
The drawbacks of VaR's, or risk management's Byzantine discussion

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Abstract Crises, such as the present economic downturn, are also usually times for much needed critical thinking about wrongdoings and best practices. Yet these periods are commonly full of commentators saying 'I told you so'. Much like the attacks on value at risk (VaR) in the 1990s, today's discussions seem to be looking for a risk management tool to blame, at least in part, for the catastrophic losses experienced by banks and other financial intermediaries. But is the technique really to blame? Whatever the answer, looking for a scapegoat will help neither the financial system nor the risk management profession and, more importantly, will not prevent future generations from making the same kinds of mistake. As such, this paper does not set out to defend or propose enhancements to a particular model. Instead, it holds that tools are only as good as the framework, judgment and expertise used to implement them. Consequently, a constructive debate on risk management should not focus on the appropriateness of certain tools, but rather on the approach and assumptions used to implement them, thereby characterising uncertainty more robustly. In short, and although VaR is used as an illustrative case, this paper calls for more realistic assumptions and modelling paradigms, for now and for the years ahead.

Keywords: *behavioural finance, correlation, expected shortfall, extreme value theory, fractal Brownian motion, fractals theory, Levy-stable distributions, value at risk (VaR), volatility*

Advances in financial theory and practices have helped investment and risk professionals to better understand and manage complex economic phenomena. We need to use these

advancements bearing in mind that models are partial representations of real-life events and the interpretation of the results they achieve, as well as the decisions made using their output, are

the responsibility of the people in charge of the models; therefore financial modelling is ultimately people's business not the business of a machine or artificial intelligence constructs. That said, it is likely that risk managers have not been completely fooled by the subtleties of current risk management tools; rather, much like in John Le Carré's *The Tailor of Panama*, risk managers have become blind, hiding behind 'broadly accepted' assumptions, playing an increasingly complicated game that no one has been really interested in stopping.

Tools have limitations that require people to exert judgment, assume responsibility, and make decisions. Would it not be fairer to understand value at risk (VaR) as a framework where the results are only as good as the underlying assumptions and input used in its implementation? Indeed, are these not the same assumptions that constitute the building blocks of classical financial economics? Yet, just as in 1998 during the Long Term Capital Management crisis, it would seem that instead of spending time rethinking risk management's approach to statistical analysis and the quantification of uncertainty, more time is being dedicated to pointing at the already well-known limitations of this common methodology.

For starters, consider a generic definition taken from www.riskglossary.com: 'Value-at-risk (VaR) is a category of risk metrics that describe probabilistically the market risk of a trading portfolio'. According to this, VaR is perhaps best understood as a methodology rather than a specific measure. In turn, the accuracy and reliability of this methodology are directly informed by statistical

assumptions, such as the type of distribution used, which in turn determine the degree of dispersion of the loss values and the technique used in the calculation of parameters representing the risk factors (eg volatilities, correlations, etc). In other words, a VaR method can be only as good as the underlying assumption and inputs used to implement it, and therefore poor results should be directly inputted to suboptimal characterisations of the variables used to model risk (ie assuming normal distributions or independent observations for financial time series).

VaR limitations have been largely documented since the early 1990s. For instance, Artzner *et al.*¹ demonstrated how VaR is an incoherent risk measure due to violation of the sub-additivity property. Partly based on this work, other approaches emerged as a means to overcome this main flaw, such as expected shortfall or conditional VaR. Additionally, more advanced statistical methods like extreme value theory have been introduced with the aim of properly accounting for the fat-tailed distributions found in financial time series and loss model distributions. So, thus far, the plain old VaR, ie the x per cent confidence loss measure for a certain time horizon, has been challenged and complemented by, if not perfect, statistically and economically superior measures. The question then remains: why, despite all its deficiencies, is it still a widely used measure? A combination of convenience and familiarity with the overall framework might be part of the reason for this. But determining this is beyond the scope of the present paper. What must be said, however, is that many risk managers still spend most of their time crunching

numbers using the traditional statistical tools of financial economics, which really boil down to the old principles outlined by Bachelier, as updated by JP Morgan's *Risk Metrics Technical Document* in 1994, which details how to measure portfolio market risk.² There was strong demand for the document, popularising the VaR concept, and JP Morgan developers wrote a reference implementation in Excel and provided a free dataset of volatilities and correlations. This opens a lot of questions about the role of risk managers as net value contributors within the management ranks of financial institutions.

Indeed, David Koenig, President of the Professional Risk Managers' International Association, has proposed that risk management should be a value-adding mechanism within the strategic management and decision-making process.³ It would appear that, by sticking to the classical statistics toolbox, risk managers might be drastically limiting their role as net contributors to corporate value. Even further, it would seem that criticising VaR, a methodology that could itself benefit from alternative statistical approaches and more application of judgment and insightful interpretation of changes in market regimes, deviates attention from this crucial point.

Improvement avenues to conventional statistics applied to financial time series have been around at least since 1963.⁴⁻⁶ Take for instance the case of Benoit Mandelbrot's initial papers on the modelling of commodities prices. Ranging from Levy-stable distributions, as a more adequate representation of financial assets' value distributions, to fractals theory and fractal Brownian

motion, as an alternative approach for modelling the roughness and time-dependency characteristics of financial time series, many useful and probably more robust concepts studied by this author have been available for testing and further development for decades. Yet due to the broadly accepted parsimonious conventions of 'modern finance' (see Bernstein, 1998⁷), these advances remain vastly unknown or simply condemned to play a secondary role in financial economics.

Similarly, but on the study of economic decision making, behavioural finance has succeeded in pointing out the shortcomings of classical finance theory's assumptions about rational economic actors. With an extensive categorisation of behaviour biases and with prospect theory as the alternative approach to utility theory, behavioural finance has formalised models of bounded rationality that account for the different phenomena present in the financial markets. Its enlightening argument about the traditional finance academia's resilience to getting rid of old paradigms and replacing them with improved ones, based on the heuristic-driven biases of representativeness and frame dependence (ie by using a familiar approach to solve a problem in a familiar way and then developing more theories based on the same familiar assumptions, it is difficult to move to a new unfamiliar and probably more challenging paradigm), is a very relevant point of consideration for risk managers in what should become their attempt to explore and incorporate alternative methods within their current frameworks, which are of course not restricted to VaR.

The wealth of research on behaviour biases that has been created by

behavioural finance academics provides a source of concepts to incorporate in risk models. Consider, for example, a framework that could build on these concepts to simulate a trader's tendency to engage in riskier trades in the run-up to when bonuses are being determined. Does that sound Société Générale familiar?⁸ Although a traditional VaR model might not be able to account for this type of situation, a 'behavioural VaR' might be able to.

These ideas have gone some way to informing the message of Nassim Taleb, the well-known uncertainty theorist.⁹ First, as individuals people are not naturally equipped with the tools to think rationally in terms of well-defined probabilities. Secondly, risk cannot be fully pictured when trying to circumscribe it within a rather narrow scope such as that afforded by traditional approaches. Taleb has also argued that techniques such as VaR are neither good nor bad by themselves.¹⁰ The major flaw within the whole VaR framework discussion might truly be the way in which a risk manager uses it to make his case about the 'real' underlying risk exposure trying to be measured. In other words, it is not the selected VaR metric or the framework itself, but the assumption used to arrive at the number and the way in which it is presented as a reliable indicator of the actual potential losses given the current market regime. It should be clear that the risk manager's job is to figure out the best way to interpret quantitative and qualitative concepts in order to provide a clear picture of what constitutes a risk exposure and what would be the courses of action to mitigate it.

In summary, there appears to be enough evidence that fundamentally

different quantitative approaches in combination with qualitative add-ons, can indeed improve the results obtained from general frameworks. It seemed curious at first, and rather entertaining later, how some practitioners, cited in an article published by *Risk Magazine* in February 2008,¹¹ were debating the necessity of shorter time windows for the estimation of certain risk factors. This type of dynamic updating should be more than a logical step within a stressed environment such as at present. It is true that procedures for corporate risk models cannot be changed overnight without a formal approval process, but a risk manager's responsibilities certainly include (i) to be proactive and come up with *ad hoc* adjustments to at least have an idea of how the risk estimates (ie VaR) can change if the market's perceptions are updated more often, and (ii) to educate senior management about the limitations of and possible improvements to the current models and their assumptions. This last point raises the question of how limited risk managers have been in communicating the now so evident limits of a framework that they still use on a daily basis. After all, as Glyn Holton has put it: 'VaR is only a tool. All tools have limitations. For example, a hammer can drive nails, but it can not drive screws. Saying that the hammer is limited is different from saying it is flawed'.¹²

Additionally, any risk framework needs big doses of expert judgment and *ex post* analysis, and this is precisely the type of insight that a risk manager is supposed to contribute, by conducting scenario analyses, stress-testing and back-testing routines. From a regulatory perspective, these types of exercises are

now almost a standard, but how can one be sure about the quality and comprehensiveness of such checkups? This might probably be a target difficult to achieve from a control standpoint; however, it should be attainable by boosting the role of internal risk committees and giving regulators a more robust role as external quality assurance-type agents for the risk management process.

Two final thoughts are in order at this point. First, and as it is usual when writing from a critical perspective, it is important to acknowledge that things look obvious when viewed in retrospective. In the current context, however, one could argue that this caveat is only partly valid because of the length of the crisis and its precedents. A nine-month long crisis should have certainly afforded certain opportunities to spot the drastic change in market regime and perceptions so as to make risk managers and boards of directors more suspicious about risk figures and eager to find additional risk indicators or at least signals. But yet again, the extremely low volatilities and credit spreads of the four years preceding the current crisis probably made people forget about how fast and drastically market conditions can change — clearly a remarkable failure.

Secondly, the availability of the concepts and alternative approaches mentioned here, which are by no means a complete list of the advancements currently available, would lead one to think that only very unsophisticated institutions are still basing their risk management decisions using conventional VaR implementations. Were this the case, VaR would certainly not be in the middle of the polemic. However, as the

methodology is again making headlines, it appears that there is much room for improvement, not only from the modelling and regulatory perspectives, but from the attitude of risk managers towards embracing more realistic and non-traditional concepts to adapt into their general VaR frameworks. The mandate of risk managers is to make sure that these improvements are made to avoid wasting more time in the now pointless debate of how good or bad VaR is. Not doing so risks repeating the staggering destruction of value that has been seen of late, and seeing the next generation of risk managers engaging in the same type of discussion.

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