for futures. To estimate the optimal hedge ratio for options, we have used fBM methodology with BSM (Black-Scholes model, 1973) as the

benchmark. We have estimated the returns on hedged positions to empirically validate the efficiency of optimal hedge ratios.

A study of hedging of Nifty (National Stock Exchange of India—NSE—50 Index) price risk through index futures and options is conducted using high frequency data (from 01.01.2002 to 28.03.2002). We find that estimates of optimal hedge ratio based on competing models (HKM in case of futures and fBM in case of options) are better than those estimated using benchmark models (JSE for futures and BSM for options, respectively). The results are statistically significant at 95 percent confidence level. However, the returns on hedged positions using the superior optimal hedge ratios are not significantly different. This is quite puzzling, and requires a plausible explanation.