Volume-3, Issue-11, Nov Special Issue -2014 • ISSN No 2277 - 8160

Research Paper FINANCE

Risk Neutral Distribution in a Specific Volatality Limits

M.ARUL MANI Assistant Professor, Department of Commerce,Kanchi Shri Krishna College of Arts and Science, Kanchipuram.

ABSTRACT

The probability distributions of stock market prices are lognormal in nature. Volatility of an option as a function of its strike price is closely related to the probability distribution of stock prices. The relationship between volatility and risk neutral probability distribution being assumed for the future asset price. The integral sum of the function (ST – K) g (ST) dSTwithin the limit (K,α) and interest rate 'r' decides the volatility of stock prices. This paper aims at deriving the expression for the risk neutral distribution for the volatility limit (K, α). Methodology used in this research is purely mathematical concepts. The notions of gaussion distribution, differential and integral calculus are exploited for the successful derivation of the expression. The author also uses the ideas of analytical geometry to give a diagrammatic expression for the derivation.

KEYWORDS : ***volatility, probability distribution, stock prices.***

INTRODUCTION

The probability distributions of stock market prices are lognormal in nature. Volatility of an option as a function of its strike price is closely related to the probability distribution of stock prices. The relationship between volatility and risk neutral probability distribution being assumed for the future asset price. The integral sum of the function (S_T – K) g (S_T) dS_Twithin the limit (K,α) and interest rate 'r' decides the volatility of stock prices. This paper aims at deriving the expression for the risk neutral distribution for the volatility limit (K, α). Methodology used in this research is purely mathematical concepts. The notions of Gaussian distribution, differential and integral calculus are exploited for the successful derivation of the expression. The author also uses the ideas of analytical geometry to give a diagrammatic expression for the derivation.

LITERATURE REVIEWS

Choi,Elyasiani,&Kopecky,(1992) A study conducted on 48 largest US commercial banks for the period 1975-1987 showed that effects of exchange rate depend on the Net position of the bank in foreign currencies. The found that, when banks had positive net position, depreciation of foreign currencies negatively affected the stock prices of banks before year 1979 and after 1979 banks stock returns responded positively with the depreciation of foreign currencies as banks had changed from positive to negative net open positions.

Daugaard& Valentine (1993) worked out different sources of risks and they found out that stock prices of banks have relationship with different variables like interest rates, exchange rates, banks profitability and market risk factor. According to them during the period from 1983 to 1991, share prices of bank responded with the appreciation of the Australian Dollar.

Antony M.Santomero (1996) reviews and evaluates foreign exchange risk management systems in North America's super regionals and quasi money centre commercial banks. The author discusses the problems which the industry finds most difficult to address, like the shortcomings of the current methodology and the elements that are missing in current procedures in managing and controlling risks.

David.H.Pyle (1997) discusses the need for risk management in banks. The author focuses on the theoretical aspects of foreign market risk management with few comments on the credit risk.

Irio& Faff, (2000) Studied foreign exchange risk in industries in Australia including the banking sector.Accoring to them bankindustry as a whole do foreign exchange risk management and therefore, this type of risk is insignificant in pricing banking companies stocks.

Allayannis, Ihrig, & Weston (2001) in their study stated that banks face foreign exchange risk management due to dealing in foreign currencies result of the operations in foreign countries or dealing with foreign exchange for their own account or for customers account. Exchange Rate Risk is an integral part of every firm's decision regarding foreign currency exposure.

Barton, Shenkir, & Walker, (2002) in their research studied that currency risk hedging strategies involve eradicating or reducing currency risk, and need understanding of both the ways that the exchange rate risk can have impact on the operations of economic agents and techniques to deal with the resulting risk implications.

Papaioannou M.G., (2006) stated that Foreign Currency Risk is an important source of risk for the banking industry based on which different studies have been done in different parts of the world. Foreign currency exposure and risk management is very important for the banks to avoid any vulnerability from exchange rates fluctuation which can affect the profits and assets values in a negative way. Different traditional types of foreign exchange risk i.e. translational, transactional and economic risks were reviewed. Also different ways and strategies for managing foreign currency risk were analyzed along with advantages and disadvantages of each strategy and technique. Additionally, best practices widely spread were outlined along with data on financial derivatives and hedging practices by US banks. Sources of risks for banking sector have been investigated by many researchers in different economies.

KatarzynaZawalinska (1999) examines the asset liability management techniques and foreign exchange risk management practices used at commercial banks in Poland. For this purpose, the author analyses and accesses the safety, profitability and competitiveness of banking by conducting a survey in 34 banks operating in Poland.

The survey implies that foreign banks and large private Polish banks are more advanced in the use of risk management and measurement techniques. These banks seem to be better equipped to face competition and manage foreign exchange transactions than small and big state owned banks.

Elmer FunkeKupper (2000) describes the key foreign currency risks faced by the banking sector and ANZ bank's approach to manage them. The bank's approach is based on three basic elements-Firstly, a clear understanding of the relationship between risk and shareholder value can be obtained by using economic value added (EVA) as the key measure; Secondly, a stress-testing regime to assess the financial impact of potential extreme events and a breakdown in risk models; and thirdly, a decision making and performance management framework that translates the insights acquired from the first two basic elements into a consistent set of business decisions. In ANZ bank EVA has become one of the dominant performance indicators and a natural incentive to focus on risk. The recent crises in Asia and emerging markets indicate that banks worldwide continue to have difficulty in dealing with illiquidity. It was suggested that Banks need

to adopt a more structured and top down approach to risk management.

Papaioannou M. (2001) in his research work found that the issue of foreign exchange risk management for firms in non-financial sector is independent from their principal business and is usually independently handled with by their corporate treasuries. In most of the firms there are independent committees who function to oversee the treasury's strategy in managing the foreign exchange risk (and interest rate risk).

Allayannis, George, Ofek, & Eli,(2001),stated using S & P 500 non financial firms with the help of multivariate analysis suggested that with the use of foreign currency derivatives, foreign exchange risk is significantly reduced. A study conducted by Boston Consulting Group, 2001 found that the sole determining success factors is not the technical development but the ability to understand risk strategically and also the ability to handle and to control risk organizationally. Secondly, in order to realize a risk based management philosophy, the attitude and mindset of the employees need to be changed whereby they must be brought to understand that will manage risk is crucial for success.

This implies that there must be intensive training, clearly defined structures and responsibilities as well as commitment to change. In addition, it was identified that bank in North America and Australia concentrate on foreign risk management primarily to enhance their competitive positions. Meanwhile, in Europe, Asia and particularly in South America, risk management is considered as a primary factor from the perspective of regulatory requirements.

Atindehou&Gueyie, (2001) stated that , it is found out from the Canadian Banks that stock prices responded positively with depreciation of foreign currencies, Foreign Exchange Risk is also found out to be one of the major sources of risks in African Region.

Christel Lane, Sigrid Quack (2002) analyze the role of banks in financing and managing risks of foreign Small and Medium Enterprises in British and Germany. The author uses comparative survey of a sample of 12 banks (7 British and 5 German Banks) which included large commercial banks operating nationwide and regionally oriented banks. It was concluded that bank strategies and institutional framework remain closely related to the existing institutional environment followed in each country.

METHODOLOGY

This paper adopts a rigorous mathematical methodology. The standard equations of conic, maxima and minima of continuous functions, Rolls theorem are used to derive the desired results. The partial differential equations with respect to x and y and t are also exploited to find an expression for hedge parameters. Besides this the statistical concepts mean, standard deviations, variance and Karl Pearson's coefficient of correlations are also used. The bounded conditions for the partial differential equations of order 1 and 2 are used to solve the equations.

The log normal property of stock prices clearly showed

$G = \log s$

$\delta g/\delta s = 1/s$; $\delta^2 g/\delta s^2 = -1/s^2$; $\delta g/\delta t = 0$

When the stock prices follows the Brownian motion with wiener process then the integral sum of the function

$(s_t - k)\, g(s_t)\, ds_t$ for the specific time is given.

The Brownian motion confirms the Gaussian probability distribution of stock prices.

$$G(x, t) = \int_{-\infty}^{+\infty} e^{-1/2((x-y)/\sigma)^2}\, dt$$

For the particular time +

Then we get $dg = (\mu - \sigma^2/2)\, dt + \sigma\, dz$

But $e^x = 1 - x/\lfloor 1 + x^2/\lfloor 2 - x^3/\lfloor + \text{----------}$ (by Maclaurins theorem)

$e^{-1/2((x-y)/\sigma)^2} T = [1 - (-(x-y)^2/\sigma / 2\lfloor + \text{……..})T$

$= 1/\sigma^2 (1-(-x^2 - \mu^2 + 2x,y / \sigma) + \text{……})T$

$= 1/\sigma^2 (1+(x^2/2 + \mu^2/2 - 2\, x,y / 2\, \sigma)\, T$

$= (\mu - \sigma^2/2)T$

The variance is given $\sigma^2 T$

Similarly we have

$\text{Log}\,(1+x) = 1 + x/1 + x^2/2 + x^3/3\ldots\ldots$

Put $x = -1$

$\text{Log}\,(1-1) = \infty$

This implies though the stock follows the normal distribution, it is affected at the time of risk neutral distribution

At time T and time o

We have

$$\text{Log}\, S_t - \log S_o = 1/\sigma\sqrt{2\Pi} \int_{-\infty}^{+\infty} e^{-(\mu-\sigma 2/2)} dt$$

$$\text{Log}\, S_t / S_o = 1/\sigma\sqrt{2\Pi} \int_{-\infty}^{+\infty} e^{-(\mu-\sigma 2/2)} dt$$

$\text{Log}\, S_t$ is $e^{-(\mu-\sigma 2/2)} dt$

But e^x is an increasing function. So we have $\log S_t$ is also an increasing function with the volatility limits t_1 and t_2

CONCLUSION

The stock market prices are normally distributed. Actually the prices vary within the volatile limits t_1 and t_2. The distribution is able to predict the prices of future with in the short span of time. The probability varies from 0 to 0.5 in positive yield as well as negative yield of stock prices. It is also concludes the risk neutral perception of investors create movements of stock prices.

REFERENCES

1. Dalbar, Inc. (2010). "Quantitative analysis of investor behavior," Adviser Edition, March 2010. | 2. David Hillson& Ruth Murray (2007). "Understanding & Managing Risk Attitude "Gower, 2007, ISBN 978-0-566-08798-1 | 3. EPW Research Foundation (2003). "Household Savings and Investment Behaviour in India." | 4. Feng, L and Seasholes, M S (2007). "Individual investors and gender similarities in an emerging stock market," Pacific-Basin Finance Journal, Online version posted on 4 May 2007. | 5. Allen et.al, D G Renn, R W Moffitt, K R and Vardaman, J M (2007). "Risky business: The role of risk in voluntary turnover decision, Human Resources Management," Article in Press | 6. Barber and Odean (2001). Expected utility and the cumulative consequences of repeated decisions: a tutorial, Risk, Decision and Policy 7, 109-119. | 7. Coleman, L (2007). "Risk and decision making by finance executives: a survey study," International Journal of Managerial Finance, 3, pp. 108-124. |