Integrating Value at Risk Concept in Risk Management Frame work- A Critical Review

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ABSTRACT
Participants in the financial Markets are prone to carried kinds of financial risks such as credit risk, operational risk, liquidity risk, systemic risk etc. It is most prudent on part of such financial institutions and market regulators to continually monitor risk, so that counter risk management strategies can be devised and implemented. For some years now the concept of, Value at Risk has gained currency and has been adopted as one of the standard measures of financial risk measurement and analysis. This concept has the advantage of quantifying risk in single number which makes it highly appealing and it approximate the Highest expected loss in given time interval and desired confidence level. This paper intends to highlight the importance of the Value at Risk concept and then how risk management has assimilated the same in contemporary risk management practices and organizational paradigm.

Key words: Value at Risk (VAR), Risk Management, Basel Accord

I INTRODUCTION

Every type of business involves some extent of risk. Risk can be minimized but cannot be totally eliminated. The only way to totally eliminate risk is by stopping the business itself. Given this fact, a question which comes to the mind of a businessman is "How risky is the business I am undertaking and how can the risk be measured?" or "How bad can the affairs get in the course of business?" Value at Risk is the concept which can provide an answer to this question. Value at Risk has the advantage of quantifying the risk in single number which makes it highly appealing and it appears to measure the worst expected loss at given time interval and confidence interval.

II REVIEW OF LITERATURE

Reto R Gallati [14] defines Value at Risk as the predicted worst-case loss at a specific confidence level (e.g., 95 percent) over a certain period of time (e.g., 10 days).

According to **Philippe Jorion [17]** "**Value at Risk** measures the worst expected loss over a given horizon under normal market conditions at a given level of confidence"

Linsmeier and Pearson [19] have given the following formal definition for Value at Risk:

"Using a probability of x percent and a holding period of t days, an entity's Value at Risk is the loss that is expected to be exceeded with a probability of only x percent during the next t-day period." Value at Risk can thus be defined as the maximum loss a portfolio of securities can face over a specified time period, with a specified level of probability. For example, a Value at Risk estimate of $1 million for one day at a probability of 5% means that this security can expect loss of at least $1 million in value in one day with a 5% probability. Consequently, there is 95% probability that loss in value of portfolio in one day will not exceed$1million.

Various Authors like **Damodaran A (8), Dowd Kevin [10], and Holton G [15& 16]** have written elaborately on Value at Risk in its different perspectives and its relevance in contemporary scenario wherein risk management is central theme across financial organizations. Risk Management experts like **Reto R G [14], Jorion P [17] & Mark S Dorfman [9]** give the importance of Value at Risk and its rightful place in the risk management process.

Basel accord [6] & Risk metrics technical document [25] discuss Value at Risk as a central benchmark for risk estimation procedure in quantifying Risk. **Marshall C & M Siegel [20]** provide a means of Value at Risk implantation in entire risk management process. Financial Risks & their quantification are elaborately explained in various risk management works written by **Dowd Kevin [10], Mc Neil et al [22]** elaborates extensively on risk & its measures. **Tsai [29]** focuses on risk management via Value at Risk methodology. **William Fallon [12]** elaborates on Approximating Value at Risk in its most basic form**. K kuester et al. [18]** provides insight on calculation & predicting Value at Risk by various approaches. **Campbell et al [7]** give various econometric details of Value at Risk estimation. Extensive insight is provided by work of **Allen D. E et al [1, 2 &3]. Bao young et al [5]** shed insights on performance of Value at Risk concept specifically in emerging markets using various models of estimating it.

III EVOLUTION & CONCEPT VALUE AT RISK

(a) Evolution: "Value at Risk" was not used in common parlance prior to the decades of 1990s, its origin lies much back in time. The work of **Holton G A [15]** provides a detailed exposition of Value at Risk origin. The mathematics that underlies Value at Risk was largely conceptualised as part of portfolio theory by Harry Markowitz and others, though that was for different purpose i.e. – devising optimal portfolios for equity investors.

The Focus on market risks and co relational effect from the crux of Value at Risk computation. Impetus for use of Value at Risk came from the various crises that have struck financial service firms over time and regulatory responses to above.

Regulatory compliance in terms of capital requirements for banks first came into scene after the Great Depression of 1928 and the subsequent bank failures. Securities Exchange Act came into force and Securities Exchange Commission (SEC) was formed which required banks to keep their borrowings below 2000% of their equity capital. Risk and control measures were then devised by to ensure that regulatory capital requirements.

Increased risk quotient created by the advent of derivatives and commissioning of floating exchange rates in the early 1970s, caused a redefining of capital requirements and hence SEC's Uniform Net Capital Rule (UNCR) was promulgated in 1975. Thus financial assets Categorization of banks was done in twelve classes, and based upon risk exposure, and requirement of different capital requirements for each of them ranging from 0% for short term treasuries to 30% for equities was mandated. Reporting by Banks on capital disclosure was made compulsory in quarterly statements.

Holton G A [15 & 16] explains that Value at Risk, first came into the use in 1980 with SEC mentioning in its rules , that capital requirements of financial service firms be ascertained on the basis of loss which can be incurred with a confidence interval of 95% over a 30 day horizon, in various asset classes. This was done on the basis of historical returns. These were initially named as Haircuts a term still in use, it was clear that the idea was to estimate one-month 95% Value at Risk and hold that much capital to cover losses. With the trading portfolios commercial banks larger and more volatile, there was a need to define more efficient risk control measures. First reference to Value at Risk came in form of bankers trust internal documents which gave a inherent perspective of Value at Risk for fixed income securities.

Down Kevin [10] explains that As 1990s arrived, financial firms began to use Value at Risk in its most basic and primitive forms with some variations. With the advent of Derivatives and the inherent risks involved a lot of capital was betted on for speculative positioning resulting in some catastrophic losses around the world markets leading to some major bankruptcies ex. Failure of Barings. Thus the need for more comprehensive risk measures arose.

In 1995, **J.P. Morgan [25]** made public access to its risk measurement tools & control, for the first time. This Package developed over a decade and used along with software was called Risk metrics, and it contained the concept of Value at Risk. Thus Value at Risk was welcomed by regulatory experts in industry, mostly commercial and investment banks, who appreciated its basic appeal. Applications of Value at Risk analysis and reporting have extended from position/ portfolio Value at Risk, to nonfinancial organizations, to expanded application of the Value at Risk methodology, such as earnings at risk (EaR), earnings per share at risk (EPSaR), and cash flow at risk (CFaR) as explained in the work of **Artzner P et al. [24].**

(b) Context & Concept According to **Dowd Kevin [10]**, market risks can be subdivided into four classes: interest rate risks, equity price risks, exchange rate risks and commodity price risks. Financial Market Participants face many different kinds of risks, including market risks, credit risks, liquidity risks, operational risks and legal risks.Historically Banks and investment houses have balance sheets made up almost exclusively of financial assets whose value is subject to changes at any point of time. These changes are mostly as a result of changes in the interest rates.

Historically, these risk can be managed by matching them with similar risks on the liability side of the balance sheet, or in other words, matching the duration of the assets and liabilities. If done correctly and accurately, a change in interest rates would be nullified by change in the corresponding asset and liability, About ten to fifteen years ago, this was an ideal concept known as Asset/Liability Management (ALM) as Illustrated by **Mark S Dorfman [9]**.

For the last few years, the balance sheets of banks have become too complex for simple matching of assets and liabilities and even for other hedging techniques like derivatives, without a proper measurement of risk Risk measurement standards on derivatives based Delta, Gamma and Vega as well as Interest Rate measures like Gap, Dollar Value on Basis Points and Convexity measures were used, but were not found sufficient. While these measures were quite accurate, they could not sum up different types of risk, did not allow for preventive control measures and could not measure capital or earnings at risk with precision. Value at Risk was originally developed to measure market risk, which is caused by movements in the level or volatility of asset prices - **Jorion P [17].**

Value at Risk is a statistical measure of the maximum potential loss from uncertain events in the normal business over a particular time horizon. It is measured in units of currency through a probability level. It is the loss measurement consistent with a confidence limit such as 99%, on a probability distribution (usually a normal distribution), implying that this is the measurement of a loss which has a chance of only 1% of being exceeded. In simple words, if a trader mis-hedges a deal, it is a must to know the chances of loss before they occur. Value at Risk is one such technique that allows the management to do so. One of the most important aspects of Value at Risk is that Value at Risk actually assigns a probability to a dollar amount of happening of the loss.

This probability and its corresponding loss amount (5% and $1 million in the above example) are not associated with any particular event, but it could cover any event that could cause such a loss. For example, a Value at Risk estimate that only measures losses due to market risk will not be able to capture credit losses. **-Allen D [2] & Mc Neil & Frey [22]**

It is important to remember that Value at Risk is not the maximum loss that could occur, but only a loss amount that could expect to exceed only at some percentage of the time. The actual loss that may occur could be much higher than the Value at Risk. The concept of Value at Risk is to determine the probability distribution of the underlying source of risk and to identify that worst given percentage of outcomes. Thus the basic idea behind Value at Risk is straightforward since it gives a simple quantitative measure of portfolio's downside risk. The figure of a normal curve illustrates the principle behind computing VAR when the distribution of the change in portfolio value is continuous. The normal curve is widely used for computing Value at Risk though not necessarily appropriate in all the cases.

The biggest attraction of normality is that if the portfolio return is normal, the Value at Risk is the multiple of portfolio standard deviation and the normal value of the confidence level. Developed initially by JP Morgan, so as to study the maximum possible amount of losses on all portfolios, Value at Risk has gone from being merely being a risk measurement concept to a regulatory feature as proposed by **Basel accord [6]** to maintain capital adequacy requirement in banks. **Holton G A [16] e**laborates that Value at Risk has two important and appealing characteristics – First, it provides a common consistent measure of risk for different positions and instrument types. Second, it takes into account the correlation between different risk factors. This property is absolutely essential whenever computing risk figures for a portfolio of more than one instrument from a statistical point of view.

The estimation of Value at Risk entails the estimation of a quartile of distribution of returns. The fact that return distributions are not constant over time or normal provides exceptional challenge. When interpreting Value at Risk figures, it is essential to keep in mind the time horizon and the confidence level since without them, Value at Risk numbers are meaningless. Statistical models of risk measurement, such as Value at Risk, allow an objective, independent assessment of how much risk is actually being taken in a specific situation. Results are reported in various levels of detail by business unit and in the aggregate. It takes into account the corporate environment of an institution, such as accrual vs. mark-to-market accounting or hedge accounting for qualifying transactions. Furthermore, the focus is now on the longer-term impact of risk on cash flows and earnings (quarterly or even annually) in the budgeting and planning process

IV VALUE AT RISK APPROACHES & METHODS

Value at Risk methods have been quantified as bellow: -

(a) **Parametric approach and Methods:** Variance-Covariance Method
(b) **Non parametric approach and Methods:** Historic Simulation & Monte Carlo Simulation
(c) **Semi parametric approach:** Combination of parametric and non parametric methods with/ or without additional refined techniques such as Neural networks / Extreme Value Theory.

Value at Risk calculation methods are divided into parametric and non-parametric approach and methods**- Willam F [12]. Parametric Approach and Methods**: These methods in statistics assume that data have been progressed from a type of probability distribution and thus inferences are made about parameters of distribution.

Parametric method use time series analysis from previous data to derive volatilities and correlations estimate on large financial instruments set. Assumptions in a Parametric methods are more than non-parametric methods and if these are correct, they produce accurate and precise estimates from their counterparts as they have high statistical power. In case these assumptions are wrong, parametric methods and their outcomes can be grossly flawed. **Dowd Kevin [10].**

(i) Variance- Covariance Method:
This approach allows an estimate to be made of the potential future losses of a portfolio through using statistics on volatility of risk factors in the past and correlations between changes in their values. Risk factors for Volatilities correlation are calculated from historical data for a selected period of holding the portfolio. Value at Risk calculation is done by multiplying expected portfolio volatility by a factor as per confidence levels. Variance-covariance approach inspired from assumption that under lying market factors comes from a multivariate normal distribution. Portfolio return comes from a linear combination of normal variables; it is assumed to be normally distributed **- Simon B et al [28].**

Normal Value at Risk is easy to handle because Value at Risk is a multiple of portfolio standard deviation, and the portfolio standard deviation is the linear functions of individual volatilities and covariance's. It is based on assumption that market parameters changes and portfolio values are distributed normally. The normality assumption is basic and straightforward. Thus it is ideal for simple portfolios consisting of only linear instruments - **Dowd Kevin [10].**

When implementing variance-covariance approach, the first step is to 'map' individual investments into a set of simple and standardized market instruments. Each instrument is then put as a positional set in standardized market instruments. For example, ten-year coupon bond is put as ten zero coupon bonds.
After identifying standard market instruments the variances and covariances of these instruments are estimated. Historical data helps statistics. Calculation of Value at Risk is last step for portfolio by using estimated variances and covariance's and the weights on the standardized.

While parametric approach assumes conditional normality of returns, estimation process for "normal" variance-covariance approach has to be refined to incorporate empirically proven fact that most return distributions show deviations from normal. Estimates of volatility and correlation are used as inputs in Value at Risk analytical models. Even though this method is easy to implement, the normality assumption causes problems. Financial assets sometimes show 'fat tailed' return distributions, meaning that in reality extreme outcomes are more probable than normal distribution would suggest. As a result, Value at Risk estimates may be understated. – **Holton G [15].**

Problems grow even bigger when the portfolio includes instruments, such as options, whose returns are nonlinear functions of risk variables. Solution to this issue is to take first order approximation to returns of these instruments and then use the linear approximation to compute Value at Risk. This is delta-normal approach that's only; shortcoming is that it only works if portfolio contains limited non-linearity.

There is another set of advanced value at Risk quadratic Value at Risk methods, also known as delta-gamma models, which go even further as they use a second order approximation rather than a first order one. Obviously improvement over delta-normal method is improved, but its simplicity of the basic variance-covariance approach is lost. The advantage of variance-covariance approach is its simplicity. Value at Risk can be easily calculated if normality assumption is held as normal distribution properties help to estimate Value at Risk levels. **- Dowd Kevin [10].**

Campbell et al [7] say that in using this approach it is necessary to take into consideration the following facts:

- Market prices and their returns not necessarily follow a normal distribution, evident in tailed distributions and extreme values
- Market Risks may not predict market risk arising from extreme events.
- Correlation from past may not always hold key to future.

Variance-Covariance Methods, assume that loss that can happen is proportional to standard deviation of return. We estimate Value at Risk through equation

$$\text{Value at Risk at time } t = \phi \cdot \tau \cdot \sigma_{TP} \quad (1)$$

Where Φ is the likelihood parameter; σ_{TP} is the return standard deviation for time t; and τ is a parameter used when we calculate Value at Risk for a time period with a different length from that used to estimate the standard deviation**- Campbell John Y. et Al [7].**

Variance-Covariance Methods use various methodologies can to calculate the Value at Risk for computing variance (standard deviation) in different ways values:

- Constant Variance-Covariance Approach: Assumes price variance remains constant with time.
- EWMA (Equally Weighted Moving Average) Approach: Assumes variance in future can be predicted by using fixed amount of historical data and all historical observations carry equal weights.
- Exponentially Weighted Moving Average Methodology (EQWMA). The main difference between this and the previous methodology stems from the different weight associated with the historical observations used.

EQWMA Methodology is based on observations (current) by using exponentially weighted moving averages of squared deviations in the formula.

$$\sigma_t = \sqrt{(1-\lambda)\cdot \sum_{s=t-k}^{t-1} \lambda^{t-s-1} \cdot (x_s - \mu_t)^2}$$

Here
σt denotes forecasted standard deviation for time t;
Xs is equal to oil price return for time s;
μt is value of historical average for this return;
k is number of observations included in calculation procedure;
Parameter λ is decay factor determining rate at which weights on past observations decay as they become old.

The Variance covariance approach also uses different statistical models for the inherent variance calculation that is used for this calculation.

(ii) Non-parametric methods differ from parametric methods in the way that model structure is not specified before but is derived from data. i.e. their defining parameters are flexible. Non-parametric methods are widely used and in many respects are highly attractive approaches to calculate Value at Risk. They have a reasonable track record and are often superior to many parametric approaches based on simplistic assumptions such as normality.

> They are also capable of considerable refinement to deal with some of the weaknesses of more basic nonparametric approaches. They work fairly well if market conditions remain reasonably stable, but pose a problem when dealing with extremes, particularly if we don't have a large sample size. The Calculation of Value at Risk using parametric approaches has, the distinguishing feature of that they require us to specify explicitly the statistical distribution from which our data observations are drawn.

Parametric methods are based on statistical parameters of risk factor distribution and non-parametric models are Simulation or historical models. Variance-covariance approach is thus based on assumption that change in market parameters and portfolio value changes are normally distributed.

Historic Simulation and Monte Carlo Simulation called as non parametric methods – **Allen D.E et al [3].** Historical Simulation standard approach focuses on deriving an empirical distribution from price changes over a period which is prior to time at which calculation is done. Calculation of Value at Risk is done from maximum loss in distribution pertaining to required likelihood percentile.

Monte Carlo Simulation Method also uses empirical distribution derived from price changes. This method does not use historical price changes. Series of pseudo random variables are generated from the assumption that they follows a determined statistical distribution. Value at Risk is quantified from the maximum loss in distribution of these pseudo random variables, pertaining to required likelihood percentile- **Campbell John Y. et Al [7].**

(iii) Historic Simulation Method

When it comes to non-parametric methods, Historical Simulation is probably the easiest approach to implement. Starting step of historical Simulation is to identify the instruments in the portfolio and to obtain time series for these instruments over some defined historical period. Then weights are used in current portfolio to simulate hypothetical returns that would have been realized if current portfolio was held over the observation period. Value at Risk quantities can be noted from histogram of the portfolio returns. The assumption here is that distribution of historical returns acts as a good compliment to returns over next holding period-

Thus Value at Risk calculation from historical Simulation starts from noting changes seen in market prices and risk factors are analyzed over a specified historical period, say, one to five years. The portfolio under examination is then valued, using changes in the risk factors derived from the historical data, to simulate and create the distribution of the portfolio returns. We then assume that this historical distribution of returns is also a good proxy for distribution of returns of the portfolio over the next holding period. Relevant percentile from historical returns distribution of helps to calculate expected Value at Risk for current portfolio**- Allen D.E et al.[2]**.

One important consideration for computing historical Simulation Value at Risk is the historical period used for calculation and it should be long enough to form a reliable estimate of the distribution, but small enough to avoid 'paradigm shifts'. Simulating' or constructing cumulative distribution function (CDF) of assets returns over time can be used for estimating Value at Risk by this procedure. Advantage of Historical Simulation is that it does not assume any distribution on the asset returns unlike most parametric Value at Risk models. Also, it is relatively easy to implement**- Allen D.E et al. [2]**.

Historic Simulation Value at Risk forms from the assumption that historical distribution of returns will remain the same over the next periods; basically assuming that price changing behaviour replicates over time. Therefore the distribution of returns in future will be as ordained by empirical, historical return that will be used in estimating Value at Risk. As a result, Value at Risk from Historic Simulation will be the empirical quantile of distribution pertaining to confidence level **- Campbell John Y et al [07].**

$$VaR_{t+1}, q = Quantile(\{X_t\}_{t=1}^{n}).$$

Historical Simulation also has some disadvantages. Out-of-sample Value at Risk estimate is difficult to derive historical Simulation Method. Historic Simulation ignores potentially useful information in the volatility dynamics.

Historical Simulation is based on the concept of rolling windows. First, one needs to choose a window of observations that generally ranges from 6 months to two years. Then, portfolio returns within this window are sorted in ascending order and the θ-quantile of interest is given by the return that leaves θ% of the observations on its left side and (1-θ) % on its right side. If such a number falls in between two consecutive returns, then some interpolation rule is applied. Value at Risk is computed the following day, by moving forward the whole window by one observation and repeating procedure. Which means that implicitly it assumes portfolio returns distribution do not change within the window. From this implicit assumption several problems derive i.c. if it is assumed that all windows follow the same distribution, then by this it will mean that returns from these windows will be independent and identically distributed.

A convenient solution to lot of issues is to use weighted Historical Simulation which gives lower weights on observations that lie further in the past. This approach is free from calculation of correlations and volatilities. Instead it uses historical data of actual price movements to determine the actual portfolio distribution. In this way, the correlations and volatilities are implicitly handled. In fact the most important advantage of this approach is that the 'fat-tailed' nature of security's distribution is preserved since there is no abstraction to a correlation and volatility matrix.

(iv) Monte Carlo Approach

The Monte Carlo method specifies statistical models for basic risk factors and underlying assets. The method simulates the behaviour of risk factors and asset prices by generating random price paths. Monte Carlo Simulation s provide possible portfolio values on a given date T after the present time t; T > t. The Value at Risk (VaR_T) value can be estimated from distribution of simulated portfolio values**.** The following algorithm is adopted-:-

- Specify stochastic processes and process parameters for financial variables and correlations.
- Simulation of hypothetical pricing trajectories for all interest variables. Price changes Hypothetical in nature are obtained by simulations drawn from specified distribution.
- Obtaining prices of assets at time T, $P_{i,T}$, from the simulated price trajectories & Compute the portfolio value $P_{p,T} = \Sigma w_{i.T} P_{i,T}$.
- Repeating steps 2 and 3 number of times to form the distribution of the portfolio value $P_{p,T.}$
- Measure VAR_T as the negative of the $(1-\alpha)^{th}$ percentile of the simulated distribution for $P_{p.T.}$

Thus to apply this approach, first we have to calculate the correlation and volatility matrix for the risk factors. Then these correlations and volatilities are used to drive a random number generator to compute changes in the underlying risk factors. The resulting values are used to re-price each portfolio position and determine trial gain or loss. This process is repeated with each random number generated and re-priced for each trail. The results are then ordered such that the loss corresponding to the desired confidence level can be determined.

Monte Carlo Simulation can thus be seen as hybrid of the variance-covariance approach and the historical Simulation approach. Variance-covariance matrix is used to drive a Simulation. The Simulation works similar to the Historical Simulation, but instead of using history, it creates history (known as path) based on variance/covariance matrix derived from the actual historic market data**.**

The greatest advantage of Monte Carlo Simulation is that Value at Risk derived from this method uses pricing models to revalue non-linear securities for each trial. In this way, the non-linear effects of option that were missed in the variance-covariance Value at Risk can be captured in this approach. Monte Carlo Simulation, having its roots in random number generation is exposed to sampling error. There is risk of running less Simulations which adequately captures the distribution and this could result in an inferior answer.

One of its advantages is Monte Carlo Simulation generates the entire distribution and therefore it can be used, for instance, to calculate losses in excess of Value at Risk. The most significant problem with Monte Carlo approach is its computational time. The method requires a lot of resources, especially with large portfolios. As a consequence; the implementation may turn out to be expensive**.** Nevertheless, Monte Carlo will most likely increase its popularity in the future as the costs of computer hardware continuously decrease.

(v) Semi parametric Methods

These methods combine the parametric with non-parametric techniques with use of concepts like is Extreme Value Theory (EVT) and neural network approaches or traditional approaches with high reliability algorithms to generate data patterns from analyzing correlation between various data points and which give great results in the same domain with amazing ease of implementation. In sum, the semi-parametric approaches are more promising since they strike the balance between flexibility and tractability in risk modelling.

V APPLICATIONS OF VALUE AT RISK

The uses of Value at Risk fall broadly into three categories: determination of capital adequacy, performance measurement and supporting to the risk managers.

(a) Uses of Value at Risk are:-

(i) Initially, Value at Risk was used as an information tool to communicate to the management a feeling of the exposure to changes in the market prices or rates. After market risk started being implemented in the actual risk control structure, Value at Risk is being used to calculate and measure the risk adjusted performance and compensation, in addition to remaining a very powerful management information system as far as the risks of investment are concerned.

(ii) Firms with market risk measurement systems which apply portfolio diversification theory can lower their project risks.

(iii) Value at Risk is also important in identifying the effects caused by substantial future movements to the value of the portfolio. Based on the measurement made by Value at Risk, the portfolio manager can compare it with the maximum acceptable risk and take appropriate measures either by using derivatives to hedge the position or by changing the portfolio components to reduce the risk in Trading.

(iv) In 1995, 10 major central banks realized the use of Value at Risk in order to assess the capital adequacy ratio for market risk and started their own in house Value at Risk modeling. Of course, now this has become a regular practice with most central banks in developed countries. Thus Value at Risk can be used in ALM to estimate the changes in the net interest income and economic value of portfolio equity.

(v) In addition, Value at Risk can be used in Corporate Applications to measure the risk of foreign exchange exposures, interest rate changes, effectiveness of hedging and derivatives portfolio, management of credit risks for each counterparty, evaluation of complex transactions to be undertaken and investment management in overall.

VI LIMITATIONS OF VALUE AT RISK

Value at Risk is often criticized as being over-hyped, based on forty-year-old ideas of risk management as said there is nothing new about Value at Risk as a way of measuring risk.The concept of Value at Risk is very simple but this is also one of the main sources of critique. Value at Risk reduces all the information down to a single number, meaning the loss of potentially important information. For instance, Value at Risk gives no information on the extent of the losses that might occur beyond the Value at Risk estimate. As a result, Value at Risk estimates may lead to incorrect interpretations of prevailing risks.

One thing that is particularly important to realize is that portfolios with the same Value at Risk do not necessarily carry the same risk. Experts suggest a method called Conditional Value at Risk to deal with this problem. **Allen E D et al [3].** Conditional Value at Risk measures the expected value of the loss in those cases where Value at Risk estimate has been exceeded. Value at Risk has also been criticized for its narrow focus. In its conventional form it is unable to account for any other risks than market risk. Further criticism has been on the aspect that Value at Risk considers only the loss at the end of the estimation period, but at the same time many investors look at risk very differently. They are exposed to losses also during the holding period but this risk is not captured by normal Value at Risk models. To take into account for this, the authors suggest a method called continuous Value at Risk modelling.

In addition, every Value at Risk model is based on some kinds of assumptions which are not necessarily valid in any circumstances. Due to these factors, it is not a foolproof method**- Allen E D et al [1]. Tsai [29]** emphasizes that Value at Risk estimates should therefore always be accompanied by other risk management techniques, such as stress testing, sensitivity analysis and scenario analysis in order to obtain a wider view of surrounding risks. The choice of a methodology has some far-reaching impacts. The users should not view models as black boxes that produce magic numbers. It's important to realize that all three methodologies for measuring Value at Risk are limited by a fundamental assumption that future risk can be predicted from the historical distribution of returns. The **parametric approach** assumes normally distributed returns, which implies that parametric Value at Risk is only meant to describe losses on a "normal" day. Other types of days, such as crises (fat-tail events), which happen rarely but have a serious impact, do not exist within the "normal" view as said on econometric modelling by **Campbell et al [7]**. **Non parametric & Semi-Parametric approaches** rely on continuous & dynamic estimation of Value at Risk & use varied models to estimate the same. **–Allen E D et al [4].** This means that all three approaches are vulnerable to structural changes or sudden changes in market behaviour. Value at Risk has these limitations which need to be kept in mind while in use:

(a) It cannot measure risk accurately in extreme market conditions, because modeling is never perfect to decipher risk under such conditions.

(b) It focuses on a single arbitrary point. The Assumptions are too simplistic. It cannot capture model risks, thus requiring the use of model reserves also. Volatility also keeps varying with time and is not stable. It uses many models with a wide variety of assumptions and methods of calculations, producing different results under different models.

(c) It is basically a statistical measure and not a managerial one. It is impossible to arrive at a decision using a single quantum of information. Another aspect is more important because Value at Risk is based upon probabilistic estimate, subject to certain assumptions. Sometimes, in real life even one percent risk may create disaster for institution.

(d) Event and Stability Risks: The main drawback of models based on historical data is that they assume that the recent past is a good projection of future randomness. Even if the data has been perfectly fitted, there is no guarantee that the future will not hide nasty surprises that did not occur in the past. On practical side, there are high costs of maintaining and operating a Value at Risk based system-computer hardware and software, obtaining price date, employing expertise analysis, etc. Thus the technique should be supplemented by Stress Testing, which is explained in the next paragraph.

(e) Parametric Risk: Also known as estimation risk, parameter risk stems from imprecision in the measurement of parameters. Even in a perfectly stable environment, we do not observe the true expected returns and volatilities. Thus, random errors are bound to creep in because of sampling variation. Distribution may not be normal distributions in all given circumstances.

Correlations may not be stable in all the given circumstances.

(f) Data Mining Risk: This is among the most insidious form of risk. It occurs when searching various models and reporting only the one that gives positive results. This is particularly a problem with nonlinear models (such as neural network or chaos models), which involve searching not only over parameter values but also over different functional forms.

VII RISK MANAGEMENT VALUE CHAIN (RMVC)

Weiner Z [30] & Risk Management experts like Dowd Kevin (10) elaborate that Value at Risk is not single function in the process of risk estimation and quantification. The level and amount of risk needs to ascertained and then documented comprehensively so as to fuel further action. Hence experts recommend the implementation of Value at Risk using in the **Risk Management Value Chain (RMVC).** This process, termed as risk management value chain, will include the organizational considerations, role of senior management, IT requirements and Modeling VAR.

(a) **Organizational consideration** First important aspect of creating a risk management value chain in an institution is to assess whether the present organizational structure is suitable for risk control strategy. Two main factors that impact any assessment are:

   (i) **Size and geographical structure:** In this, two types of structures can be assessed: fully centralized and regional structure. A fully centralized risk control structure provides information on a detailed and consolidated basis to all those involved in derivative activities. This is usually best suited for regional or small commercial banks where there is degree of homogeneity is business operations across the different locations. All the important issues would be fully controlled at the centre. In case of regional structure, regional risk function coexists with a centralized function at the centre of the organization. This type of structure would be suited to large organizations with a wide geographical span of activities. The regional control area would look after and coordinate risk control activities of a routine nature on day to day level with the responsibility of limit reporting and control. Central office would control over all risk strategy like limit formulation, consolidation of risk profiles, performance analysis, reviewing risk strategy and assisting in goal formulation.

   (ii) **Existing functional involvement:** The existing functional structure of an organization should be reviewed in the light of new changing orientation of the risk management area. Some rationalization of the existing function is inevitable. The review should be conducted over a reasonable period so that the potential barriers are removed.

(b) Role of senior level management: Another important consideration in establishing a risk management value chain is the role played by the senior management in this respect. The top management is primarily responsible for developing the notion of an integrated risk culture. Since derivative exposures are unique in nature and different from other risks, it is essential to create appropriate environment and culture in the organization. For this the top management should sponsor the risk culture, assume responsibility for risk factor and establish objectives.

(c) Information & Technology requirements: Information requirements of the participants in the risk management process are essential characteristics of an integrated risk area. Different levels of information are required to the participants for making decisions. Two inter-related aspects are considered such as, tactical vs. strategic user level and timeliness of information. Strategic level information relates to senior level management, which need information for taking strategic decisions. The information moves from top to bottom. All such matters regarding firm profits, level of expense, risk budget, trading limits and derivative performance are provided at the strategic level. Tactical level information relates to exposure supervision. The focus would be on detailed information, which includes product, pricing analysis, incremental risk calculation.

This also includes portfolio exposure breakdowns and mark to model risk calculations and so on. Both level of information is essential for integrated risk management.

The most important point in the risk estimation is that information must be provided as quickly as possible to the right person because risk information can be critical to making mitigating decision. In this respect, it is essential to develop real time systems. This system provides up to the minute market information for tactical information requirements. Provision of risk management information is a cost/benefit trade off, requiring careful analysis to ascertain the level and intensity of information required.

   (i) **Analytical choices:** After establishing a sound organizational structure and appropriate information network, another aspect which need to be considered in creating a risk control analytical functions, are as follows:

(ii) **Constructing building block approach:** The management of risk exposures is a complicated task which needs expertise, adequate sources and appropriate information requirement on various aspects like credit, market, liquidity, etc. Various methodologies and tools are used for risk analysis. Hence, in order to avoid duplication of efforts in constructing risk measurement approaches, a small number of analytical approaches should be followed to form the building blocks upon which further analytical method can be constructed.

(iii) **The risk continuum:** The basic objective of the risk continuum relates to compatibility with two main components of integrated risk system: a centralized risk management function and a performance measurement system, which computes return unit of risk using various methodologies. Key element in risk continuum approach is an awareness of creating efficiencies which can be measured in both time and cost.

(iv) **Choosing the models or Methodology- Allen D.E and R.J. Powell [1, 2& 3] discuss that t**his relates to the selection of a particular suitable methodology or set of methodologies for the task of risk management. In this process various aspects like suitability to portfolio composition, flexibility in relation to different risk types; speed versus accuracy trade off and essential back-testing are taken into consideration. **Flexibility** is important because it needs to ascertain whether methodology is subject to desired or required adjustments or not because some models may not be so flexible to accommodate requirements. **Speed versus accuracy** consideration highlights the model efficiencies or the lack of it and need to be balanced for a thorough assessment. **Suitability** of particular methodology for managing a derivative position/exposure depends upon nature of the position and market is important. **Back-testing / stress testing** should be done carefully while selecting a particular model or methodology, as it is essential. If no back-testing plan is formulated, it is quite possible that misleading information be communicated not only to decision-makers but also to the regulators of the organization. Back-testing is concerned to evaluating the performance and its actual experience in the market to the risk model. There is no point in opting for a complex solution which does not lent itself to be benchmarked against actual results.

VIII CONCLUDING REMARKS

As the complexity in markets increases, firms are being forced to implement risk management systems and procedures to compete effectively in the market place. Risk Managers estimate that Value at Risk concept will be an effective tool for risk management in varied perspectives in all institutions of markets where risk interfaces with business operations. As a highly comprehensive risk measure, Value at Risk summarizes risk exposure through a single quantitative parameter. It is important that accurate estimation of Value at Risk is done for, as companies control and manage risk-bearing business activities. Despite weaknesses of Value at Risk concept, it is probably the best available technique for measuring the risk for a large and complicated portfolio.

Value at Risk has proved to be vehicle through which modern financial experts and economists rely. Users of Value at Risk should be aware of deciding level of return at particular degree of risk. Hence, it may be used with utmost caution and in conjunction with stress tests because it is highly mathematical methodology with a plethora of grade symbols, equations and derivatives. The Concept of Value at Risk is not like a black box. More than one approach to calculate Value at Risk should be followed to assess and predict Value at Risk. Further outputs from these systems should then be adjusted and followed by rigorous stress testing. Market Participants are still deciding about applications of this unique concept to manage risks, and it is expected that it is going to change the way forward.

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