

## Building Toward A Resilient Financial System

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### Abstract

In this paper we present a conceptual framework for regulatory and policy responses to systemic risks, in light of lessons learned from the recent financial crisis. We argue that capitalism works best when it facilitates fair market discovery of prices. However, the market is imperfect; there are practices that actively seek to take advantage of structural issues that hinder price discovery. Such practices, if unchecked, will pose new surprises to the financial system. We note that the financial system has evolved to become so large and complex that renders conventional regulatory approaches ineffective. What is needed is *smart* government policies and regulation. We propose a Risk Intelligence Framework to equip regulators with a conceptual framework, methods and tools. This framework includes several components: (1) examine structural issues and prioritize key risk areas, (2) analyze firms' business models, (3) design tools for countering systemic risks, (4) re-develop risk models based on risk characteristics of systemic risks, and (5) prepare for responding to emerging threats.

*Keywords:* Systemic Risks; Regulation; Risk Intelligence; Price of Risk; Business Model; Structural Imbalance

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## Section 1. Lessons Learned From Recent Financial Crisis

A sound financial system is the foundation for economic development and value creation. This has been made abundantly clear during the recent financial crisis. After enjoying a long period of easy, low-cost credit and high asset valuations, the financial system went into cardiac arrest and almost froze in the fall of 2008 due to the accumulation of several imbalances over the previous decade. As a result of the financial crisis, the U.S. economy quickly fell into a rather deep recession. The U.S. government has undoubtedly softened the blow by injecting trillions of dollars into the financial system and billions into financial institutions to avoid a systemic meltdown. However, major damage has been done to the financial sector and the general economy and may take years to heal.

The root causes of the recent financial crisis are many structural issues accumulated over the past decade. Here we cite a diagnosis by Jamie Dimon (2009): “Any plan for the future must be based on a clear and comprehensive understanding of the key underlying causes of – and multiple contributors to – the crisis, which include the following:

- ✓ The burst of a major housing bubble
- ✓ Excessive leverage pervaded the system
- ✓ The dramatic growth of structural risks and the unanticipated damage they caused
- ✓ Regulatory lapses and mistakes
- ✓ The pro-cyclical nature of virtually all policies, actions and events
- ✓ The impact of huge trade and financing imbalances on interest rates, consumption and speculation

Each main cause had multiple contributing factors.”

We argue that capitalism works best when it facilitates efficient market discovery of prices. The market mechanism offers firms/entrepreneurs the right incentives for selecting risks that they are most capable of taking. Fair market pricings of the full spectrum of risks are essential for balanced economic activities. However, many practices hinder market price discovery. For instance:

- Practices of unfair subsidies, forum shopping, or hide assets or liabilities in off-balance sheet accounts have distorted fair market competition.
- Much of the excessive risk-takings are driven by out-of-balance compensation and misplaced incentives.
- The financial system now rewards short-term performance rather than long-term value creation in part, due to accounting systems that may be subject to distortions.

We must address such structural issues and root causes; otherwise, they will build up large imbalances until another financial crisis hits upon us.

Many leaders have recognized the need for change and have called for reform of our financial system and its regulations. Most notably, on June 17, 2009, President Obama unveiled sweeping regulatory changes as a formal policy response to the current financial crisis. One of the goals of his administration’s plan is to require regulators not to look only at individual institutions, but the “stability of the system as a whole”, which calls for the establishment of systemic risk regulators.

Policy and regulatory responses to systemic risks require a coherent conceptual framework. In a recent U.S. Senate Banking Committee hearing on systemic risks, PCI (2009) testified “The financial crisis that began last year has brought into sharp focus a key vulnerability in our current financial services regulatory system -- the absence of a comprehensive understanding of the nature of systemic risk and effective systemic risk oversight.”

Current theories have been lacking when it comes to systemic risks due to traditional silo-based approaches and highly specialized disciplines. In the past, there have been only isolated attempts to studying the financial “system” as a whole. Instead, most firms and professions have focused on their own interests and local concerns, and most academics have focused on their specific field of study. A new framework shall require fresh studies of the financial system as a whole, and how it interacts with the economy.

In this paper we propose a Risk Intelligence Framework that includes (i) examining root causes for structural imbalances, (ii) analyzing business models of various firms, and (iii) a new paradigm of risk modeling.

## **Section 2. The Context for Systemic Risks**

The financial system serves the general economy, by channeling saving into investment, and allocating capital to various areas of the economy. In the general economy, firms undertake real projects that produce products and services to meet people’s specific needs. In the general economy, market forces of supply and demand are mechanisms of pricing tangible products and services. In the financial system, the pricing of financial products are conducted via “the price of risk,” which is measured by the relative magnitude between (perceived) upside potential and downside potential.

Risk taking is an essential element for economic development. The most important function of the financial system is to facilitate capital allocation through the *price of risk*. When the financial system is functioning well capital is efficiently allocated to areas that generate the greatest returns, the invisible hand of Adam Smith guides economic activities. When the financial system is not functioning properly, it hurts the general economy (in this case we say that the tail wags the dog).

As evidenced in recent financial crisis, the invisible hand of Adam Smith isn’t sufficient to prevent severe threats to the financial system as a whole. Worse yet, maximizing the price of risk by a firm, without due regard to externality to the whole financial system, may be a factor in creating these threats. Shaken by the financial crisis, people have been awakened to the fact that there are widespread practices that distorts fair market pricing mechanisms, and caused rapid growth of imbalances.

As pointed out by Schwarcz (2008), like a tragedy of the commons, no individual market participant has sufficient incentive, absent regulation, to limit its risk taking in order to reduce the systemic danger to other participants and third parties. We add that no individual market participant has the full view of the

market as a whole, and is prone to herd behavior driven by market sentiments; thus, systemic risk regulations are necessary and appropriate to counter such risks.

There are no widely agreed upon definitions of systemic risks, given that it has become a widely used vocabulary only since the recent financial crisis. Schwarcz (2008) give a working definition of systemic risk: “the risk that (i) an economic shock such as market or institutional failure triggers (through a panic or otherwise) either (X) the failure of a chain of markets or institutions or (Y) a chain of significant losses to financial institutions, (ii) resulting in increases in the cost of capital or decreases in its availability, often evidenced by substantial financial-market price volatility.”

Schwarcz (2008) clarifies that “systemic risk should be distinguished from downturns that are caused by normal market swings. Although these downturns are sometimes conflated with systemic risk, they are more appropriately labeled systematic risk, meaning risk that cannot be diversified away and therefore affects most, if not all, market participants. As regulators call for management of systemic risk, it is important not to constrain market freedom in ways that deter systematic risk, which facilitates market equilibrium and curbs excessive interest rates or periods of inflation.”

The financial system contains a massive spider-web of promises and contractual transactions across different parties over extended time periods. Exchanges of such promises and transactions take place in exchange-traded capital markets or between various institutions. The sheer size of capital markets and the ever-increasing complexity of financial products and institutions have overwhelmed regulators’ capacity for monitoring. To describe today’s gigantic financial system, we first look at its various components:

- ✓ Its multiple *players*: financial institutions (banks, insurance companies, pension funds, and mutual funds), corporations, municipalities, investors and speculators, etc.
- ✓ Its many *activities*: various financial products and transactions, where money and financial claims are transferred and settled.
- ✓ Its multiple *internal* and *external forces* hot money flows across national borders, market valuation volatilities, ebbs and flows of supply of money and credit, changes in sentiments, herding behaviors of participants, technological innovations.
- ✓ *Regulation* and *government policies*, together with legal and accounting conventions, are also major forces impacting the system through their interactions with the players and other forces.
- ✓ Its *dynamics* are ever changing. New players may emerge; new products may gain popularity at roaring speed; new forces may impact things in new ways never seen before. Some players’ actions may be magnified through long-term accumulation, herd behavior, and chains of reactions.

Broadly speaking, systemic risks include all major threats to the well functioning of the financial system and the broader economy.

Systemic risk regulators, who need to make a call on what constitutes a threat to the system, must have broad understanding of the financial system as well as some quantitative indicators. System risk regulator, like a doctor, is charged with attending to the health of the financial system as a whole. To diagnose a patient, the doctor needs to use some his/her medical training, medical instruments, and experiential knowledge and judgment. We would suggest that the systemic risk regulators have the following roles and responsibilities:

- 1) Facilitate data gathering and information analysis of systemic risk exposures.
- 2) Develop tools to identify and arrest price distortions (using natural stabilizers and formulae driven adaptive capital rules or collateral requirements).
- 3) Highlight potential problem areas, quantify them in terms of their likelihood and severities and recommend possible policy solutions.
- 4) Examine current regulations for gaps in supervision, coordinate data collection and information sharing among regulators.
- 5) Improve transparency (from a risk perspective) of the financial markets.
- 6) Examine the shadow banking, hedge fund, private equity, off-balance sheet vehicles and over-the-counter derivatives markets for risks they present to the financial markets/economy.
- 7) Examine other specific issues such as “too big to fail”, highly inter-connected institutions and how to regulate or wind them down, moving more products to exchanges to reduce counterparty risk/increase transparency/lower costs/increase liquidity.
- 8) Given its knowledge of the financial system, the systemic risk regulator may help recommend government policies during time of financial crisis.

Regardless of who will be named as the systemic risk regulators, their tasks are enormously challenging. With such a broad scope including all sectors of the economy, systemic risk regulators need to coordinate with various functional regulators. Systemic risk regulators need to supplement, rather than replace, the activities of existing functional regulators.

### **Section 3. Government Policies and Regulation**

Capitalism works best when it facilitates fair market discovery of price. The well functioning of capital markets require the following elements:

- ✓ Rules are clear and enforced fairly
- ✓ Stability in the medium (currency) of financial transactions
- ✓ Information flows freely
- ✓ Mechanisms to allow for efficient discovery of the price of risk across the spectrum of business activities.

Absence of any of the above factors may cause distortions or even disruptions to the well functioning of the market.

With the goal of safeguarding the capital markets, the government has dual roles: (i) the government act as a “referee”, to promulgate and enforce rules for market practices, and (ii) during capital markets breakdown or severe economic recession, the government acts as lender of last resort, restoring market confidence and economic activities.

Some argue that government policies and regulatory changes often react to the boom-and-bust cycle and frequently have unintended (negative) consequences. A past example is the enactment of Sarbanes Oxley Acts after the Enron and WorldCom accounting scandals. There were unintended consequences of

Sarbanes Oxley Acts such as increased compliance costs. The recent financial crisis is no exception. The government rescued Bear Stearns and subsequently let fail of Lehman Brothers. With the disastrous fallout of Lehman Brothers failure, the government scrambled to bail out the big banks and become major shareholders of them. Market participants complained about the inconsistencies (or lack of a coherent framework) in government interventions during the crisis.

Our view is that coherent framework for policy and regulatory responses can only come from deeper understandings of the financial “system”: how government actions interact with other forces of the financial system, and how they impact the broader economy.

During the recent financial crisis, the government has rolled out various stimulus packages to help jumpstart the economy. However, most government stimulus programs have not yet been very effective in healing the real economy. The government purchases toxic assets to prolong the life of some big banks which may have delayed the reformation of business models of them.

We argue that the real value of money is in how it is being used. There are alternative ways of stimulating the economy. The author (Wang, April 2009) proposed an alternative plan for the U.S. government to stabilize the housing sector by purchasing minority equity shares in residential properties. When money is put in use in the right places, it would help spur economic growth. Generally speaking, it is better for the government to stay out of day-to-day micro-management of business. Nevertheless, the government can put smart policies in place to stimulate the private sectors to re-form business models and jumpstart the economy.

#### **Section 4. Characteristics of the Financial System**

In the past, corporate risk management models were dominated by “financial economics” thinking, where risks are described as random realizations of probabilistic states of the world. Economists have performed macroeconomics studies of the whole economy, but such studies were disconnected from important structural changes in the financial system. Both corporate risk management models and macroeconomic models failed miserably to predict the recent crisis of the whole financial system.

We need a new framework for studying the financial system as a whole. It must go beyond traditional “financial economics” thinking and macroeconomic analysis. Below we note three characteristics of the financial system, which shall form the basis of our proposed new framework.

**Characteristics #1.** Firstly, we recognize that the financial system is too complex and its full details are beyond the capacity of any computer or human mind. Such complexity often masks structural issues from being recognized.

- ✓ The financial system consists of numerous sub-systems that interact with each other in many dimensions. Each individual is a decision-making unit, with different knowledge, perceptions, and incentives. Firms vary in size, products and services, history and culture. Industry sectors and

market segments behave like independent sub-systems in some aspects, and interconnected in some other aspects.

- ✓ The interactions among many parts of the financial system have many uncertain elements. The information contained in accounting statements has much uncertainty. Regulatory rules are complex for specific markets and products.
- ✓ Individuals speculate on other people's sentiments and future actions. As a result, capital markets sometimes exhibit herd behavior and volatile sentiments.

In dealing with complex systems, regulators and policymakers have limited time and resources, and they must resort to higher intelligence and understanding to gain insights and knowledge about the system. In this paper, we propose a Risk Intelligence Framework to assist regulators and policymakers. It requires a disciplined approach for screening and prioritizing various economic sectors, institutions, and activities, based on the level of potential threats to the financial system. This may also require a deliberate choice of types of data for analysis.

**Characteristics #2.** Secondly, most systemic risks are manifestations of structural issues which have been accumulating over time. Some firms may engage in actively seeking to take advantage of structural issues which may create fast accumulation of imbalances and, if unchecked, may endanger the system. The business models of firms are inter-connected, which can make a local imbalance travel or magnify through the system in unexpected ways.

There is a good analogy between structural issues within an economy and cancer within a human body. Let us first review some medical descriptions of cancer.

- 1) "Cancer" is an abnormal (unbalanced) growth of cells anywhere in the body. It occurs when the genes (wrong incentives or stimulus) in a cell allow it to split (multiply or grow) without control.
- 2) There are many kinds of cancer, because there are many kinds of cells in the body, and because there are many genes that control cell growth. Some cancers form solid growths called tumors (toxic assets). Others, like cancers of the blood (leukemia) (lack of accountability, distrust, loss of confidence) travel all over the body.
- 3) Cancers may harm the body in two ways. They may replace normal cells with cells that don't work properly, and they may kill normal cells (crowd out normal business activities).
- 4) The farther a cancer spreads, the harder it is to control. Early identification is critical to successful recovery.

In order to arrest the buildup of structural imbalances, the systemic risk regulator must look for such structural imbalances before they grow out of control and endanger the whole system. Our proposed Risk

Intelligence Framework advocates developing metrics and tools for identification of imbalances in various segments of the economy.

**Characteristics #3.** Thirdly, various structural forces and imbalances may accumulate and eventually lead to broader regime changes of the system. We must have early identification of potential regime changes.

Some economists establish that the financial market exhibits different behaviors under different regimes. For instance, Fostel and Geanakoplo (2008) define three regimes:

- i. The *normal* market, when the liquidity wedge is small and leverage is high;
- ii. The *anxious* market, when the liquidity wedge is big and leverage is curtailed, and the general public is anxiously selling risky assets to more confident natural buyers; and,
- iii. The *crisis* or *panicked* market, when many formerly leveraged natural buyers are forced to liquidate or sell off their positions to a reluctant public, often going bankrupt in the process.

Uncertainty in the evolution of these different regimes necessitates flexible and adaptive policy responses, rather than relying upon static capital rules. This calls for early recognition of pending regime changes (e.g. boiling points of a booming stock market, and freezing points of a credit market), so as to enable appropriate policy responses. Flexibility in policy responses is a must to deal with a complex and hard-to-predict financial system.

Market cycles are natural processes of structural re-formations through creative destructions of obsolete business models. Government policy should help articulate the risk appetite (tolerance level) for the whole system, and put mechanisms in place to help rein in wild swings within the tolerance levels.

At different regimes of the market, the priority of systemic regulation may shift. For instance, during the recent economic downturn, the government on the one hand is pressing banks to increase lending, and on the other hand, raising capital requirements and underwriting standards. These conflicting demands really put banks in a bind. We believe that, the government can accomplish both through encouraging re-formation of new business models as a way of coming out the recession.

Based on the above observed characteristics of the financial system, we are ready to introduce our Risk Intelligence Framework.

## Section 5. Our Risk Intelligence Framework

*“Intelligence is quickness in seeing things as they are”* -- George Santayana (1863-1952).

In a military battle, good intelligence is a matter of survival; ignorance and presumptions are dangerous. In the same way, systemic risk regulators must adopt this attitude toward risk intelligence, given their tremendous responsibility and urgency for timely actions.

The 2007-2009 financial crises, in part, can be attributed to intelligence failures regarding the housing market bubble. So *what led to the intelligence failure?*

1. The scale, scope, and complexity of the financial system were overwhelming. There was too much noise or misinformation in the system.
2. Risk analysis was mostly silo-based, with a narrow focus (on local parts of the economy, and on specific types of risks) due to professional division of labor. Risk analysis focused too much on short-term rather than long-term broader picture, relies on superficial data equations, not paying regard to structural issues.
3. Overall, most market participants who enjoyed “the party of housing boom” turned a blind eye on various hints of problems, or in other words, failed to practice risk intelligence.

In a striking contrast, a few individuals who practiced risk intelligence were able to foresee the coming crisis (e.g. Robert Shiller, Nouriel Roubini, Stephen Roach, and Meredith Whitney, among others). Of these few success stories, some took notice of the departure from a long-term (over a century) trend in the pace of housing price appreciation; some observed speculative behaviors of their neighbors and relatives; some took field studies of mortgage originations and saw alarming signs of loose underwriting and outright fraud.

The current regulatory framework has been based on static risk metrics and capital rules, rather than based on risk intelligence. This is a major shortcoming, since static capital rules are based on historical data which are generally lagging indicators. New threats can emerge from any part of the financial system and can develop very fast. With limited time and resources, regulators must find efficient and effective ways for gaining intelligence.

We propose a Risk Intelligence Framework to assist regulators and risk managers for identifying, measuring and countering systemic risks. This framework studies the financial system as a whole, and includes the following elements:

- 1) Identify major forces (incentives) that drive market participants’ risk-taking behaviors. Screen and prioritize areas of the economy based on vulnerability to macro-economic trends and mispricing of risk. Pay special attention to key institutions with higher inter-connected exposures, fast growth areas, and financial products with lots of embedded options.
- 2) Go beyond reported balance-sheet numbers to analyze business models. Analyze the “supply chain” in the inter-connected business models among financial institutions and corporations.

- 3) Re-develop the risk models with a new paradigm based on risk characteristics of systemic risks.
- 4) Design tools for systemic risk regulators to counter major forces of threat
- 5) Actively prepare for responses to emerging systemic risks

In the remaining sections, we shall discuss in more detail some aspects of our Risk Intelligence Framework.

## **Section 6. Analysis of Forces to Reduce Corporate Risk Capital**

As an application of our Risk Intelligence Framework, we present a synthesis analysis of various forces to reduce prudential capital in corporate risk taking. Over the last few years there have been numerous forces with the net effect of reducing the amount of capital held at financial institutions. Innovations or changes that truly reduce the risk within a company and the economy as a whole should be encouraged. However, many of the changes we mention below have reduced the capital held for a risk without truly changing the underlying nature of the risk.

### *Unconstrained maximization of Return on Equity (ROE)*

For the system as a whole, wealth is maximized only when all firms focus on what they do best (as defined in their own business models). In the past decades, maximizing (short-term) shareholder value has been a driving factor in corporate decisions. Maximizing ROE can be achieved by reducing the “E” in the “ROE”, thereby incentivizing corporations to minimize “cushion capital” for the same amount of risk taking. In some way, “to maximize ROE” is like saying “to maximize the speed of driving”.

In the past decade, a standard industry practice for calculating economic capital has been to explicitly derive portfolio diversification benefits on total economic capital from an assumed correlation matrix. With this practice, maximizing ROE encourages driving multiple cars at maximum speed at the same time. In other words, maximizing a firm’s ROE encourages “doing everything”; even starting a bicycle business would help reduce the economic capital for a financial conglomerate.

### *Stakeholders’ perspectives have changed over time*

The following groups each influence the firm’s collective risk taking behavior:

- ✓ Shareholders
- ✓ Bondholders
- ✓ Management
- ✓ Rating Agencies
- ✓ Customers
- ✓ Regulators

Normally there are constructive checks and balances between these groups. For example, shareholders provide capital and have an implicit call option on the value of the firm. This call option’s value is

increased with increasing risk taking (volatility). The bondholders provide debt financing and have implicitly sold the call option to the shareholders. Thus, you would think there would be a natural tension between the two groups as greater volatility increases the value of one group's claim at the expense of the other. Also, customers would naturally assess the value a promise from a riskier firm at less than the value of a less risky firm thereby restraining putting some bounds on the risk taking of the firm. Management has incentive plans (e.g., stocks, options and bonuses) which are typically aligned with shareholders interest and thus tend to increase with increasing volatility. Rating agencies also measure and rate the firm according to views of the firm's relative risk and thus would incentivize firms to keep risk at reasonable levels if they desire higher ratings. Regulators clearly can greatly influence the firm's risk taking. Thus, you would expect that bondholders, customers, rating agencies and regulators would all provide a check on the risk taking behavior of a corporation while shareholders and management might be more inclined to try to increase risk (and profit potential).

Over the past few years a number of forces have been in play that we believe have severely lessened the importance of some of these checks and balances (predominantly leading to more risk taking).

1. Bondholders can now buy protection/insurance on their investments in the form of credit derivatives. This can reduce the incentive for bondholders to research or seek out the bonds of the least risky firms.
2. Guarantee funds, government guarantees and other backstops mean customers no longer need to worry about the financial strength of the underlying firm but instead rely on the strength of the guarantor.
3. Rating agencies are paid by the firm's issuing the debt and as such there are conflicts of interest and thus potential pressure and the ratings may not be as objective as one would like. Firms can shop for the rating agency that will give the highest rating.

We believe these forces have generally worked toward the reduction of capital held relative to the risks retained (i.e., increased leverage). Prudent reform would look at these underlying structural issues and try to address them as they may be more effective than regulations or capital requirements that try to fix the problem without addressing the true underlying cause.

## **Section 7. Analysis of Business Models**

Presently corporate risk analysis has largely focused on a firm's balance sheet. We advocate for broadening the scope to also analyzing business models and the predominant risk factors to those models.

Over a short-term horizon the balance sheet perspective may be the most important from a solvency perspective. However, over longer time horizons the current balance sheet may not adequately capture the key risks to the business or its solvency.

A case example is that at early 2007 (before the breakout of the financial crisis), AIG and Lehman Brothers had outstanding balance-sheet numbers. However, their business models were heavily exposed to the risk of a housing market downturn. With too much focus on balance-sheet numbers, the simple

question of “what if the housing market takes a down turn” never made to the analysis of their disclosure of risk to shareholders.

Two companies with identical balance sheets today may have very different business models and subject to very different risks. For example, think of two airlines where one services business class/affluent travelers and hedges against fuel costs above \$100 and the other is a discount airline that hedges against fuel costs rising above \$65. While they may both have bought the same airplanes and financed them in similar ways and left with similar hedges on their books (due to the path of fuel prices) their business models are very different and subject to some similar but other dissimilar risk factors. A recession may severely hurt the income prospects of one airline and jeopardize their solvency while only modestly hurting the prospects of the other. Thus one model could be seen as much riskier than another even though a balance sheet analysis of risk might show they have very similar risks.

Balance sheets represent the aggregate decisions of the past and as such may not represent the same mix of risks they face going forward. For example, a company could have operated in the same manner with a single business model subject to a same set of risk factors for as long as the firm was in existence, e.g., a Property-Casualty insurer that only writes commercial liability insurance. However, at some recent point in time they may have considered it prudent and relatively inexpensive to reinsure their loss reserves beyond some threshold. After that was done the balance sheet perspective would show a different risk profile (i.e., less sensitivity to the risk due to the underlying business and more to the credit risk of the reinsurer(s)) than the underlying business model would suggest. Without analyzing both perspectives one might miss an important risk factor to the firm’s future success.

Similarly a company can relatively quickly change its balance sheet structure over a fairly short period of time. This can significantly reduce the balance sheet risk of the firm (e.g., investment banks reducing their leverage from 35 times to 20 times in a few months). However, firms don’t change their business models as frequently or as easily and as such there is still a component of underlying risk to the firm due to their exposure to the underlying business model.

Additionally, in some industries a significant portion of a going concern’s risks may come in the volatility of their income as opposed to (or in addition to) the risk inherent in their balance sheets.

Another benefit to the business model perspective is that organizations in seemingly unrelated industries can be subject to the same set of risk factors and this commonality can be used to identify systemic risks to the broader system. For example, looking at the exposure throughout the economy to the housing sector could be approximated by examining all companies whose business models share a significant exposure to home prices. This may have shown the inter-connectedness of the insurance, pension, construction and banking sectors and potentially the secondary effects on credit card issuers, retailers, etc.

Analysis of business models shall include a review of liquidity risk, funding sources and contingent capital. At the market level, liquidity indicates market confidence and availability of credit. At the firm level, liquidity represents operational flexibility under various stress scenarios. Thus, an analysis of liquidity risk of a firm requires a review of the firm’s business operations, in light of various possible regimes of the broader market. Firms rely on short term whole-sale funding may be subject to higher risk of liquidity squeeze in a panicked market.

The regulator can ask firms to disclose their business models, including what value-added the firm brings, and vulnerability in light of technological advances and competition (including debt burden, rigidity vs. flexibility of costs, diversity of revenue streams). From analyzing the business models of a collection of firms, the regulator can identify potential accumulations of systemic risks.

### **Section 8. A New Paradigm for Risk Modeling**

As pointed out earlier the prevailing theories of risk have been dominated by the “financial economics” approach. Below we highlight the major elements of this methodology:

- ✓ Simulating the prices of assets are at the heart of the methodology and these are modeled stochastically (generally consistent with the assumption of no-arbitrage).
- ✓ The shocks to the prices are (exogenous) random processes. That is, the effort is put into mimicking the shocks rather than an explanation of what factors are driving the changes. Within the system (the set of prices being modeled) these shocks appear random as there are no explanatory variables in the system to explain them.
- ✓ Interactions are largely handled through correlations between the random components of the price processes. This also allows for the handling of the benefit of diversification in a manner consistent with portfolio theory.
- ✓ Focuses on relatively short time horizons (usually 1 year or shorter).
- ✓ Focuses on a single entity with most information coming from the balance sheet

This methodology has served some aspects of the risk management profession well. We would summarize its positives as identifying potential short-term risks posed to a specific entity by the variability that has been seen in the past for the set of prices/variables being modeled.

On the other hand, systemic risk can be characterized by the following:

- ✓ Shocks are not purely random process but rather due to macro factors and/or the systemic build up of large, unsustainable imbalances within the broader financial/economic system.
- ✓ Statistical correlations do not adequately model the interactions between prices. Assets and liabilities often move together due to more fundamental underlying reasons (e.g., recession, inflation, and interest rates) and these relationships change over time. Statistical correlations are clearly not sufficient to handle any but the simplest (linear, constant) relationships. Additionally, diversification isn't a factor with systemic risk as this risk can't be diversified. You can move it around within the system but you can't eliminate it from the system as a whole.

- ✓ Systemic risks are usually built up over relatively longer periods than a single year. It takes time for imbalances to accumulate, for new belief to take hold, and for new products to grow in size to present a threat to the system.
- ✓ Systemic risks may be posed by a single firm (e.g., LTCM, AIG) of substantial size or interconnectedness, but more often than not systemic risk will be the result of the aggregate risks posed by many firms. These firms will not necessarily all be from a single industry or country.

Given the large gaps between the current methodologies and the characteristics of systemic risk it really isn't surprising that today's risk management practices/systems did not warn us of the impending dangers leading to the current financial crisis. We note that the regulatory community has been skeptical of complex risk models, with a good reason (see Vaughan, 2009).

This argues that a new modeling paradigm is going to be critical in the measurement and management of systemic risk.

Clues as to what elements will be necessary in the new methodology can be found by looking at who had provided us with early warnings of the most recent systemic crises. Robert Shiller, Nouriel Roubini, Stephen Roach, Meredith Whitney are some of the names frequently mentioned for having seen the impending crisis before others but, they are by no means the only ones. It is interesting to note that none of them were prominent risk managers. In fact we know of very few cases where the risk management models were pointing to any trouble whatsoever.

So what are the critical elements to a modeling framework for dealing with systemic risk? We would suggest the following:

- ✓ Needs to identify unsustainable imbalances and disequilibrium within the economy/financial system that pose a significant threat because they may be susceptible to damaging reversals. This would include asset bubbles, over-leverage by a group (e.g., government, corporations, and consumers), unsustainable consumption, large budget/trade deficits, political instability and too many other items to list. Prioritizing this list is of the utmost importance. This is the Risk Intelligence aspect of the framework we are proposing.
- ✓ In the same way that the current methodology models the changes in prices we need to be able to model the impacts of and feedback of the unwinding of the imbalances or disequilibrium converting these to their impact on economic variables (e.g., interest rates, GDP, inflation, currencies) and potentially to prices of underlying asset classes. This would undoubtedly require the use of macro-economic models. The major change here is that the impacts on economic variables and asset prices aren't random noise but rather the reasonably predicted results of the unfolding scenario. This could be thought of as form of scenario analysis. Given the complexity of the system, smaller, more purposeful macro-models that isolate the main factors would be developed rather than building a huge macro-economic model.
- ✓ In the same way that the current methodology analyzes the sensitivity of financial instruments to the modeled changes in prices we need to be able to analyze the sensitivity of the economy/financial system to the underlying systemic risk factors. Here is where major changes

may be required. One potential approach would be to ask all companies in all industries to run these scenarios through their models and aggregate the results to see the impact (similar to the Government stress-testing of the 19 largest banks). The drawbacks with this approach include extraordinary time it would take to get the results from all of the companies as well as the duplicative expense of each building similar models to analyze the same scenario(s). There would also be skepticism with respect to the comparability of results as many companies would handle the same scenario differently.

- ✓ A better alternative might be to break companies into a set of general business models which would serve as the counterpart to financial products in the current paradigm. For each business model, one could derive the sensitivities to the major systemic risk factors. Then one could classify each company into its various component business models and get aggregate results across many companies/industries much more quickly.

Unfortunately, at present, consistent splits along these lines generally aren't available and frequently accounting data isn't sufficient to derive the sensitivities to the systemic risk factors.

Dr. Hiemstra (2007) points out that a firm's risk models have very different focuses from prudential risk models. We even make a point that internal models and principle-based regulation may have handicapped the regulator in their ability to independently and proactively find and quantify risks. They are now much more reliant on the companies themselves to identify and take appropriate steps to mitigate these risks. We argue that regulators may always be at a disadvantage relative to the firm about its specific risks; on the other hand, regulators can do much more on the systemic risk front which is less focused on a specific firm and more focused on the industry/economy.

## **Section 9. Tools for Countering Systemic Risks**

Our Risk Intelligence Framework includes not only intelligence gathering and analysis, but also designing tools for countering systemic risks.

### *Quasi-Market-Pricing Mechanisms*

We prefer quasi-market-pricing mechanisms for countering systemic risks. This approach is not just a binary "yes" and "no" types mandates. Using an analogy, the systemic risk regulators are monitoring the speed of a car (risk-taking behaviors). When the regulators realize that the car is running too fast under a specific road condition, it is better to gradually apply the brake pedal to avoid a rollover of the car due to a sudden stop. To minimize disruptions due to uneven regulatory forces, the systemic risk regulators should resort to "quasi-market-pricing" mechanisms for countering systemic risks.

### *Signal Market Participants through Responsive Capital Requirements*

Systemic risk regulators can collect and publish system-wide exposure to major risk factors, and signal market participants through increased capital charges. For instance, by publishing aggregate housing inventory and new permits of construction in a region, participants can see accumulated imbalance in

supply and demand. If the systemic risk regulators deem that the imbalance is posing danger, systemic risk capital charges may be levied to business fueling such housing boom. This can be an effective way of avoiding a building glut. For the purpose of aggregating risk exposures, the systemic risk regulators may demand monthly or quarterly reports of key exposures and activities from all major market participants.

#### *Encourage Transparency and Accountability*

A good example is the installation of cameras at traffic intersections. There are cameras! If a driver is caught by the camera of speeding or running through red lights, there will be big fines. Another good example is the use of bar codes in retail stores and express mail deliveries. Using bar code can help track down “who” and “where about”, which significantly increases knowledge and enhances accountability. Systemic risk regulators can adopt similar measures/tools to encourage transparency and accountability. For instance, the regulators can impose high capital charges on complex over-the-counter derivatives (to push them to the open exchange), and impose extra capital requirements based on a firm’s scores of complexity and lack of accountability.

#### *Punish Those Who Are Gaming Regulatory Capital Rules*

It has been common practice for many firms to engage in gaming regulatory capital rules to minimize their regulatory capital. As stated by Douglas A. McIntyre in his blog, “given any fixed risk-based capital rule, firms will find new ways of creating risk, in a fashion that is fast, insidious, and ingenious.” Many Wall Street firms and accounting firms advised companies to engage in regulatory and accounting arbitrages. Systemic risk regulators should be given the authority to challenge such practices and impose fines on such transactions. As one way to prevent the practice of gaming regulatory capital rules, the regulators can send to market participants a clear warning signal that “we will come back to get you with big fines if you game the system”.

### **Section 10. Emerging Systemic Risks**

Risks revealed by the recent financial crisis have already been extensively exposed and under the spot light and scrutinized by the public conscious (e.g., Sandberg, 2008). The real dangers are from hidden risks that have yet to surface.

Below are just some of many potential threats to the already fragile economic system:

- ✓ A second wave of market downturn or loss of confidence
- ✓ Volatility in the U.S. dollar relative to other major currencies, accompanied with a sudden rise in inflation and interest rates,
- ✓ A major natural disaster and geopolitical risks: an eruption of war in the Middle East may cause a supply-chain disruption of oil

Some slowly accumulating risks would not be able to be identified easily over a short-time horizon, but becomes obvious only over a longer time horizon. Such examples include the impacts of global warming

on the frequency and severity of natural catastrophe, the incubation of asset bubbles after a prolonged time period of very low interest rate, the effect of trade imbalances on the strength of the U.S. dollar, the consequence of an increase in entitlement on economic development. However, it is quite tricky to decide when to sound the alarm for these long-term threats.

There are an infinite number of potential threats every day but people still need to go about their business. Good risk intelligence is needed to formulate and prioritize plausible scenarios to alert market participants. Without good intelligence, “crying wolf” may compromise future effectiveness.

To prepare for sudden shocks to the financial system, the systemic risk regulators should help firms and entities to develop contingent plans to ensure the basic needs of people and the society for some emergency time period. The basic needs of people include security of basic infrastructure, supply chain of essentials (food, water, and energy), disaster relief, and price stability.

Globalization of the economy, new technology, and the large-scale government interventions in several major economies, will continue to drive further structural changes to the financial system. Only through continued monitoring can the systemic risk regulators possibly keep up with emerging systemic risks.

## **Section 11. Conclusions**

This paper presents a conceptual framework for regulatory and policy responses to systemic risks. We argue that capitalism works best when it facilitates fair market discovery of prices; however, practices that hinder price discovery or cause price distortions, if unchecked, can create structural imbalances and pose threat to the financial system. Smart government policies and regulation are needed to counter such threats.

The financial system has become very complex and fast evolving. To keep up with this challenge, we propose a risk intelligence framework that includes examining structural issues, analyzing business models of various firms, and a new paradigm of risk modeling.

It is the hope of the author that this paper can stimulate more studies of the financial system and how it interacts with the general economy. Much research efforts are needed to bring these concepts and methodology to fruition with concrete data analysis of various sectors of the economy. Policymakers and regulators can definitely take leadership by encouraging such research efforts.

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