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JUNE 2011

Systemic Risk: Strategic Challenges for Policymakers and Practitioners

Systemic risk has emerged as a critical challenge for central bankers, regulators, asset owners and managers. While the influence of the phenomenon is well understood, systemic risk is often virtually invisible until it erupts into widespread market dislocation. New regulatory standards, oversight bodies and quantitative research approaches seek to moderate its influence and stabilize global markets.

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A System on the Brink

A worldwide relaxation of financial oversight, pervasive low interest rates, lax lending standards, minimal market volatility and general risk engagement pushed the global financial system to the brink of systemic failure in 2008.

By the time regulators, risk managers and central bankers realized that systemic risk had taken root in markets, it had already exploded into full-scale systemic distress. As asset owners and managers engaged in a frantic bid to liquidate assets and respond to breaking events, they turned the market on its head — selling high-quality liquid assets because impaired illiquid assets could only be sold at distressed prices. Survival, not long-term asset building, was the critical objective.

Systemic risk is now one of the most debated and analyzed financial topics in the world. But what exactly is systemic risk? Can it be measured? What can regulators do to get it under control? And what practical tools can policymakers and practitioners deploy to defend markets against it?

In defining systemic risk, economists with a historical bent are fond of citing the Aristotelian admonition, "For that which is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest."[1] Another often-cited framework for defining systemic risk derives from the classic essay "The Tragedy of the Commons,"[2] which identified the "commons" as a shared resource, whose exploitation benefits multiple systemic actors, but where none of the participants bear unique responsibility for ensuring the sustainability of this exploitation.

By this line of thinking, which is often applied by those who liken financial markets to natural ecosystems that thrive on diversity and sustainable stewardship, the global financial marketplace is the commons. While individual financial actors — investors, managers, regulators, central banks and finance ministries — might carry out vigilant oversight of activities within their purview, the aggregate balance sheets and market exposures of multiple institutions can create catalytic and cascading risk. And when economic activities, such as runaway asset appreciation, leverage or ill-advised lending, become unsustainable, they stop — often with destructive consequences for all concerned. This is the "tragic" part of the tragedy of the commons.

Financial markets are prone to systemic risk because all market participants are connected. Financial shocks landing in one corner of the system can quickly migrate because the balance sheet of any given financial

[1] Aristotle, *Politics*, Book II, Chapter III.

[2] Garrett Hardin, "The Tragedy of the Commons," *Science*, Vol. 162, No. 3859, December 13, 1968.

Defining Systemic Risk

Systemic risk is the risk that the failure of a participant to meet its contractual obligations may in turn cause other participants to default, with the chain reaction leading to broader financial difficulties.

Bank for International Settlements, Annual Report 1994

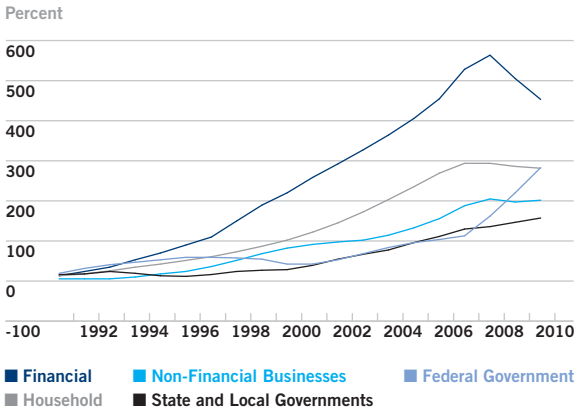
actor comprises assets that are either liabilities of other actors or whose values depend on the behavior of other actors.[3]

When an asset owner or manager suffers a decline in the value of their assets, they reduce investment and risk exposures; if the decline is steep enough, they may be forced to sell assets under pressure. This uncertainty transmits risk through the vector of counterparty relationships. When this risk compounds across millions of relationships and transactions, the result can be a chain reaction of margin calls, liquidation, repatriation and default. And, with international markets digitally linked through real-time networks that can transmit thousands of trades per millisecond, systemic risk can move through the system at breathtaking speed.

When systemic risk spirals out of control it can erupt into systemic distress characterized by one-way trading, herding, concentrated positioning, extraordinary co-movement within asset classes and a marked decline in selectivity. Systemic risk indiscriminately threatens all market actors — active and passive bystanders alike — regardless of their risk position or risk appetite.

Financial market systemic risk is particularly critical today because contemporary financial markets and investment volumes are more complex and larger, in both real terms and relative terms, than at any time in the history of money. In the US, for example, the

Change in US Credit Market Debt Outstanding



amount of debt held by the financial sector soared from $3 trillion in 1978 to $36 trillion in 2007 and more than doubled as a share of gross domestic product.[4] US financial debt expanded by over 500 percent between 1990 and 2008 — more than twice the rate of expansion seen for nonfinancial business debt.[5] What's more, because systemic risk is defined by the comingling, correlation and compounding of individual risks that in and of themselves might be rational and manageable, when systemic risk lands it is both no one's and everyone's fault.

[3] George G. Kaufman, John F. Smith Professor of Finance and Economics at Loyola University Chicago, "Bank Failures, Systemic Risk and Bank Regulation," *Cato Journal*, Vol. 16, No. 1, Spring/Summer 1996.

[4] United States Financial Crisis Inquiry Commission, "Report on the Causes of the Financial Crisis," January 27, 2011.

[5] Federal Reserve Flow of Funds Accounts of the United States, Statistical Release, March 2011.

A Global Policy Response

In the worlds of economic and financial academia, policymaking and central banking, there is general agreement as to the drivers of the systemic risk that spurred the recent financial crisis. At the macro level, unprecedented imbalances — between creditors and debtors, between widely divergent economic growth rates, and between the rapid expansion of savings in developing economies contrasted with a parallel dearth of savings in the most developed economies — stimulated huge investment flow volumes.

These investment flows drove up asset valuations unsustainably and prepared the ground for their collapse. In financial markets, low interest rates and minimal volatility, easy credit, lax regulation and opaque securitization led asset owners and managers (and, critically, banks) to "reach" for returns, increasing their use of leverage and short-term money market funding, moving ever further out onto the risk spectrum.

Armed with this knowledge, financial policymakers today are taking advantage of a once-in-a-generation opportunity to re-regulate financial markets, putting into place action plans that academics, regulators and central bankers have been discussing for decades, but which found no purchase during the prosperous years of low inflation, steady economic growth and outsized financial returns prior to the financial crisis.

Ever since World War II, financial markets have enjoyed increasing globalization, reduced capital controls and general convergence in terms of regulatory arrangements. And the top-line features of the new, post-crisis regulatory environment, elaborated at the highest global-level policy institutions, will generally continue this momentum toward greater homogeneity.[6] But upon close examination, it becomes clear that national policy nuances are distinct, reflecting the unique macroeconomic, financial and political challenges of individual markets.

Counter-cyclicality, Liquidity and Leverage

Given that the worst impacts of the crisis rose at the heart of the financial system — in some of the world's largest financial institutions — there has been general agreement that banks should maintain increased capital ratios and counter-cyclical buffers that encourage them to retain capital in good times, so that it can be deployed for damage control when markets dislocate. The intention is not so much to eliminate the ebb and flow of cyclical rotation, but rather to moderate the intensity of boom, bust and systemic risk.[7]

Institutions are also being urged to carefully monitor the liquidity of their investments. One of the most notable drivers of systemic risk during the financial crisis was the inability of investors to sell illiquid assets that they did not want and the forced sale of more liquid assets that they would have preferred to retain on their books. Closely related to capital and liquidity concerns are those related to leverage — the notion that maximum loan-to-value ratios be reconsidered, carefully monitored and reported to regulators.

[6] John Nugée, Official Institutions Group, State Street Global Advisors, and Dr. Sven Kasper, Director, EMEA, State Street Regulatory, Industry and Government Affairs, "Current Issues in Financial Regulation and the Impact on Global Financial Markets," SSgA Capital Insights, February 2011.

[7] Markus Brunnermeier, Andrew Crockett, Charles Goodhart, Avinash D. Persaud and Hyun Shin, "Fundamental Principles of Financial Regulation," Geneva Reports on the World Economy, Inernational Center for Monetary and Banking Studies, January 2009.

SIFIs and Too Big to Fail

Increased regulation of Systemically Important Financial Institutions (SIFIs) is rising as an across-the-board response to the "too big to fail" problem and to ensure that no more taxpayer money is diverted to dealing with bank failure. While it may be obvious that large banks at the center of financial systems may be too big to fail, in many countries where very large banks are embedded within relatively smaller economies, these institutions may be "too big to save" because the size of their balance sheets can rival the GDP of the countries in which they are headquartered.

An important point of consensus among financial policymakers is the notion that not only banks, but non-banks such as hedge funds, broker-dealers and multinational corporations, also known as "shadow-banking" institutions, might also be considered systemically important. This is not only a function of the growing role of non-bank finance, but because many banks may consider shedding systemically significant activities to non-bank entities in response to restrictions on proprietary trading and the ownership of hedge funds and private equity funds.

Concerns center on the notion that a SIFI designation may cut a number of ways. It will trigger the establishment of higher capital buffers and allow regulators greater powers of information gathering and orderly liquidation authority (OLA) to help wind up the affairs of failed institutions. Institutions seeking to avoid SIFI designation have expressed fear that higher capital ratios may cut into their margins, eroding their competitiveness.

But, the SIFI designation may also give markets the impression that these institutions enjoy implicit guarantees from taxpayers, thus inviting moral hazard. By at least one calculation, the perception that a bank is too big to fail may lower its funding costs by up to 50 basis points, enabling it to borrow more, increase leverage and take on more risk.[8]

Different approaches to the disposition of SIFIs are still being resolved by policymakers. In the US, which is adopting a more rules-based (as opposed to principles-based) regulatory regime, OLA centers on the ability of financial authorities to mandate the drafting of "living wills" and the closure of distressed institutions, effectively creating surge protectors and circuit breakers to impede the movement of contagion across the financial landscape.

In the UK, the Independent Commission on Banking interim report to the UK Treasury recommended that policymakers direct universal banks to maintain separate pools of capital for their retail and investment banking operations, with retail banks required to hold 10 percent of core tier one capital, more than the 7 percent envisaged by the Basel III international agreement. Contrary to early speculation, the commission did not recommend a Glass-Steagall style divestiture of commercial and investment banking into separate companies or the breakup of large banks into smaller institutions.

The US and UK, by calibrating market restructuring, have reduced the likelihood that banks will shift their activities around through an exercise in unproductive, market-distorting regulatory arbitrage. It also has removed, for the time being, the possibility that large banks might depart their traditional headquarters for jurisdictions of least regulation.

Increased Transparency for Securitization and Derivatives

While much of the most egregious mispricing of assets that took place during the financial crisis was to be found in markets for securitized products, it should be remembered that for decades before, derivatives had systematically and successfully reduced the cost of capital, linked global markets and distributed risk. So in elaborating the new financial architecture designed to mitigate systemic risk, policymakers have sought to re-engineer the trading of derivatives in a manner that preserves their market utility and enhances their transparency.

[8] Simon Johnson, Ronald Kurtz Professor of Entrepreneurship, MIT Sloan School of Management, Testimony before the US Senate Committee on the Congressional Oversight Panel, March 4, 2011.

Are Hedge Funds Systemically Important Financial Institutions?

The Financial Stability Board (FSB), established by the G-20 at its Seoul summit in November 2010, will extend the purview of its regulations to include several types of Systemically Important Financial Institutions (SIFIs), including hedge funds.

There is general consensus in the policy community that there are systemically significant institutions to be found beyond the strict confines of the banking industry. And G-20 conferees agree that new regulations along the line of the Dodd-Frank Act in the United States should mandate that hedge funds and/or their managers be made to register and disclose information to regulators on an ongoing basis.[9]

Hedge Funds and Systemic Risk

But there is less agreement over whether hedge funds or private equity funds introduce potentially destabilizing systemic risk. Bank capital and liquidity requirements are well understood. But, the idiosyncratic nature of hedge funds and private equity funds — and their diverse strategies — means that these institutions may not lend themselves to regulations designed for highly regulated banks. Moreover, many in the hedge fund industry are quick to point out that hedge funds were at best bystanders, or even victims of the worst practices that led to the financial crisis.

It has also been noted that inclusion of selected non-banks into such a regulatory regime may produce unforeseen consequences. For example, markets may eschew trading with hedge funds that are included in SIFI oversight for fear that enhanced regulatory scrutiny and control may increase the funds' cost of capital, thus impeding investment returns. Conversely, some wonder whether the designation of a hedge fund as a SIFI may generate moral hazard in the belief that such funds enjoy the unofficial backstop of central banks and finance ministries.

Given the ease with which investment flows today move between jurisdictions and between various types of investment firms — banks, broker-dealers, hedge funds, sovereign entities and myriad asset managers — it seems that the next generation of financial regulation may be focusing more on mechanisms and practices than on the underlying legal personality of institutions. Regulators seem to be acknowledging that financial markets today are being redefined by the steady convergence of financial practices between different types of financial firms, different jurisdictions, and between traditional and alternative varieties of asset management.

[9] G-20 Fact Sheet, Office of the Press Secretary, the White House, Washington, DC, November 2010.

But once again, policymakers have achieved consensus on the large themes and diverged on the details. It is generally understood that over-the-counter, bilateral trading of most derivatives should be migrated to exchange-like structures and central clearing in an effort to lend transparency and stability to this critical market. Electronic trading facilitates information gathering because it allows real-time risk monitoring and leaves an auditable, digital trail. But while regulators in the US propose to require that derivative trading platforms display price quotes from multiple participants, the European Commission has proposed a less restrictive rule, allowing the continuation of bilateral price quotes, but in an online format instead of over the phone.[10]

Another divergence can be found in proposals that foreign exchange derivatives trading migrate to mandatory clearing and reporting. In the United States, the Department of the Treasury has decided that FX swaps and forwards should be granted exemption from the clearing requirements of the Dodd-Frank Act. In Europe, the Council of the European Union, European Commission and European Parliament are still discussing whether new central clearing requirements should take into account the specific nature of individual asset classes.[11]

The concern, for derivatives as with new bank capital requirements, is that an inconsistent set of governing regimes would invite regulatory arbitrage, with systemic risk building in less-restrictive markets.

[10] "Proposed Rules on Taming Swaps Markets are Proving Controversial," *The Economist*, March 3, 2011.

[11] Joe Clark and Farah Khalique, "European Parliament and Council on Collision Course over FX Exemption," *FX Week*, February 11, 2011.

Systemic Monitoring and Regulation

The nature of financial regulation has been historically accretive. Over time, laws and governance authority have been put in place over individual types of financial activity, with relatively little attention paid to systemic activities that drive correlation among these individual elements. In the months and years leading to the crisis, financial activities expanded in areas that fell between the macrofinancial, monetary responsibilities of central banks and the more micro-focused duties of financial supervisors concerned primarily with the health and stability of individual financial firms.

Central banks have the technical expertise to undertake systemic monitoring, and as the ultimate source of any economy's liquidity, they are naturally positioned as agents of remediation. But monetary stability, not sound market practice, is their primary raison d'être. Supervisory agencies also have technical capacity but have dedicated their primary efforts over the years to the soundness of individual components of financial markets, rather than to the buildup of systemic stress and potential market-wide risk.

Despite the advent of new regulations and enhanced capital standards, systemic risk could still arise. Responsibility for monitoring the horizon for incipient systemic risk will fall to new, systemic risk regulatory agencies charged with national, regional and global oversight of macroprudential issues such as capital, liquidity and leverage ratios, links between financial firms, unusual market correlations, concentrated risk and herding, and unsustainable systemic stress.

In terms of financial diplomacy, it was noteworthy that action plans elaborated during the crisis did not fall to the G-7 leading economies, but to the G-20, which includes economies from both the developed and developing worlds, thus reflecting new economic relatities. Also springing to action was the Basel Committee on Banking Supervision (BCBS), located at the secretariat of the Bank for International Settlements (BIS).

The Basel Committee adjusted the capital and liquidity framework of its Basel III accord with a view to strengthening global capital and liquidity and helping the banking sector to address systemic risk. The updated regulations establish tighter definitions of common equity, new leverage ratios, counter-cyclical capital buffers, and new restrictions on counterparty credit risk and short- and medium-term quantitative liquidity ratios. The new Basel accord was endorsed by the G20 leadership at its Seoul summit, which agreed that member states should integrate the accord into their national legislation and regulation by January 2013, so that they can be phased in by January 2019.

It is worth noting that while the systemic implications of the financial crisis have been widespread, many parts of the world, notably fast-growing developing markets in Asia and Latin America, avoided much systemic stress and bounced back far more quickly than other regions. This time, systemic risk did not come from the periphery; it rose from the heart of the global financial complex. Asian financial markets had undertaken a strengthening of regulations and capital structures in the wake of that region's 1997–1998 currency crisis and thus avoided many of the worst impacts of the

Official Perspectives

One of the best ways to protect the financial system against future systemic shocks, including the possible failure of a major counterparty, is by strengthening the financial infrastructure, including both the "hardware" and the "software" components.

US Federal Reserve Chairman Ben S. Bernanke, August 22, 2008

Systemic risk is the threat that developments in the financial system can cause a seizing-up or breakdown…triggering massive damages to the real economy. Such developments can stem from the failure of large and interconnected institutions, from endogenous imbalances that add up over time, or from a sizable unexpected event.[12]

Jean-Claude Trichet, President of the European Central Bank

2007–2008 event. The global financial crisis was notably North Atlantic in its origins.[13] And it is in Europe and the US that the most far-reaching regulatory initiatives, in particular to address systemic risk, are emerging.

In the US, the Financial Stability Oversight Council (FSOC), created under the auspices of the Dodd-Frank legislation, is a collaborative effort between various state and federal regulators under the chairmanship of the Secretary of the Treasury. The council has a mandate to constrain excessive systemic risk and will be able to designate nonbank financial institutions as systemically important, in an effort to fill regulatory gaps that allowed for weakened standards and regulatory arbitrage prior to the financial crisis.

The FSOC has been tasked to facilitate information sharing between agencies and has the authority to collect information from individual financial companies with a view to determining whether their market activities create systemic risk. The council also has the ability to designate financial market utilities and payment, clearing and settlement activities as systemically important and therefore subject to monitoring.

Perhaps most controversially, the FSOC can recommend stricter standards, including heightened capital and liquidity levels for large, interconnected banks and non-banks alike, and can require those firms to file an "orderly resolution plan" describing how they could be dismantled without engendering systemic risk. The council can even break up firms that it determines pose a "grave threat" to the financial stability of the US. Smaller firms that carry out activities concentrated in a particularly significant corner of capital markets can also be brought under these regulatory auspices at the discretion of the council.

The European Union has created its own collaborative body, the European Systemic Risk Board (ESRB), which brings together governors of European central banks, new European Supervisory Authorities (ESAs) and national supervisory authorities from all 27 EU member states. The board will provide macroprudential oversight, collect information, identify potential systemic risks, and issue warnings and recommendations for remedial or enforcement action to the ESAs.

[12] Jean-Claude Trichet, President of the European Central Bank, "Systemic Risk," Clare Distinguished Lecture in Economics and Public Policy, University of Cambridge, December 10, 2009.

[13] John Nugée, Official Institutions Group, State Street Global Advisors, and Dr. Sven Kasper, Director, EMEA, State Street Regulatory, Industry and Government Affairs, "Current Issues in Financial Regulation and the Impact on Global Financial Markets," SSgA Capital Insights, February 2011.

The new ESAs — the European Securities and Markets Authority (ESMA), the European Banking Authority (EBA) and the European Insurance and Occupational Pensions Authority (EIOPA) — will seek to create a single EU rule book for capital markets, backstop national supervisory authorities and carry out investigations. The ESAs can mediate in disagreements between national supervisory authorities and, in emergency situations, can carry out decisions that are binding on national supervisors and on individual financial firms. While national supervisors will continue to take primary responsibility for interacting with individual financial firms, this new architecture will likely reduce inconsistency in the application of financial regulation across different markets in Europe.

At the global level, the Financial Stability Board (FSB) — the former Financial Stability Forum — hosted by the secretariat of the BIS, coordinates the work of national financial authorities and international standard-setting bodies such as the International Organization of Securities Commissions (IOSCO). The FSB has been charged with monitoring implementation of the Basel III accord, assessing vulnerabilities of the global financial system, reviewing supervisory actions, maintaining surveillance of market developments and advising on regulatory best practices.

The FSB has established a policy framework for reducing moral hazard and monitoring the systemic risk implications of SIFIs, providing technical assistance for the establishment of national resolution regimes, determining whether increased Basel III capital standards will drive the migration of business to non-bank institutions, recommending additional OTC derivative market reforms, collaborating with the BIS and the International Monetary Fund (IMF) to develop macroprudential frameworks and tools, coordinating global accounting and regulatory standards and reforming compensation practices to support financial stability.

A System of Systems

Assuming a best-case scenario of new regulations, more transparent and stable financial assets and new mechanisms to identify systemic risk and stop it in its tracks, it should be remembered that the financial system exists within a system of systems. Even if the new financial architecture is robust and well-functioning, systemic risk could re-enter from financial markets from any one of several directions.

The financial system resides at the heart of a larger macroeconomic system. And the same macroeconomic stresses that engendered systemic risk during the crisis — financial imbalances and wide discrepancies in economic growth and employment — linger in markets today. Economic growth in the G-7 ex-Japan stands at 3 percent[14] and in China it is three times higher at more than 9.6 percent.[15] Large emerging-market governments flush with cash from the export of commodities and finished goods enjoy surpluses, while in the US and in much of Europe, debt-to-GDP ratios are rising sharply.

In response to the financial crisis, initial policy triage centered on fiscal policies, bailouts and economic stimulus in the form of massive government spending. As the positive effects of these initiatives reached the limit of their effectiveness, policy interventions shifted to currencies, with economies in surplus purchasing US dollars to restrain the appreciation of their currencies, and economies in deficit using balance sheet expansion and quantitative easing (QE) to generate liquidity with which to remove impaired assets from financial markets, stimulate economic expansions and buttress asset valuations. Interest rates have diverged, with emerging-market economies using high interest rates to restrain inflation and moderate growth, and developed markets keeping interest rates as low as possible to restrain asset price deflation and stimulate faltering economic growth.

[14] Organization for Economic Cooperation and Development, "What is the Economic Outlook for OECD Countries? An Interim Assessment," April 5, 2011.

[15] International Monetary Fund, "World Economic Outlook Update," January 25, 2011.

In many highly developed economies, the massive generation of new liquidity through QE has generated concerns over inflation for the first time in a generation. The transfer of risk from private markets to the public sector via the acquisition of impaired assets by central banks, and explicit government guarantees for bank deposits and debt securities, has generated sovereign risk concerns in the heart of Europe, raised doubts over the value of the US Treasury securities, and led to concerns over the stability of developed-market currencies such as the euro and the US dollar.

This macroeconomic layer of systemic risk is translated directly into worldwide political risk because banks hold government debt and governments own or guarantee bank debt. Some believe that individual governments, consistent with their constituent responsibilities, are engineering market dynamics in a "zero-sum" environment. To cite just one example, policies designed to maximize export revenue for energy, agricultural products or other commodities in one country may engender rising food and energy prices and incipient inflation in another.

Some have speculated that these policies, together with QE, may have generated economic pressures that have resulted in social and political unrest, popular insurrections and even changes of government. It goes without saying that political instability exacerbates underlying economic and financial systemic stress.

The political approach of using the G-20 to mitigate systemic risk, while diplomatically inclusive, has come with mixed success in unifying the widely divergent priorities of emerging and developed market governments. While the large-scale G-20, which comprises two-thirds of global population and 90 percent of global GDP,[16] has successfully agreed on a common agenda, the greater challenge will be to implement these measures in a mutually beneficial and pragmatic fashion.

Systemic risk at the financial, macroeconomic and political levels is in turn trumped by far-reaching, systemic environmental risk. With both floods and droughts in Australia, Brazil, China and the US, hurricanes and cyclones in the Asia-Pacific region and the US, and record heat, cold and wildfires across North America and Europe, climate-related risk has the power to impact everything from food production, mining and energy operations, to transportation and consumer spending. And when one factors in such out-of-nowhere disasters as earthquakes in Haiti, Chile and Japan, oil well disasters in the US and a tsunami and nuclear accident near Tokyo, it is clear that the regulatory mitigation of financial market risk can only go so far in insulating the global economy from any one of several drivers of systemic risk.

[16] G-20 Secretariat, "How does the G-20 Differ from the G-7", G-20 FAQ, www.g20.org.

Emerging Research

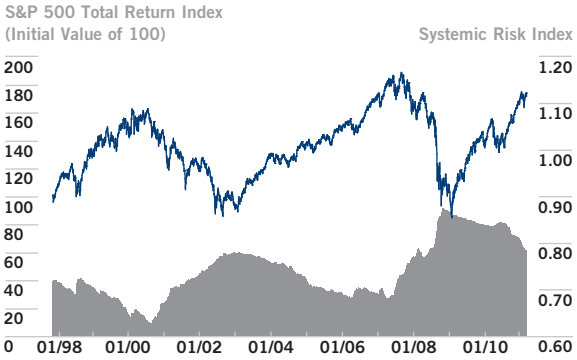
In a complex and interconnected world, isolated endogenous or exogenous shocks can wreak havoc if the markets in which they land contain high levels of systemic risk. All financial actors — multilateral institutions, central banks, finance ministries, regulators and practitioners — have a vital interest in understanding whether systemic risk levels in any given market make them likely to explode into open systemic distress.

Financial policymakers today understand the criticality of systemic analysis and monitoring. And they are developing an impressive toolkit for buttressing the stability of systemically important financial institutions and for impeding market contagion once it lands. But, they still lack a fundamental understanding of systemic risks that can build for extended periods underneath markets that, in the absence of catalytic shocks or bad news, post strong performance and demonstrate no superficial signs of fragility. New quantitative research into market structure, investor behavior and unusual price movements seeks to address precisely this inability to identify systemic risk early.

A Systemic Risk Index

Investors are vitally interested in systemic risk, but it is not always easy to observe. Securitization adds complexity and obscures connections between stakeholders. Private transactions that take place over the counter or through dark pool trading are usually opaque. Special-purpose vehicles and off-balance sheet investing can impede the ability of regulators to monitor counterparty relationships. And even if new practice standards and regulation succeed in rendering markets more transparent, they are constantly evolving.

Systemic Risk



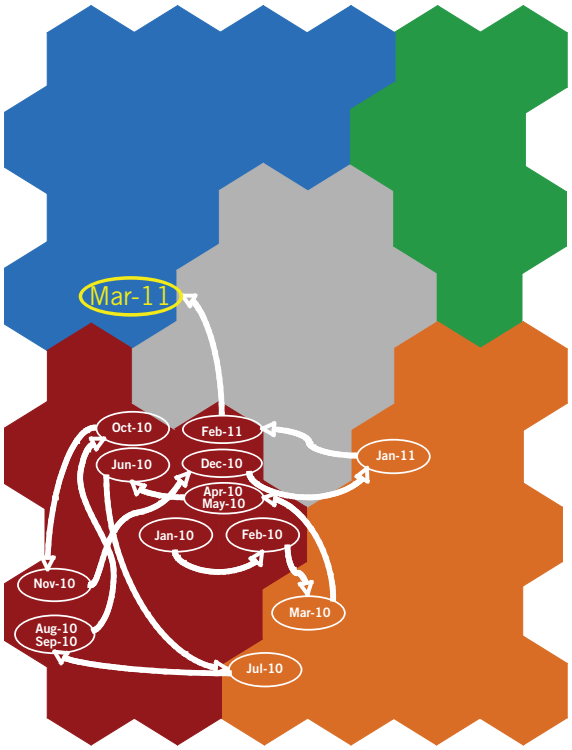
Source: State Street Global Markets research

As an alternative to conventional market stress analysis, new research approaches center on examination of the "absorption ratio," which can be defined as the fraction of the total variance of a set of assets explained or "absorbed" by a finite number of eigenvectors (in mathematics, eigenvalue, eigenvector and eigenspace are related concepts in the field of linear algebra that can be used in matrix factorization.)[17]

A high absorption ratio implies that markets are tightly coupled. Compact markets demonstrate high commonality of price movement and are fragile. In these markets, shocks propagate more quickly and broadly than when markets are loosely linked and prices are

[17] Mark Kritzman, Yuanzhen Li, Sebastien Page and Roberto Rigobon, "Principal Components as a Measure of Systemic Risk," MIT Sloan School Working Paper 4785-10.

Regime Map



Leverage:
Herding into Asia and industrial cyclicals

Riot Point:
Broad-based retrenchment from equities

Liquidity Abounds:
Reallocation to equities with an accent on growth

Neutral:
A transition regime

Safety First:
A preference for developed markets

Source: State Street Global Markets research

well dispersed. As a result, the absorption ratio can be considered a measure of implied systemic risk.

The absorption ratio provided early warnings of the US housing bubble, anticipated several incidents of financial turbulence and coincided with many global financial crises including Black Monday, the Gulf War, Russian default, the collapse of the tech bubble and the global financial crisis.

Given that spikes in the absorption ratio have preceded most significant US stock price drawdowns, investors may be able to profit by varying their equity exposures around this measure of systemic risk. Following these spikes, stock returns tend to depreciate significantly. On average, when the absorption ratio declines sharply, equity returns appreciate significantly.

Investment Regimes

In line with the principles of Modern Portfolio Theory (MPT), many investors and analysts assume that markets will respond to such fundamentals as price/earnings ratios and balance sheet data in a uniform and rational manner. In practice, however, asset prices can diverge from fundamentals for extended periods of time, even for years. This phenomenon is very much driven by investor sentiment and concomitant behavior, rather than by fundamentals.

Investor behavior and investment correlation are widely perceived to be key determinants of whether or not financial shocks convert inherent systemic risk into systemic stress. If market participants are of a risk-engaging frame of mind, they may accept some level of systemic shock without incident. Conversely, the combination of a market possessed of high systemic risk and investors of a risk-averse frame of mind may mean that even a minor financial shock in a single asset class quickly migrates around the world, generating systemic distress.

To measure the oscillation of investor risk appetite, investment flows can be mapped and categorized into specific regimes, ranging from extreme risk aversion to equally fervent risk engagement.[18] Generally speaking, risk-engaging investors liberally allocate investment to overseas equity markets, while risk-averse investors tend to repatriate or purchase fixed income securities.

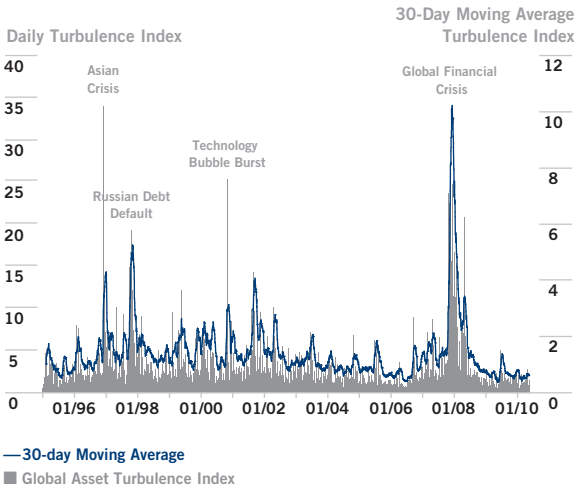
High levels of systemic distress are often accompanied by extreme risk aversion, the repatriation of globally allocated portfolios and the engagement of perceived safe havens. But systemic risk, investor sentiment and flows are highly nuanced. During the global financial crisis, notwithstanding the fact that the US was clearly

[18] State Street Global Markets Research, "Mapping Investment Regimes," December 12, 2006.

an epicenter of crisis, systemic distress was supportive of the US dollar and of Treasuries, in large measure because of massive asset repatriation by US investors. But global equity markets — US markets included — plunged in lockstep as systemic distress took hold and investor sentiment collapsed.

What's more, it cannot be assumed that high levels of risk aversion and of systemic risk are synonymous. A market with high levels of systemic risk — of which investors are unaware — may well enjoy high levels of risk appetite right up until the moment that systemic risk erupts into systemic distress. Conversely, investors might demonstrate high levels of risk aversion for any number of reasons, despite the fact that markets are well dispersed and possessed of minimal systemic risk.

Global Asset Turbulence



Turbulence

The architecture of systemic risk and investment regimes can set the stage for shifts in asset pricing. And when dynamic price swings, also known as turbulence, seize markets, they combine with the herding instincts of investors to accelerate this price movement in a self-fulfilling and persistent feedback loop.

Turbulence can be characterized as statistical unusualness. It is above all a measure of unusual price movements — either up or down.[19] Periods of extraordinarily high returns can be considered just as turbulent as those of market collapse. The rising technology, media and telecom bubble at the turn of the century (and its collapse) and the unsustainable boom in housing prices 10 years later (and their collapse) were all highly turbulent events.

Many believe that the single largest failure of risk management in recent years was the fact that risk managers have used average risk numbers rather than regime-specific risk numbers to gauge risk. By dividing historic investment returns into turbulent and quiet markets, investors can quantify the amount of turbulence associated with any given investment period, achieving a more insightful view of market dislocation than can be achieved by analyzing full-sample measures of returns, volatilities and investment correlations.

Investment performance differs radically in turbulent and non-turbulent periods, with a notable differential both in terms of market returns and risk levels. Armed with information on how specific segments of the market react during turbulent and non-turbulent regimes, as well as the notable persistence of these reactions, investors can stress-test portfolios and estimate probability of loss, use turbulence-related risk parameters to build portfolios that are more resilient in the face of market dislocation, and scale their exposures in anticipation of regime shifts.

And, while systemic risk can lurk beneath quiet markets for extended periods of time, in most cases systemic risk usually eventually leads to, and continues to build during, turbulence. Over time, after market correction and in response to policy initiatives, it dissipates.

Given that shocks propagate more rapidly and broadly when systemic risk is high, turbulent episodes that take place against the backdrop of fragile systems are particularly dangerous, leading to asset price collapse and widespread dislocation. Analysts can therefore use

[19] Mark Kritzman and Yuanzhen Li, "Skulls, Financial Turbulence and Risk Management," *Financial Analysts Journal*, Vol. 66, No. 5, September/October 2010.

Official Perspective

The rapid growth of the largest financial institutions and their increasing interconnections through securities markets has heightened systemic risk in the system. In response, we need to expand our capacity to contain systemic risk.

Timothy F. Geithner US Secretary of the Treasury, before the Senate Banking Committee, May 20, 2009

systemic risk and turbulence measures in tandem to anticipate tail risk — the risk that assets or portfolios can move more than three standard deviations from their current prices.

Systemic Risk, Regimes and Turbulence

Because elevated systemic risk, high levels of risk aversion and turbulence are not always revealed by conventional research, they don't always correlate directly to market prices. For example, while many severe market drawdowns have occurred against a backdrop of high systemic risk, systemic risk itself does not necessarily imply poor market performance. Bull markets can thrive amid systemic risk if no dislocating shocks land in the system. This is why fundamental research and evolving views into systemic risk, investment regimes and turbulence — blended in various combinations — offer new opportunities for understanding heretofore opaque systemic threats.

While most risk measures and asset allocation models are based on assumptions about single distributions — for example, US equities or developed market bonds — measures of systemic risk, investment regimes and turbulence can be applied to a wide range of investment assets. And because these phenomena are demonstrably persistent, investors that use dynamic allocation models to reallocate their portfolios to assets, regions, currencies and sectors that can benefit from combinations of systemic risk, investment regimes and turbulence, prevailing at any given time.

In times of high systemic risk, top-down, macro themes tend to dominate. Investors allocate in accordance with macroeconomic data and broad trends rather than micro fundamentals. The combination of turbulence indicators and regime mapping can help identify turning points in markets. For example, from November 2008 to February 2009, investors demonstrated extreme risk aversion as global markets were seized by systemic distress. But interestingly, by March-April of 2009, when global equity market prices were still bottoming out, investor sentiment was already improving. Investors that reallocated accordingly, using turbulence and regime measures rather than pricing to drive risk-sensitive trades, were able to invest in regions and sectors well positioned to benefit as systemic distress abated and global equity markets rallied.[20]

By contrast, over the course of 2010–2011, amid improving economic indicators, robust global equity returns and a marked absence of turbulence, institutional investors have hunkered down in the most risk-averse regimes, suggesting a deep unease over the sustainability of stimulus-led recovery, inflation, and concerns that systemic risk may be lurking unseen and building in strength.

[20] "Research-Driven Strategies in Turbulent Markets," State Street Corporation, September 2009.

Sustainable Growth Without Systemic Risk

Policymakers are collaborating closely on their re-regulation of market practices and structures. But markets themselves, and the economic systems in which they operate, show evidence of lingering imbalance and even decoupling. But while uniformity of approach evokes productive cooperation, there is a case to be made that the varied economic and financial circumstances of market participants may lead to systemic diversification and therefore a more resilient system.

Reconfigured financial regulation and the placement of systemic risk at the center of the macroprudential agenda will likely instill greater confidence in investors. But, in a system as vast and complex as that of contemporary global financial markets, virtually any and all actions can have unforeseen consequences. In the case of systemic risk mitigation, there is always the possibility — remote, but real — that efforts undertaken to forestall or avoid systemic risk might have the opposite effect. Precisely this kind of concern is being expressed in policymaking circles as the details of the new systemic risk architecture emerge.

For example, few can doubt the benefits of increased capital ratios and counter-cyclical buffers for banks that became overstretched to near breaking point when systemic distress seized markets at the height of the crisis. In setting new standards, the Basel Committee determined that the baseline for banks' core tier one capital should be 7 percent of risk-weighted assets.

But this added measure of surety does not come cheap; according to some estimates, Basel III stipulations could cut bank returns on tangible equity by between 7 and 9 percent.[21] And in most jurisdictions, institutions designated as systemically significant will face demands for yet higher additional capital buffers. In the UK, regulators have surpassed the Basel III targets with their proposed 10 percent capital buffer; in Switzerland political parties are discussing proposals that would require banks to have a total capital ratio of 19 percent.[22]

While bank profits may not be politically popular, it is worth recalling that without healthy operating margins, banks may lose the commitment of stock and bond investors, with inevitable implications for their ability to extend credit and finance productive economic activity. An across-the-board de-risking by banks may be safe for banks over the short term, but it could also have profound and far-reaching systemic consequences in the form of more restrictive lending and slower economic growth.

Perhaps the most profound system shift over the course of recovery from the financial crisis has been the massive transfer of risk from private financial institutions to central banks and governments. Whether through the direct acquisition of impaired securities, the explosion of deficit spending as a means of generating economic stimulus or the issuance of new liquidity through quantitative easing, governments and central banks have been deeply involved in the ownership and disposition of financial assets and risk.

[21] Patrick Jenkins and Brooke Masers, "Higher Capital Ratios Talk Cuts Banks' Appeal," *Financial Times*, March 27, 2011.

[22] "Swiss Parties Seen Backing Tougher Bank Rules," Reuters, March 20, 2011.

While repatriation effects have thus far enhanced the stability of highly developed currencies, economists and market practitioners are parsing data in pursuit of signs that a multi-trillion dollar tipping point might arise and dramatically reverse the course of economic recovery and of these currency valuations.

The world's largest economies are, at best, only half-way through the long march of financial recovery. Large developing economies, notably China, must slow growth to forestall inflation that could rob their economies of the hard-won gains of recent years, while re-engineering their economies away from risky dependence on high-volume exports and toward a more balanced mix of external and internal economic activity.

Highly developed economies must soon embark on their long retreat from bailouts, government stimulus and quantitative easing. To cite just one (substantial) example, the US Federal Reserve's balance sheet roughly tripled from less than $900 billion in August 2007 to $2.6 trillion in March 2011, with the composition of holdings altering markedly through the acquisition of long-term Treasuries, mortgage-backed securities and the provision of loans to financial firms.[23]

US policymakers are vexed over the twin challenges of nurturing economic recovery and protecting the value of the dollar. While the US dollar and Treasuries have thus far found willing buyers, the systemic risk implications of this policy shift are difficult to exaggerate. With an eye on the ballooning government deficit and the impending withdrawal of QE scheduled for June 2011, some of the world's largest institutional investors have sold or even sold short Treasuries in the belief that yields will soar, bond prices will contract and the economic recovery will stall.[24]

Perhaps more ominously, analysts wonder what might happen if global policymakers successfully mitigate risk in financial systems to the detriment of the economic systems around them. For example, European and American central banks, finance ministries, legislators and regulators can take satisfaction in their coordinated response to the global financial crisis. But what might happen if the deficit spending, guarantees and new liquidity deployed in the face of crisis call into question the value of the euro or even of the US dollar — the definitive reserve currency, which is used in 85 percent of all foreign exchange transactions, serves as the denominating currency for nearly half of the global stock of international debt securities and in which central banks hold more than 60 percent of their foreign currency reserves?[25]

Interest rates must eventually rise in the United States. Asian central banks have already started raising rates to choke off incipient inflation. The European Central Bank has also done so, in part over inflation concerns, but also to fend off "bond market vigilantes" speculating in distressed sovereign debt from the European periphery.[26] The great wind-down from stimulus spending, quantitative easing and the assumption of private market risk by governments and central banks may represent one of the greatest policy challenges, and potential sources of systemic risk, in contemporary financial history.

The long-term, sustainable health of global capital markets does not depend on an absence of risk. On the contrary, risk engagement and the articulate provision of speculative investment is the essential mission of finance. So it would be no small irony were the net result of the present round of re-regulation to be a stifling of risk appetite and innovation.

Financial markets have been steadily liberalized and globalized for more than a generation. However dislocating the financial effects of crisis have been over the past three years, it should be recalled that the decades of liberalization leading up to the crisis neatly coincides with the longest, most geographically dispersed period of sustained global economic growth in history.

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[23] Federal Reserve Bank of Cleveland, "Credit Easing Policy Tools," www.clevelandfed.org/research/data/credit_easing/index.cfm.

[24] Tom Bawden, "World's Largest Bond Investor PIMCO Dumps US Treasuries," *The Guardian*, April 11, 2010.

[25] Barry Eichengreen, "Exorbitant Privilege — The Rise and Fall of the Dollar and the Future of the International Monetary System," Oxford University Press, 2011.

[26] Stelzer, Irwin, "Will Spain be a Domino or a Dam?," *The Wall Street Journal*, April 18, 2011.

Optimal economic growth is achieved through a precise balance between risk engagement and systemic protection. Clearly, in recent years deregulation and the powerful forces of financial and macroeconomic imbalances swung the pendulum away from prudential care and risk management, generating historic levels of systemic risk.

But the pendulum can also swing the other way. If the new global network of regulation, oversight, supervision, information gathering and restrictions on trading systematically raises the cost of capital to the detriment of economic growth, the prudential measures designed to minimize financial system risk could impede economic growth and increase the risk of renewed recession.

The same forces of globalization that have generated compounding, accelerating productivity in the sciences, technology, medicine and other fields, can be brought to bear in global financial markets. The drivers of systemic risk are well understood, as are the broad goals of economic rebalancing and macroprudential re-regulation. It falls to policymakers to ensure that recovery, remediation and risk mitigation programs serve the greater good of sustainable global economic growth and of helping financial markets to fulfill their primary mission of routing investment flows to their most productive use — without generating systemic risk.

Contact Information

If you have questions regarding State Street's services and capabilities for systemic risk, please contact:

William Kinlaw
+1 617 234 9496
wbkinlaw@statestreet.com

David Turkington
+1 617 234 9484
dturkington@statestreet.com

Christopher Probyn
+1 617 664 1074
cjprobyn@statestreet.com

For questions or comments about our Vision series, e-mail us at **vision@statestreet.com**.

STATE STREET®

State Street Corporation
State Street Financial Center
One Lincoln Street
Boston, Massachusetts 02111–2900
+1 617 786 3000
www.statestreet.com
NYSE ticker symbol: STT

Content, design and production by State Street Global Marketing

11-0002-2684-0411
CORP-0321 EXP. DATE 06/30/2012