

Betting against the risk of the outlier

Rethinking risk management to achieve high performance

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A major lesson from the 2008 financial crisis is the recognition of the over-reliance on and shortcomings of value at risk, or VaR, as a risk measure. The primary drawback of VaR is that, as typically calculated, it relies on historical analysis of risk as a predictor of future risk. Today, enterprises need a much richer, more sophisticated understanding of their risks. Gaining this understanding will require rethinking financial risk management and implementing a different approach to risk measurement. Among the possible approaches, Accenture believes enterprises need to perform more intensive analyses of an array of risks to identify the magnitude of each risk and to examine how they interact with each other through comprehensive stress testing and scenario analysis. Such an approach is designed to identify which risks are catastrophic to the organization, and is not exclusively dependent on taking a backward-looking view.

Shortcomings of VaR

There is not enough data to properly study past performance. Success may be a short-term phenomenon and may be masking huge risks that have yet to be discovered.

As originally designed, VaR was meant as an attempt to determine a short-duration, probabilistic loss determinant, that is, a worst-loss scenario given the current composition of the portfolio. Leading practice methodology (as defined by Philippe Jorion in his book, *Value at Risk: The New Benchmark for Managing Financial Risk*¹) recommended calculation using a Monte Carlo simulation process to randomly shock the portfolio multiple times (1,000 iterations minimally), and then catalog the mark-to-market change in the form of a distribution. The next step was to then calculate two sigma (i.e., two standard deviations) of extreme losses (left-hand tail) to come up with a notion of a one-day maximum expected mark-to-market loss.

Computing VaR in this way, however, is a very time- and computation-intensive process. To bypass this limitation, various approaches were employed to approximate VaR, including historical and delta-normal methods. Using this approach, it became easy to produce a VaR number, but fewer risk groups dug deeply into the implications of taking such approximations. In effect, many risk departments became intellectually lazy. Nevertheless, VaR became a fundamental measure of risk for a majority of trading floors.



Risk management is about identifying the risk that has catastrophic consequences to the trading organization. In this regard, VaR has demonstrated to be a simplistic tool that fails to provide adequate insight as markets enter extreme events or catastrophic risk starts to accumulate in the trading portfolio, among other shortcomings.

VaR is an adequate tool in low-volatility markets, but is inadequate when volatility experiences regime shifts—ironically when it is needed the most. More importantly, it does not identify the accumulation of risks that could become mutually reinforcing under the worst circumstances. VaR is a good example of where the mathematics of risk and finance have become a misapplication of hard sciences dressed up in equations. In an attempt to model the behavior of assets, the quantitative analysts of the financial world have built models based on fragile assumptions. The most tenuous of the assumptions is that VaR, as currently practiced, represents the worst-case, one-day, mark-to-market (MTM) change that a portfolio can experience (VaR is typically calculated only on the most liquid tenor of a portfolio. Long-dated deals and assets typically are not included in a VaR calculation due to the difficulty of estimating forward prices for tenors greater than 24 months). Catastrophic risks do not manifest themselves in a day. They accumulate in the portfolio, slowly over time and, when triggered, exact their fury on the enterprise.

What VaR does not explicitly recognize is that risk is theoretically unlimited and the VaR value is just an estimation of the starting point. This development has led to a dangerous situation in which organizations believe they have effectively

quantified risk, whereas in reality all they have done is engendered a false sense of confidence that since it has been measured, it can be managed. Buoyed by this sense of confidence, risk practitioners have given themselves license to take on more and often unwise risks. The markets, however, are under no obligation to subscribe to equations.

With an infinite number of monkeys typing on infinite number of typewriters, one will produce a sonnet. Would you bet on that particular monkey going on to write *The Iliad*?

Another shortcoming of VaR is that it suffers from the problem of being distribution-dependent, and suffers from the scalability of error functions inherent in all probability distribution-dependent forecasts. As a risk predictive tool, VaR has a poor performance record. Rather than focusing on prediction, we believe risk management should focus on preparation. Markets will continue to dislocate and defy fundamental supply and demand laws in the short term. And thus, for as long as leverage continues to be applied to trading, there will be no shortage of undercapitalized and overleveraged players with abundant hubris that will continue to upset markets. The key to prudent risk management is to prepare the portfolio for these inevitabilities that have yet to come instead of analyzing the last crisis.

Would you cross a river that is, on average, four feet deep? This is what VaR does. It averages your risk profile.

For these reasons, VaR should be assigned a role as a reported metric to help identify a risk perimeter—that is all. There should be no more investment in it than as a single metric in today's world. Inside this perimeter there is plenty of data to help optimize decisions on allocation of capital. Outside the perimeter, we cannot rely on this data to judge risk. The problem is that VaR has come to be seen as a neat number that can be pigeonholed into representing all trading risk. Risk, however, is dynamic, correlated and non-stationary. It is abstract and cannot be neatly folded into one number. The reality today is that the role of the risk control function needs to be one of a financial forensic analyst that is constantly looking, testing and probing the trading portfolio tail risks, looking for the nexus of risks that could lead to catastrophic failure.

The year 2008 was the Waterloo of VaR

Leading up to 2008, VaR was under increasing criticism for not being able to identify fat tail (catastrophic) risk. The 2008 financial collapse showed why VaR is not the best tool as an industry standard risk measure. Because VaR is backward-looking, it fails to immediately catch a huge shift in volatility, prices or in market dynamics—all of which occurred in 2008. As a result, it proves unsuitable as a “trip wire” when there is a regime change in risk (see Figure 1).

Understanding key risk drivers of the organization

Going forward in today's world, we believe the new mission of risk management should be to identify and monitor how price, liquidity, volatility and credit risks interact with each other. Risk managers today should be asking questions such as: What price, volatility and liquidity conditions have to occur at which point so that my credit risk becomes material? What risks should I be hedging and when? What are the external conditions that push my portfolio of physical and financial assets into a suboptimal position and what are the leading indicators of this shift? More relevant to energy trading is the concept of crowded trades, in which a concentration of positions of a similar nature can lead to illiquidity and high unwind costs caused by a simultaneous rush to the exit.

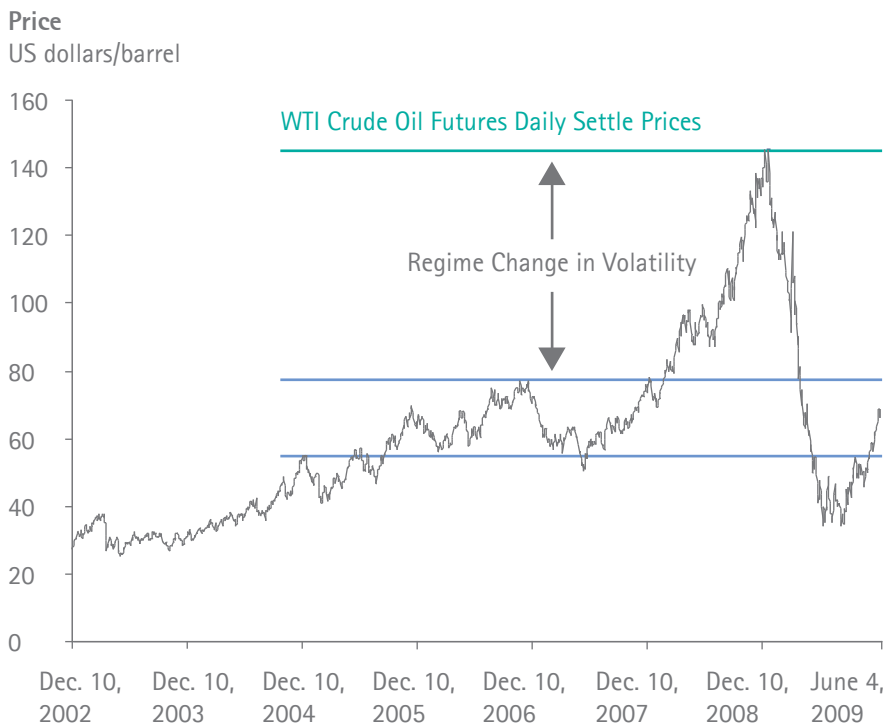
With regard to credit risk, what may seem like innocuous matters such as failure to correctly represent and link counterparty subsidiary relationships in the system of record can result in concentrated credit exposure to a single counterparty. Related to this issue is where the inability to legally enforce collateral and netting agreements can aggravate credit exposure where it is assumed to be minimal.

Rethinking risk management

Dynamic back testing doesn't take into account all the failures and incorporate their evidence. We only see the survivors.

Accenture believes the focus of risk control should be on preparation, as in “How prepared is our firm in the event of...” and less on trying to predict what tomorrow's risk will be. Understanding a company's risk profile is a prerequisite to understanding its vulnerabilities. Stress testing and scenario analysis were originally envisioned to complement VaR analysis to understand a company's risk profile. However, it is our observation that both these tools have been relegated to a minor role in current risk management practice.

Figure 1. Market-wide shift in volatility with regime change.



Source: CME Group, www.cmegroup.com; Accenture analysis.

Traditional approaches to stress testing suffer from the same weaknesses as VaR; they focus on trying to predict the next bad event by modeling the last bad event as an example. The pitfalls of relying on backward-looking scenarios are brought out in the book, *The Black Swan*, by Nassim Nicholas Taleb.² In the book, Taleb makes an analogy of the current risk mind-set of trading operations to that of the problem of induction/inductive knowledge:

Consider a turkey that is fed every day. Every single feeding will firm up the bird's belief that it is the general rule of life to be fed everyday by friendly members of the human race "looking out for its best interests" as a politician would say. On the afternoon of the Wednesday before Thanksgiving, something unexpected will happen to the turkey. It will incur a revision of belief (Taleb, 2007).³

The fundamental issue in question here is how does the observation of events in the past give us confidence to figure out the properties of the phenomenon we are studying? Add to this problem the issue that risk is not a linear process. It follows the power law in terms of scaling, whereby the addition of a new observation can radically change the nature of the descriptive statistics of the data. This lack of appreciation is the problem with current approaches to risk management. Yesterday's markets will not necessarily tell you what tomorrow is going to bring.

Reviewing scenarios for preparation

To prepare, there should be—and perhaps will be—more emphasis on stress testing the trading enterprise and performing scenario analysis. A leading practice can be found with the US Department of Defense. The Defense department does not try to predict where the next war is going to happen; rather, it conducts war-game scenarios. This sort of approach is less concerned about how something is going to happen and more about identifying the weak spots in the current strategic footprint if this scenario manifests itself. It is our view that stress testing will usurp VaR and eventually become mandated by government regulation for physical commodity traders as part of the current financial regulation proposed to improve supervision of financial markets. Regulatory compliance is going to require the enterprise to know its holdings, know the value of its holdings, know their business partners and clients and know how material changes in the risk profile of any of these three constituents affects its business.

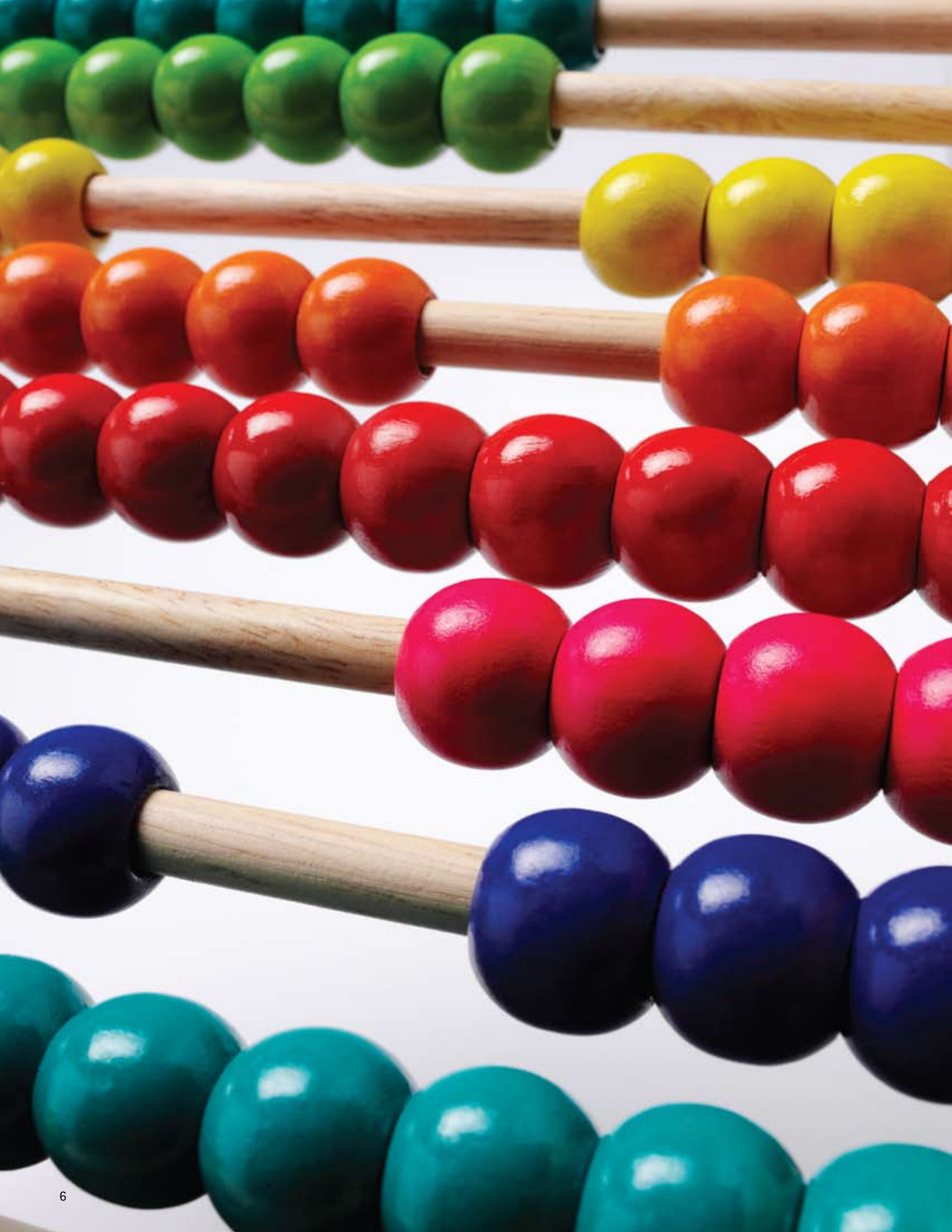
Today, where energy markets are highly intertwined and leveraged, where a few global counterparties can account for significant volumes in all the markets and where the vast majority of participants rely on lines of credit to fund their businesses, it does not take very much for tomorrow to be the day before Thanksgiving (as previously described by Taleb). One could certainly argue that this is exactly what happened in the 2008 credit crisis.

Accenture has developed an approach that compensates against the reliance of history as an indication of the future. The lesson for risk managers is to always fundamentally question all of their assumptions. And to run stress tests as a means of testing said assumptions.



2. Taleb, Nassim Nicholas, "The Black Swan: The Impact of the Highly Improbable," Random House (2007).

3. Ibid.



Accenture's leading practices for dynamic risk management

1. As a necessary prerequisite, conduct a risk review to assess and identify risks that are natural to the company and from which the company stands to benefit given its asset and strategic footprint. Identify risks that the company does not want to manage and outsource them to willing third parties. Barring that, make the appropriate structural changes to minimize or eliminate these exposures from the risk profile.
2. As a first pass, use the VaR process to identify the boundary of tail events and design and define the parameters of the stress test and scenario analysis to further assess the tail events. Use stress test results to refine trading strategies, risk limits (position, VaR, earnings at risk, MTM loss, etc.) and hedge ratios and to determine capital requirements.
3. To achieve a more realistic and necessary view of the risk profile, solve for the traditional risk inputs by first defining the outputs (bad situations that the company wants to avoid, e.g., violation of VaR limit, position limit, dollar threshold of collateral calls and MTM loss values) and reversing the stress test to determine the market conditions. With knowledge of the company's appetite for risk exposure from points 1 and 2, set as the input conditions to solve for the spectrum of market, volatility, liquidity and credit conditions that would cause such a combination of risk-limit violations. This approach is where Accenture sees the value of breaking away from preconceived "canned" stress tests. While quantitatively trickier to produce, we find that the information gained from this approach to be richer and more thought-provoking to risk managers than is available from current practices.

4. Outside of market risk-related levers, risk managers also need to consider other operational risks that can disrupt the trading portfolio. Examples include simulating the freezing of financial transfers due to the insolvency of a major broker-dealer or intermediary bank, markets closing due to external factors resulting in the inability to hedge price risk, rogue trading activities at a counterparty causing massive unwinding of positions that the company is naturally exposed to (serious issue in the energy markets) and so on. These risks need to be conceptualized and quantified and reported to management to ensure that prudent counter-measures are deployed to mitigate the exposure if the hypothetical becomes reality.

Ultimately, the goal of risk management is to come up with the real risk profile of the company—and determine if that profile is acceptable. If the risks are unacceptable, they can be addressed in a number of ways, such as through capital allocation, investment decisions, strategic shifts or organizational changes or by simply changing the trading strategy. It is a dynamic and evolving process and should be treated as such.

About the author

Alex Chandy is a senior manager in the Accenture Commodity Trading and Risk Management Services group. Based in Houston, he leads the offering for chemical and natural resources clients. His experience includes 15 years of commodity trading and risk management in natural gas and natural gas liquids in North America, primarily in the merchant trading, utilities and gas processing industries. Prior to joining Accenture, he was a natural gas and natural gas liquids (NGL) trader.

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