Taming Global Village Risk

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The steadfast walls once restraining capitalism are crumbling. Highly integrated markets, coupled with rapid innovation, have created a world that can now best be thought of as a single global village. Investment services, products, and opportunities, which know few boundaries, are rapidly spanning the globe. The seeming insatiable global appetite for investments (and risk) has led to new, sophisticated investment structures engineered by what are now global financial intermediaries. While the field of capitalism—sowed with individual property rights and free and open capital markets—has indeed precipitated a bountiful harvest, every few years the harvest is spoiled by an intense, disruptive storm that brings staggering losses and exacts the toll of a considerable time to recovery. It seems the seeds of disruption are sowed alongside the seeds of prosperity.

This article presents an exploration of the driving forces behind the market dislocations frequenting capital markets and will hopefully provide readers a powerful calming elixir to apply against such forces. A better understanding of market risk by market participants will go far toward mitigating these severe disruptions.

PERENNIAL STORMS

The seeds of the latest financial purge were likely planted some 20 years ago in the aftermath of the Cold War. A structural bull market in risk grew from these fields of market capitalism which were fertilized with cheap and plentiful credit, and can be most readily observed in the explosive emerging economies (think Asian Tigers). Between 2002 and 2007, growth of the developing world has advanced at nearly double the pace of the developed world (Greenspan [2007]). Sovereign wealth funds have benefited from rising commodity prices and surplus trade gaps. Some 29 sovereign funds, now worth about $3 trillion in total, have been created to date and have a significant influence on global markets (*Economist* [2008]).[1]

Understanding investors' attitudes toward risk is key to understanding market dislocations. The underpricing of risk precedes financial excess. As we will see, investors' consideration of risk is often subsumed by their consideration for return. In hot pursuit of return, investors often forget a primary tenet of modern portfolio theory—that risk and return must be considered together. Viewed in this context, it is possible to understand how this conflict results in occasional financial instability. For example, during 2007, required yield spreads on high-yield bonds fell to historic lows and with that development came more questionable loan guarantees and fewer loan covenants. Furthermore, financial scalability has led to immense levels of credit risk in the banking sector that dwarfs the subprime mortgage sector. This high

risk concentration among a relative few with high levels of uncollateralized leverage fully tested the system and resulted in a global credit crisis.

Disruption in this structural bull market originates in investors' hunger for higher returns and new and riskier product structures, coupled with an underappreciation for the uncertainty of outcomes. An increased demand for return pressures the quick delivery of new and more sophisticated products that are broadly accessible to the expanding marketplace. Together, this has engendered a climate of risk-taking beyond prudent tolerances. A consequential day (year) of reckoning appears about every five years or so—a global storm of mammoth proportions. Consider the crash of 1987, banking failures of 1992–1994, LTCM and Asian currency crises of 1998, TMT bubble of 2000–2001, and the credit meltdown of 2007.

ROLE OF DIVERSIFICATION

It is important to note the palpable role of diversification in proper portfolio construction as a response to the market aberrations facing investors. Proper diversification means that investors broadly diversify their portfolios across a myriad of asset classes, while, of course, keeping their unique circumstances top of mind. Asset allocation in this framework suggests that investors build portfolios to complement their lives or, in other words, that they consider their asset allocation in coordination with their liabilities. Doing so leads to a wide spectrum of suitable investment assets, which include capital assets, such as global stocks and bonds, as well as noncapital assets, such as life insurance.

Suitable noncapital assets are those which improve consumption smoothness or lower required precautionary savings, and thus mitigate consumption risks especially in adverse economic environments. Examples are investments having contingent claims characteristics, such as life and disability insurance to protect the investor's human capital and long-term options to protect against an undesirable portfolio shortfall. These types of investments are reasonably considered in portfolio construction. Proper portfolio construction unifies the return and risk decisions across time and contingencies with the intent of mitigating the risk associated with an uncertain future (Sullivan [2008]).

For the remainder of the article, we turn our attention to gaining a better understanding of the factors underpinning the risk and uncertainty of markets.

EXPLORING MARKET DISLOCATIONS

An effective response requires a thorough understanding of the ingredients that generate disruptive financial market storms. In this section, we examine the drivers of increased market risk. A calm, reasoned voice within the storm is needed to inform decisions and appropriately ensure that results align with intended goals.

Connecting the Economy with Capital Markets

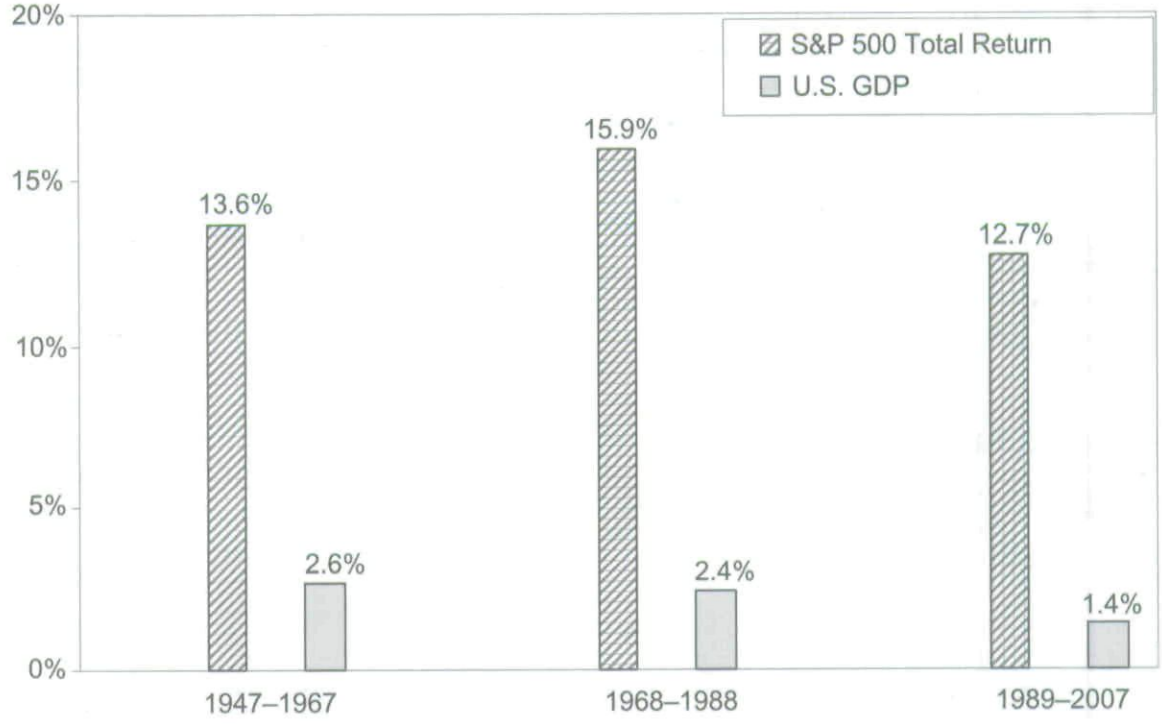
In addressing this challenge, investors must first understand the link between the real economy and capital market pricing. The capital asset pricing model suggests that investors demand a risk premium in exchange for taking certain investment risks. In particular, investors price assets in accordance with an asset's systematic risk, which in turn is ascribable to the supply and demand characteristics of that asset. In short, investors demand risk compensation that reflects aggregate macroeconomic risk.

Returns to the macroeconomy provide an anchor for returns to the corporate sector. As suggested by Arnott and Bernstein [2002], this occurs because over the long term corporate sector earnings growth cannot exceed sustainable aggregate GDP growth. Capitalism creates a dilution effect through new enterprises and new stock offerings in existing enterprises and a balance in returns to capital and labor. In fact, since 1947 the real economy has grown about 3% per year, while stocks produced a real total return of about 4% per year.[2] As one would expect, earnings—growing at about 2.8% per year—expanded more in line with GDP than with stock prices whose earnings *multiples* expanded over this period.

Although corporate earnings growth is closely linked to the growth of the overall economy, the volatility of their respective returns is curiously much less closely linked. Historically, corporate earnings growth and stock prices have been much more volatile than GDP. Since 1947, the annual standard deviation in real equity returns has been 13.6%, the standard deviation in earnings growth 10.6%, and the standard deviation in GDP growth 2.3%. Furthermore, as depicted in Exhibit 1, while capital markets have maintained their level of riskiness in recent decades, the variability of the real economy has actually declined when measured by standard deviation. Thus, the relative disparity in risk between financial markets and

EXHIBIT 1

Economy vs. Stock Returns, Annualized Standard Deviation



Source: Data from U.S. Bureau of Economic Analysis and Robert Shiller's website.

the economy has widened. Consider how the relative level of risk, measured by the ratio of stock market volatility to macroeconomic volatility, has almost doubled from earlier decades. For the current 20-year period, this relative volatility ratio stands at about 9, up from around 5 in earlier periods. Financial market volatility is not mirroring that of the overall real economy.

The evidence suggests that the global economy has become a less risky place with fewer and shallower recessions, while capital markets continue to be volatile and disruptive. We argue that the relative global economic stability has encouraged increased risk-taking and complacency. But, first, we examine this increased economic stability, sometimes referred to as the Great Moderation.

A confluence of many factors is influencing the phenomenon of a calming global economy, but four factors are of particular importance. First, the economy has become far more diversified with the emergence of new industries such as technology. This increased diversification serves to dampen economic swings. Second is the fact that emerging markets are entering measurably into the global economic arena. Emerging economies have catapulted onto the stage with remarkable growth in output, innovation, and productivity. Like the greater breadth in industries, emerging economies play a significant diversifying role by counterbalancing the ebb and flow of our dynamic tradable-goods global economy. Our economy, once dominated by the volatile agriculture and manufacturing sectors, has now become more diversified as it is impacted positively by industry and country effects, smoothing both the demand and supply side for goods and services. Third, monetary policy has evolved over recent decades as the Fed and other central banks have gained a better understanding of its influence on the economy and are thus better equipped to navigate the ebb and flow of economic cycles. A fourth influence involves safety-net government programs, such as unemployment insurance and social security.

In short, the integration of global economies along with better informed monetary policy has worked to dampen economic fluctuations. Capital markets should logically follow suit with diminished volatility, but this simply has not been the case. To appreciate how this situation can

exist requires an examination of the contributors to this counterintuitive escalation of relative market volatility.

Market Complexity

We turn our attention now to the disruptive forces affecting global capital markets. We have already argued that the broadening of industries and melding of countries has led capital markets to be more globally interconnected and complex. Via dynamic feedback loops, capital markets continually digest information and adapt to changing economic conditions. Following others, we suggest that capital markets are, in effect, complex adaptive systems (Barnett [2000], Bookstaber [2007], Mauboussin [2008], Waldrop [1992]); *complex* in that the economic system is made up of a great number of interactive agents and their decisions relate and influence each other in nonlinear and unanticipated ways, and *adaptive* in that the economic system evolves so that economic agents actively take advantage of changes in the environment. This increasingly complex and more interconnected system is a key driver of increased market volatility. Recall the global subprime meltdown with the contagion between collapsing banks that began in the summer of 2007. Kindred structured credit woes were rapidly ported to Europe and Asia from the U.S.

Markets are well characterized as complex adaptive systems, in part, because investors are sociobiological agents with complex utility functions and decision processes. Investors are not perfectly rational, unemotional calculators who make decisions based on callous quantitative models. Capital markets, too, are dynamic social animals, which process information via continuous feedback loops. Capital markets are vigorous and dynamic. They digest information and adapt to changing economic conditions. Although perhaps partly rational, markets are mostly behavioral, evolutionary organisms (Lo [2004], Statman [2005]).

The key point is that evolutionary systems must be analyzed with evolutionary tools that incorporate the complex, interconnected behavior among agents—both endogenous and exogenous. Normal investors and markets thus cannot be described by normal statistics. The statistics of normal distributions derived by smooth, linear, and continuous functions and used to adequately describe many physical sciences are unfit in the realm of complex adaptive systems which characterize capital markets. Recent advances in mathematical techniques, such as jump diffusion, GARCH, and copulas, among others, have spurred the development of sophisticated models that seek to explain and predict the risk–return tradeoff in markets. However, even these advanced techniques rate poorly at anticipating the "anything can happen" direction that our complex adaptive markets take. Such analytical approaches make unrealistic assumptions about the way individuals and markets act, and so these approaches fail, but not with grace. Consider again the market shocks mentioned earlier. Such events are also captured by Taleb's notion of a black swan[3] and are endemic to complex adaptive systems (Taleb [2007]).

Exhibit 2 provides ample evidence of the well-known notion that equity returns do not follow a normal distribution. This histogram applies long-term monthly returns data from 1871 to 2007. It suggests a fat-tail return distribution, possessing both positive skewness of about 0.35 percent and a significant level of kurtosis of around 14.

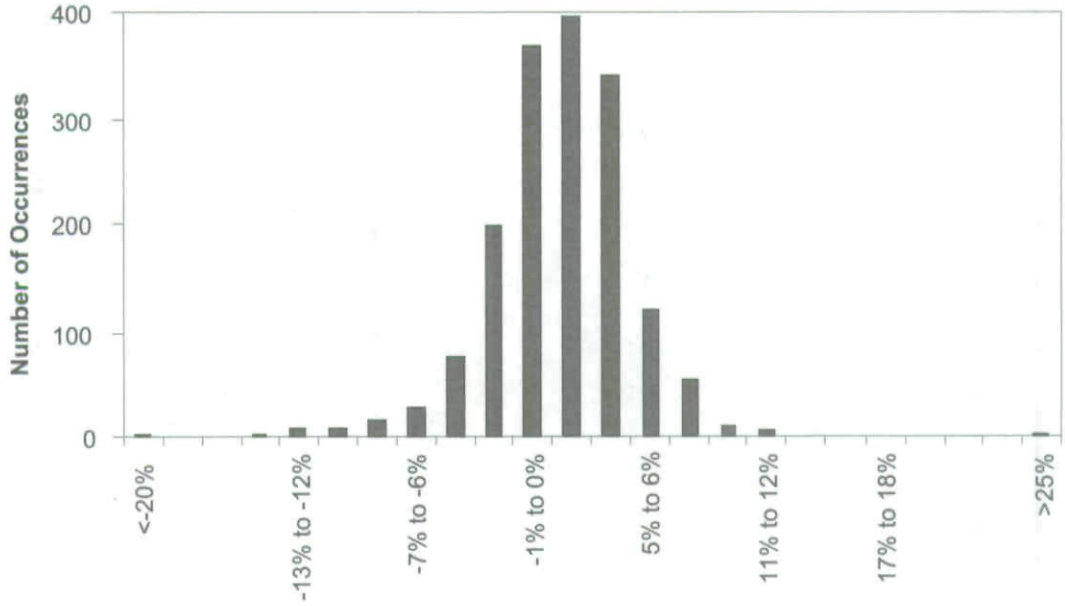
Impact of Technology and Risk Systems

Technological innovations have also contributed to rapid development of the complex adaptive system that typifies capital markets. Technology has flattened the earth by significantly reducing the cost and portability of information and by allowing for increased complexity of models. The principal result is that information, and thus market activity generated by both creating trade ideas and executing those ideas, now moves at breakneck speed. On the downside, risk models, which are often built on the principles of physics to describe complex, adaptive sociobiological systems, are inherently flawed. Automated, mathematically driven models calibrated to yesterday's calmer, more normal waters run aground when the water is churning with anxiety and fear. Our mathematical models, as elegant and sophisticated as they have become, are still far too simple. Economic models that necessarily abstract from the real world do not, and cannot, fully capture the full array of variables governing our global economy.

It appears that risk management practices are not keeping pace with advances in market complexity. Increased product sophistication in an uncertain environment screams for a robust risk-decision framework. A sound risk management system in such an environment requires that investors first have a solid framework for understanding what risk means. As suggested by Knight [1921], investors should distinguish between risk

EXHIBIT 2

S&P 500 Total Return Distribution, Monthly, 1871–2007



Source: Data from Robert Shiller's website.

and uncertainty—a distinction with an important difference. Knight asserts that risk can be objectively quantified because it has distinct outcome probabilities that are deterministic and known a priori. An example is the known probabilities associated with the roll of a dice. Uncertainty, however, is radically different. Uncertainty cannot be objectively quantified because the future outcomes are not all known. To Knight, uncertainty is not deterministic.

Building on Knight, Holton [2004] provided an excellent general definition of risk that we will use for the purposes of this article. Holton suggests that risk has two elements—exposure and uncertainty. Here, *exposure* means people care about the outcome, and *uncertainty* means people do not know all the possible outcomes in advance. Risk, therefore, is exposure to a proposition that has uncertainty. For instance, a person starting a new business clearly faces risk. Importantly, financial markets typify this definition of risk.

Simply put, markets cannot be fully described with hindsight-driven, naïve empirical models that consider markets as simply risky while ignoring that they are, in reality, uncertain; therefore, operationally addressing the challenges of risk management means recognizing that true risk cannot be fully captured. Risk metrics can only be useful tools in aiding our understanding of the exposure and uncertainty—the two elements of risk—which we face.

Making this same point, Keynes argued that, in the realm of investments, calculating probabilities is futile. He argued that uncertainty in investments has "no scientific basis on which to form any calculable probability whatever" (Keynes [1937, p. 214]). Knowing this, Keynes suggested that investors can only fall back on mass sentiment and thus form their expectations and future prospects based on the judgments of those around them. However, as we have already pointed out, expectations can shift rapidly, fundamentally affecting the availability of liquidity provided by investors (i.e., markets can be highly volatile). We return to this idea later in the article.

A solid risk management process is frequently clouded by the use of leverage, a practice very much on the rise (Gross [2008]). With investors' greater access to borrowing, financial leverage is markedly greater now than in the past, even the recent past. Samuelson [2007] recently commented that balancing a standard-length baseball bat in the palm of one's hand is reasonably manageable, but doing so with a bat the length of a tall building would certainly be quite difficult and the bat could easily be knocked off-kilter with even the slightest breeze.[4]

In addition to increasing the speed of connectivity, technology has also fostered complexity through new, innovative financial instruments available to investors. Financial markets are becoming increasingly sophisticated in measuring, pricing, and transferring risk. Financial products such as derivatives, structured products, and securitization arguably benefit capital markets overall by making them both more resilient and efficient. They can improve risk-sharing by allowing risks to be ported from those unwilling or unable to take certain risks to those who are willing to take them. But unfortunately, in reality, these instruments bring risks of their own, often with the perverse consequence of amplifying market shocks.

The unfortunate reality is that the benefits of increased sophistication are greatly reduced by a world with information and incentive problems. Financially engineered investment products, brought to market faster and with greater complexity, operate with a high degree of opacity. The result is little investor understanding of the market basis for risk and return. On a more sinister level, financial products can also be accompanied by a misrepresentation of the inherent risks, motivated by self-dealing. These agency risks confound the relationship between principals and agents, meaning that such products are better sold than bought. As Bogle [2005] has oft repeated, we must not put salesmanship ahead of stewardship.

Role of Liquidity Providers

Underneath mismatched risk and ballooning leverage lies a voracious appetite for return with seemingly little attention to the concomitant risk. Some have suggested that this attitude has been parented over recent decades by central banks' allowing nothing to go wrong in financial markets (McCulley [2007]). Reserve banks, playing the repeated role as market savior, have in turn created a moral hazard—the so-called free Fed put. By seemingly limiting risk associated with return, reserve banks have bred imprudence. In this regard, risk-taking and leverage among market participants continues to mount with little concern about investments going sour. U.S. Federal Reserve Chairman Ben Bernanke seems interested in removing this free put, but doing so without deepening the market turmoil will clearly be a challenging mission with a considerable commitment of time and delicate communication.

Keynes provided a key insight regarding liquidity. Liquidity in Keynes' view was not determined exogenously by central banks as observed by the money stock. Instead, he recognized that the availability of liquidity is mostly determined endogenously by profit-seeking financial intermediaries or liquidity providers that exist outside of the direct purview of the central bank (Keynes [1936]). Consequently, the system is financially fragile and volatile.

Keynes' idea is driven home by observing the increasing importance in today's liquidity-driven markets of the liquidity-providing financial intermediaries such as hedge funds and structured conduits, including CLOs and CDOs. At year-end 2007, the Bank for International Settlements estimated outstanding credit default swaps at $43 trillion and total derivatives at over $500 trillion. These contracts are used by SIVs and CDOs, among other financial conduits. Together, these intermediaries comprise the so-called shadow banking system as popularized by McCulley [2008], following Keynes. The shadow banking system consists of unregulated, levered intermediaries that seek profit and risk.

Liquidity comes from these levered savers seeking compensated risk and is not a simple money stock measure such as M2. To see the importance of this shadow system, consider that the genesis of market liquidity is risk seeking. The pool of risk capital is therefore not a constant, but is directly linked to the ebb and flow of liquidity. In this sense, market liquidity relies on the faith of the financial markets. An increased risk appetite among investors facilitates greater liquidity via easing credit conditions. This chain of events precedes a willingness to underwrite greater risk and increased financial leverage via investment vehicles such as CDOs, SIVs, and the like.[5]

Unlike the central banking system, the shadow banking system has no lender of last resort, no discount window, no deposit insurance, and no capital requirement regulations.[6] The risk profile of these agents is highly susceptible to liquidity. Liquidity in the shadow banking system can thus dry up with startling rapidity, dependent solely on the market's tolerance for risk. In the case of a sudden systematic reduction in risk appetite, the ensuing liquidity withdrawal precipitates forced selling which can negatively affect prices and create a self-reinforcing cycle—a downward Minsky-type spiral of de-levering and collateral-related liquidity-seeking by levered investors,[7] or Greenspan's so-called liquidity conundrum. Hence, market instability can quickly erupt into a high-intensity risk-aversion storm. A seemingly minor

economic shock may become severely destabilizing when joined by a run on the shadow banking system.[8]

Consider, as witnessed in 2007 and 2008, how problems in one corner of the market can spill over into other completely unrelated corners; for example, from subprime mortgages into the entire fixed-income market and then into the equity market. The extent of the propagation relates to the confluence of risk, leverage, and liquidity, and to the interconnectedness of the financial system. When leveraged risky positions become victims of a suddenly reduced risk appetite, the need to liquidate escalates, and as the market is cascading downward in price, liquidation orders rise and liquidity providers diminish (Bookstaber [2000]).

Finally, consider the impact of rising market efficiency as witnessed in recent decades. Markets are indeed becoming more efficient, as evidenced by declining alpha availability. Black, according to Mehrling [2005], once suggested that markets become increasingly volatile as they become more efficient. This occurs because market participants all tend to react in the same way when unanticipated new information becomes available, thus leading to larger price movements. Magnifying the effect, many market participants assume that markets are perfectly rational. But, as mentioned earlier, markets cannot be described with deterministic models and naïve empiricism. Here, the application of deterministic, mathematically (or quantitatively) driven investment decisions applied to what, in reality, are dynamic stochastic market processes is akin to crossing the street blindfolded. Financial modeling without healthy skepticism leads to disaster.

BEHAVIORAL CONSIDERATIONS

We can also look to the role human behavior plays in capital market activity and aberrations. As social animals, certain embedded cognitive and emotional behaviors lead us to systematic errors in judgment. Consider how confirmation bias, for instance, affects our views. We tend to look for information that supports our beliefs. Extreme events require the opposite mindset, seeking out that which refutes our beliefs. For example, all analysts know how quantitative analysis is conducted with a set of what might be considered reasonable outcomes (or, worse, a particular outcome) already in mind. If the result of our analysis does not fit with our prior beliefs, the model can be tortured until it confesses to them. What analyst hasn't tweaked an asset pricing model that suggested an initial result that was different from what they expected? It is easy to see how this conduct can be taken to an extreme with severe consequences.

We also find assurance in building ever more elegant and complex mathematical models that promise invulnerability in measuring the future with precision. But these are false promises, in part a result of overconfidence bias, common source opinions, and groupthink.[9] Consider how investors underestimate true risk by confusing measurable risk with immeasurable uncertainty. Combining this confusion with the impact of overconfidence in models leads investors to fall into the fallacious-thinking trap that the future is predictable. Our views also tend to be strongly influenced by those around us. Replacing independent thinking with groupthink leads to the herding and misplaced enthusiasm found in asset pricing bubbles. Markets work best when individuals form independent views.

Short-term thinking is also clearly at play. An investor's obsessive focus on near-term results is often parlayed into long-term value destruction. Minsky [1974] helped us see the destructive effects of *short-termism*. He described how investment cycles swing between boom and bust periods. These cycles are driven first by rational investment for which investment debt can reasonably be expected to be repaid via the income stream generated by the asset. But then speculative fervor takes hold in the form of a pyramid (or ponzi) scheme. The ponzi phase is highly speculative in that the investor can survive only if the asset's price moves higher. This is the result of an investor's use of considerable leverage against an asset, which is priced such that little hope exists of repaying the borrower via the asset's income stream. The only hope is that the asset's price moves ever higher and the investor can sell the asset in the short term to another, less-suspecting investor. This game ends badly, however, when the music stops playing and there aren't enough chairs to go around.

The list of errors in judgment includes other cognitive lapses, such as hindsight bias and recent memory bias in which investors frame prospects for the future based on what has happened in the past. This idea works well for human survival (e.g., recalling that to plant crops in the spring offers the best prospects for a bountiful summer harvest), but is inappropriate for financial markets in which anything can happen. We cannot presume the past is prologue to the future. However, as black swans suggest, models aspiring to predict the future cannot be well

calibrated to past events. All of these influences coalesce into an elegant and compelling package that demonstrates how emotions factor prominently into market instability.

Considered together, these errors in judgment obviously feed into the various risk drivers discussed earlier and hence form a unified view of volatile market pricing and events.

REGULATORY CLIMATE

It takes little imagination to see how the current global storm could precipitate a climate of increased regulation as a balancing mechanism, be it industry self-regulation or increased government oversight.[10] There are warnings aplenty of the potential ahead for severe market disruption. If more investment regulation is to become the powerful elixir for calming volatile markets, then we are encumbered to ensure that the proper regulations are passed.

Therefore, what are some of the potential policy implications aimed at controlling market dislocations? The degree of leverage and liquidity available in credit markets is rooted in the profound trust of the solvency of counterparties (Greenspan [2008]). It is thus crucial to better understand counterparty risk. This task could be accomplished by simplifying and increasing the transparency of financial products and instruments. Practices surrounding financial reporting, product transparency, and investment valuation need to significantly evolve in order to ensure proper risk assessment of investments. How many market participants fully understood the risks of the various layers of CDO tranches bought prior to the most recent market meltdown? We must also ask the bigger question, do we really need to create tradable investment assets out of virtually every financial instrument that has a cash flow?

The so-called shadow banking system is now a significant player in the viability of the global economy. Given the growing role of these unregulated players who can withdraw liquidity at a moment's notice, consideration should also be given to fully measuring and understanding the global levels of liquidity, leverage, and systemic risk employed in capital markets (Kandhani and Lo [2007]). Determining the appropriate or optimal levels of these factors certainly presents a challenge, but should not preclude the effort.[11] Take leverage, for instance; the optimal level is certainly not zero, but it is also not so high that it cannot be properly balanced, to use Samuelson's analogy. With caution given to not being overly paternalistic, efforts aimed at adequately measuring and coordinating these various risk factors would go far toward reducing systemic shocks that cascade through our interconnected market system.

Finally, we might also consider mellowing the frenetic pace of markets by slowing the speed of market activity. For instance, circuit breakers and market closings have been demonstrated to be effective tools in restoring calm in the midst of financial disaster.[12] The effectiveness of these tools should be evaluated and expanded, where appropriate, to strengthen market confidence. And as previously mentioned, emotions play a prominent role in financial activity. Taking unfettered time to sort out these emotions can help to replace panic-induced activity with activity based on sound judgment.

It is important that any reforms adopted should not inhibit the key drivers of the long-term success of our complex and adaptive global economic system—market flexibility and competition. Any regulatory action should focus on simplifying and clarifying the machinery of the market. This means that any new regulations should be in alignment with the intended goal of benefiting capital markets. A focus on increased transparency, wider dissemination of information, temporary market respites, and measurement and limitation of systemic risk caused by leverage could form the basis for proper reform. Changes in capital market regulations invariably can come with varied and unpredictable consequences of their own, but can also serve to support a stable capital market foundation.

SUMMARY

Asset price bubbles build and burst today as they have since the early 18th century, when modern competitive markets began to evolve (Greenspan [2008]). Although the variability of the real economy has declined in recent decades, capital markets have not followed suit. They remain volatile and unpredictable. Although a benign environment is not likely in the cards, greater investor understanding could bring us closer to a market environment which is better aligned with macroeconomic activity. We should not abrogate our responsibility for creating a better financial system. Exploring the driving forces behind market volatility can provide investors a basis for an effective response in dealing with market risk.

Even with stunning technological advances, financial management risk systems are inadequate for today's

complex adaptive markets and related sophisticated products. As complex adaptive systems, markets are composed of a great number of decentralized decision makers who are continually digesting information and interacting in unanticipated and nonlinear ways. The fact that markets are complex adaptive systems has critical implications for how we think about and manage investment risk. In risk management, we must focus on the market mechanisms driving capital markets to higher volatility, including the emotions of investors, complexity of adaptive markets, and advances in technology and mathematical modeling. Improving risk management means finding new tools to measure the interconnectedness of markets plus the total amount of systemic risk, leverage, and liquidity in the markets. With improvements in risk management, investors and regulators will be better equipped to mitigate the market volatility that often culminates in financial market instability.

Importantly, investors should regard risk management as a guide for quality decision making in the face of uncertainty and not simply view it as being about risk measurement tools or generating an all-inclusive set of risk numbers. Improved risk management requires a broad understanding of the complex financial market system and cannot be reduced to a few numeric metrics.

Reasoned voices must partner in the pursuit of healthy, functioning capital markets. This pursuit means investors must try to better understand market volatility and even possibly effect regulations that seek to control market meltdowns and their ensuing contagion. A window of opportunity exists now to influence minds toward mitigating markets which have created so much benefit, before these markets beget equal woe.

ENDNOTES

This article reflects the views of the author, and does not represent the official views of the author's employer, CFA Institute.

[1]In all, capital values of the world's traded securities markets have roughly doubled to about $165 trillion during the last eight years.

[2]Similarly, Arnott and Bernstein [2002] showed that real stock prices grew about 2.5% per year between 1871 and 2000 compared to 3.5% a year for GDP over the same period.

[3]A shocking event is termed a black swan if it meets the following conditions: it is rare (improbable beyond our normal expectations), it has an extreme impact, and it can be reasoned to make sense after the fact (*retrospective predictability*). The crash of 1987, banking failures of 1992–1994, LTCM and Asian currency crises of 1998, TMT bubble of 2000–2001, and credit meltdown of 2007 all qualify as black swans.

[4]In addition, it is necessary to consider the related issue of the significant potential risk associated with mismatched assets and liabilities, such as, for example, the pension plan with assets possessing a duration much shorter than the duration of its liabilities or the bank that lends long and borrows short.

[5]As of early 2008, sovereign wealth funds have provided about $70 billion of infusions to U.S. financial services firms (*Economist* [2008]).

[6]The Fed ordinarily lends directly to commercial banks through its discount window. Although the Fed can also lend to nonbanks in certain circumstances, it has been reluctant to do so, ostensibly because nonbanks are not under its supervision and doing so may aggravate moral hazard.

[7]Minsky [1986] codified the insights of Keynes into a financial instability hypothesis which suggests that financial instability is endemic to capitalist economies. Euphoric expectations lead to a secular trend of rising debt and eventually a debt-induced crash. Asset prices can only move back into equilibrium via asset price deflation or current price inflation.

[8]Indeed, in March 2008, such a run befell the investment bank Bear Stearns. The U.S. Federal Reserve and commercial bank J.P. Morgan Chase & Co. intervened by providing emergency funding. The run concluded with J.P. Morgan seeking to purchase Bear Stearns days later.

[9]Janis [1982] described how groupthink results from the tendency of groups of individuals to suppress those views which differ from the unanimity of the group.

[10]Indeed, in April 2007, the Bush administration proposed sweeping plans to streamline U.S. financial regulation. Proposals included a consolidation of bank regulation, creation of a new type of insurance charter, increased oversight of mortgage lending, and expanded oversight responsibilities for the Federal Reserve.

[11]For instance, consider how leveraging the spread between on-the-run Treasuries and off-the-run Treasuries differs in risk from that of leveraging the spread between low-grade credit and high-grade credit.

[12]For example, the market closings following the September 11, 2001, attacks.

REFERENCES

Arnott, Robert D., and Peter L. Bernstein. "What Risk Premium Is 'Normal'?" *Financial Analysts Journal*, Vol. 58, No. 2 (March/April 2002), pp. 64–85.

"Asset-Backed Insecurity." *Economist*, January 17, 2008.

Barnett, William A. *Commerce, Complexity, and Evolution*. Cambridge, UK: Cambridge University Press, 2000.

Bogle, John C. "The Mutual Fund Industry 60 Years Later: For Better or Worse?" *Financial Analysts Journal*, Vol. 61, No. 1 (January/February 2005), pp. 15–24.

Bookstaber, Richard. "Understanding and Monitoring the Liquidity Crisis Cycle." *Financial Analysts Journal*, Vol. 56, No. 5 (September/October 2000), pp. 17–22.

——. *A Demon of Our Own Design*. New York: John Wiley and Sons, Inc., 2007.

Greenspan, Alan. "The Roots of the Mortgage Crisis." *Wall Street Journal*, December 12, 2007, p. A19.

——. "We Will Never Have a Perfect Model of Risk." *Financial Times*, March 16, 2008, http://www.ft.com/cms/s/0/edbdbcf6-f360–11dc-b6bc-0000779fd2ac.html.

Gross, Bill. "Pyramids Crumbling." *PIMCO Investment Outlook* (January 2008), http://www.pimco.com/LeftNav/Featured+Market+Commentary/IO/2008/IO+January+2008.htm.

Holton, Glyn A. "Defining Risk." *Financial Analysts Journal*, Vol. 60, No. 6 (November/December 2004), pp. 19–25.

Janis, Irving. *Groupthink: Psychological Studies of Policy Decisions and Fiascoes*. Boston: Houghton Mifflin, 1982.

Kandhani, Amir E., and Andrew Lo. "What Happened to the Quants in August 2007?" *Journal of Investment Management*, Vol. 5, No. 4 (2007), pp. 5–54.

Keynes, J.M. *The General Theory of Employment, Interest and Money*. New York: Harcourt, Brace & World, 1936.

——. "The General Theory of Employment." *Quarterly Journal of Economics*, Vol. 51, No. 2 (February 1937), pp. 209–223.

Knight, Frank H. *Risk, Uncertainty, and Profit*. New York: Hart, Schaffner, and Marx, 1921.

Lo, Andrew W. "The Adaptive Markets Hypothesis." *Journal of Portfolio Management*, 30th Anniversary Issue (Autumn 2004), pp. 15–29.

Mauboussin, Michael. *More Than You Know*. New York: Columbia University Press, 2008.

McCulley, Paul A. "Moral Hazard and the Role of Central Banks." *CFA Institute Conference Proceedings Quarterly*, Vol. 24, No. 1 (March 2007), pp. 1–5.

——. "The Liquidity Conundrum." *CFA Institute Conference Proceedings Quarterly*, Vol. 25, No. 1 (March 2008), pp. 1–4.

Mehrling, Perry. *Fischer Black and the Revolutionary Idea of Finance*. *New* Jersey: John Wiley & Sons, 2005.

Minsky, Hyman. "The Modeling of Financial Instability: An Introduction." *Modeling and Simulation*, 5, Part 1 (1974), pp. 267–272. Reprinted in the *Compendium of Major Issues in Bank Regulation*, pp. 354–364. Washington DC: Government Printing Office, 1975.

——. *Stabilizing an Unstable Economy*. New Haven, CT: Yale University Press, 1986.

Samuelson, Paul. "New Finance Theories: Triumphs and Testings." Presentation, JOIM Conference, Boston, September 23, 2007.

Sharpe, William F. "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk." *Journal of Finance*, Vol. 19, No. 3 (September 1964), pp. 425–442.

Statman, Meir. "Normal Investors, Then and Now." *Financial Analysts Journal*, Vol. 61, No. 2 (March/April 2005), pp. 31–37.

Sullivan, Rodney N. "Using Investment Consumption Value to Select Asset Classes: A Non-Traditional Approach." *Journal of Portfolio Management*, Vol. 34, No. 2 (Winter 2008), pp. 79–90.

Taleb, Nassim N. *The Black Swan: The Impact of the Highly Improbable*. New York: Random House, 2007.

Waldrop, Mitchell. *Complexity*. New York: Simon & Schuster, 1992.