



# Actuarial Viewpoints on and Roles in Systemic Risk Regulation in Insurance Markets

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This paper has been produced by the Insurance Regulation Committee of the IAA and has been approved for distribution by the same Committee.



**International Actuarial Association**  
**Association Actuarielle Internationale**

150 Metcalfe Street, Suite 601  
Ottawa, Ontario  
Canada K2P 1P1

[www.actuaries.org](http://www.actuaries.org)

Tel: 1-613-236-0886 Fax: 1-613-236-1386

Email: [secretariat@actuaries.org](mailto:secretariat@actuaries.org)

# Table of Contents

<b>Executive Summary</b> .....	1
<b>1. Introduction</b> .....	5
1.1 The Purpose of this Paper .....	5
1.2 Definition of Systemic Risk and G-SIFIs .....	5
1.3 Overview of Sections of this Paper .....	8
<b>2. Business Models</b> .....	10
2.1 Bank Business Model and BCBS Approach for G-SIBs .....	10
2.2 Insurance Business Model and IAIS Approach for G-SIFIs .....	10
2.3 Insurance Activities and Systemic Relevance .....	12
<b>3. Approaches to Global Market Regulation</b> .....	13
3.1 Market Globalization and Insurance Market .....	13
3.2 Micro-prudential Approach .....	13
3.3 Macro-prudential Approach .....	14
3.4 Global Market Stability and Trust .....	15
3.5 Market Characteristics .....	16
<b>4. Market Frameworks and Insurance Markets</b> .....	17
4.1 Information Symmetry .....	17
4.2 Market Clearing Operations .....	18
4.3 Trends within Markets .....	18
4.3.1 Product Design Innovation .....	19
4.3.2 Financial Modernization .....	20
4.3.3 Behavioral Risk .....	20
4.3.4 Technology Developments .....	21
4.4 Future Insurance Markets .....	22

<b>5. Macro-prudential Tools for Insurance Markets Designed to Decrease Systemic Risk</b> .....	23
5.1 Insurance Market Characteristics .....	23
5.2 Insurance Market Risk Metrics – A macro-prudential perspective.....	23
5.3 Macro-prudential Tools.....	24
5.4 Effects of Macro-prudential Regulation.....	26
<b>6. Actuaries in Systemic Risk Regulation for Insurance Markets</b> .....	28
6.1 Actuarial View of the Systemic Risk Environment.....	28
6.2 The Role of the Actuary.....	29
<b>Appendix A; Comparison of Insurance and Financial Portfolios</b> .....	32
<b>Appendix B; Analysis on Insurance Activities and Systemic Relevance</b> .....	35
<b>Appendix C; Actuarial Responses to Systemic Risk</b> .....	40

# Executive Summary

## Introduction

The purpose of this paper is to provide actuaries with the background to address conditions and tools to identify, assess, monitor and mitigate systemic risks. The scope of this paper is limited to global insurance market operations and risks of systemic events in those markets. From the global context, a macro-prudential approach towards the regulation for systemic risk is assumed. The role of actuaries in assisting systemic risk regulators with respect to insurance markets is identified and discussed in a global market context. This paper uses the definition of systemic risk defined by the Financial Stability Board (FSB) and the International Monetary Fund (IMF).

Products and services provided by the banking, insurance and financial markets, irrespective of regulated or non-regulated, continue to evolve. Technology is driving financial entities toward greater economies of scale (size) and significantly more complex strategies, tactics and operations as they are structured to provide an expanded range of services. Globalization is allowing for rapid product and service expansions. Under most economic scenarios, trends in financial modernization increase market efficacy and efficiency.

However, as global markets display greater inter-dependencies, there is also greater susceptibility to higher correlations across product lines. In addition, systemic risk is increased where participants have large market shares based upon speculative market positions. Such scenarios could lead to some entities in the insurance sector being a cause of, or a participant in, a systemic risk event.

From a regulatory position, the simple postulation that insurance sector entities will not be a source of future systemic risk events due to historical observation could lead to the failure to identify, assess, monitor and mitigate the critical trends and signs of future systemic risk events.

## Business Models

Based on the definition of systemic risk by the FSB and the IMF, current thought<sup>1</sup> is that traditional insurance activities represent low risk toward the initiation of any future systemic risk event. However, as financial products continue to evolve, it is important to identify the major risks of new financial products and the potential economic and financial drivers toward systemic

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<sup>1</sup> International Association of Insurance Supervisors (IAIS), Insurance and Financial Stability, November 2011,

risk for insurers. Non-traditional and non-insurance<sup>2</sup> (NTNI) activities may include some level of financial risk. In case of financial disruptions, expansions in NTNI activities can lead or exacerbate the damage caused by systemic risk and increase the financial disruption in the markets. The risk of heavy interconnectedness with other part of financial sector needs also to be recognized.

## **Approaches to Global Market Regulation**

The largest threat of systemic risk arises from a continued mismatch between local regulation and global financial market opportunities. Global market participants need to tackle different local regulations. Local regulators are beginning to acknowledge (1) the trend toward global insurance markets, (2) their role in global markets, (3) the potential downside impact of regulatory inaction, and (4) the importance of appropriate global regulatory frameworks.

The functions of global market regulation should be to create and monitor a level playing field for the transaction of financial instruments around the globe. These functions include the identification, assessment, monitoring and mitigation of operational rules for market activities.

## **Market Frameworks and Insurance Markets**

One of the critical activities of systemic risk regulators is to determine when the risks arising from a financial product or market begin to approach systemic risk potential, not only at the company level but at market operational and exchange levels, as well. Following are examples of trends which could contribute to disruptions in global markets:

- Product Design Innovation
- Financial Modernization
- Behavioral Risk
- Technology Developments

With greater familiarity of new NTNI activities, legislators and regulators may well develop confidence that the efficiency and effectiveness of financial entities will improve with the inclusion of banking, financial and insurance activities. In addition, financial and risk hedging will continue to offer opportunities to reduce an insurer's asset and liability risk profiles.

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<sup>2</sup> IAIS describes "non-traditional and non-insurance" activities in *Insurance and Financial Stability*, November 2011, "Section 3.2 Non-traditional and non-insurance business activities". Basically, the IAIS' description of "non-traditional" insurance refers to the inclusion of guarantees, removal of penalties or conditions, which materially change the risk features of a traditional insurance product. "Non-insurance" activities relate to involvement in markets which feature product characteristics more closely aligned to products found within commercial and investment banking and financial markets.

Unfortunately, financial risk management benefits often come at a cost of greater product and market complexities. In such cases not only must the benefits and risks be simultaneously evaluated, monitored and regulated at the entity level, but the stability of the hedging instruments must also be monitored and regulated at the market level. The first represents the micro-prudential regulation of the firm, while the second depends upon the macro-prudential regulation of the markets.

## **Macro-prudential Tools for Insurance Markets**

To be effective, macro-prudential regulations needs to take into account the essential characteristics of insurance and financial market operations. At the entity or group level, risk metrics should be based on an assessment of risk exposures, reflecting both on and off balance sheet items. From a market perspective, risk management metrics need to be summarized into macro-prudential models which identify sources of systemic risks. The two processes are intertwined. One possible approach is to identify the key indicators for systemic activities and interconnectedness, and then evaluate both horizontal (entity/group/competitors) and vertical (entity/market/speculators) risks for possible source of systemic risks.

Since a new risk mitigation or hedging activity has not given rise to a past systemic event, stress testing/scenario analysis is one of several “bottom-up” methodologies that can be developed to evaluate the systemic risk potential. The results of stress testing /scenario analysis can be useful tools to identify the financial impact of various levels of accumulated risk. Regulatory methodologies that build off an Own Risk and Solvency Assessment (ORSA) can also be effective. This process may identify emerging risks not currently being captured within regulatory capital adequacy requirements. With bottom up information, econometric modeling can assist regulators in identifying, assessing, monitoring and mitigating risk in global markets.

The means to meet objectives of global systemic risk regulation should be to monitor the accumulation of risk, the expansion or contraction of global financial activities, the interrelationships within financial services groups and then determine if these organizations risk management policies leave any residual risk for the development of systemic crises either as individual entities/groups or together. Systemic risk regulation requires the coordination among territories and different financial services players and cooperation for aggregating market metrics, monitoring for systemic risk events, and then acting upon that analysis at a jurisdictional level.

## **The Roles of the Actuary**

Actuaries have traditionally assumed a role which protects the interest of the general public by designing micro-economic analysis tools that recognize the risk characteristics of the insurance



product, the behavioral characteristics of insurance market participants, and the insurer's operational processes.

This paper considers the actuarial activities that could assist macro-prudential regulators in the design of tools that can be applied to identifying and monitoring systemic risk scenarios in insurance markets. Traditionally, actuarial tools can deal with not just insurance risks, but also economic trends (such as inflation and supply/demand), social conditions, behavioral, biological (growth trends and potentials for “contagion” conditions) and political influences in the products of insurance markets. Macro-prudential regulations require similar knowledge and experience in the design of quantitative tools for the identification and monitoring of systemic risk in global markets. These tools include the statistical analysis of insurance product trends and market risk aggregations, behavioral analysis of market participants, stress testing designs for risk factors and market conditions, and simulation models for market trends.

### **Afterword**

Markets are evolving continuously. This paper should not be regarded as a fixed one but needs further development in the future.

# 1. Introduction

## 1.1 The Purpose of this Paper

The purpose of this paper is to provide actuaries with the background to assess conditions and tools to identify, assess, monitor and mitigate systemic risks. The scope of this paper is limited to global insurance market operations and risks of systemic events in those markets. From the global context, a macro-prudential approach towards the regulation for systemic risk is assumed. The role of actuaries in assisting systemic risk regulators with respect to insurance markets is identified and discussed in a global market context.

This research paper was developed and approved by Insurance Regulation Committee of the International Actuarial Association (IAA) but does not represent the official opinion of the IAA.

## 1.2 Definition of Systemic Risk and G-SIFIs

There is currently no common definition of systemic risk<sup>3</sup>. This paper uses the definition of systemic risk defined in 2009 by the Financial Stability Board (FSB) and the International Monetary Fund (IMF)<sup>4</sup>.

Systemic risk is the risk of disruption of financial services that is

- i. Caused by impairment of all or parts of the financial system; and
- ii. Has the potential for serious negative consequences for the real economy.

Three key criteria that identify the systemic importance of markets and institutions are:

- **Size** (the volume of financial services provided by the individual component of the financial system);
- **Substitutability** (the extent to which other components of the system can provide the same services in the event of a failure); and
- **Interconnectedness** (linkages with other components of the system).

Fundamental to the definition is the notion that systemic events are associated with negative externalities. A financial institution has incentives to manage its own risk/return trade-offs, including how it will recover from serious adverse circumstances, however, historically more extreme tail risk in these highly skewed risk/return distributions has usually been of minimal management consideration and concern. In addition, they consider the implications of their risk

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<sup>3</sup> Mary A. Weiss, Ph.D. (Center for Insurance Policy & Research, National Association of Insurance Commissioners); Systemic Risk and the U.S. Insurance Sector, February 23, 2010,

<sup>4</sup> Report to G20 Finance Ministers and Governors, Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations, October 2009

taking within normal market operations of the financial system as a whole. While this behaviour is common to all industries, some individual financial risk taking, however, can have specific features that imply that failure would cause a significant disruption to the financial system and to the real economy. These features can determine systemic importance of individual institutions.

An impairment or disruption to the flow of financial services would include situations where certain financial services are temporarily unavailable, as well as situations where the cost of obtaining the financial services is sharply increased. It would include disruptions due to shocks originating outside the financial system that impact it as well as shocks originating from within the financial system. A systemic event should be contrasted with more general wealth effects that may have severe macroeconomic consequences but are not associated with the impairment of the financial system.

The definition requires significant spillovers to the real economy, without which an impairment of financial services would not be considered systemic. The real economy impact could be either through an effect on supply or through an effect on demand for other goods and services and could materialize over an extended period of time. The mere transfer of value between parties does not necessarily cause an impact on the real economy.

This paper adopts the above definition from the FSB/IMF. Global financial institutions satisfying these three key criteria are called Global Systemically Important Financial Institutions (G-SIFIs). For insurers, the International Association of Insurance Supervisors (IAIS) has created its criteria for the Global Systemically Important Insurers (G-SIIs)<sup>5</sup>.

The IAIS stated in its paper on Insurance and Financial Stability<sup>6</sup> *“based on information analysed to date, for most lines of business there is little evidence of traditional insurance either generating or amplifying systemic risk within the financial system or in the real economy”*.

Products and services provided by the banking, insurance and financial markets, irrespective of regulated or non-regulated, continue to evolve. The evolution demonstrate products that appear to be easy to understand, but have become complex in purpose, scope, design and function. Technology is driving financial entities toward greater economies of scale (size) and significantly more complex strategies, tactics and operations as they are structured to provide an expanded range of services. Globalization is allowing for rapid product and service expansions. Under most economic scenarios, trends in financial modernization increase market

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<sup>5</sup> IAIS, Assessment Methodology for the Identification of Global Systemically Important Insurers, or G-SIIs., Public Consultation May 2012

<sup>6</sup> IAIS; Insurance and Financial Stability, November 2011

efficacy and efficiency. However, as global markets display greater inter-dependencies, there is greater susceptibility to higher correlations across product lines. In addition, systemic risk is increased where participants have large market shares based upon speculative market positions. Such scenarios could lead to some entities in the insurance sector being a cause of, or a participant in, a systemic risk event.

From a regulatory position, the simple postulation that insurance sector entities will not be a source of future systemic risk events due to historical observation could lead to the failure to identify, assess, monitor and mitigate the critical trends and signs of future systemic risk events.

One of the problems in a discussion of systemic risk within the insurance industry is the corporate structure and organization. Consider an insurance group, which provides only insurance services, and is subject to insurance regulation, versus a financial group in which the insurance companies represent only a portion of the overall financial services of the group. In the case of AIG's credit default swap (CDS) activity, AIG was acting as a financial intermediary and market maker rather than an insurer. In thinking about insurance a distinction needs to be clearly made when considering insurance activities and non-insurance activities. The insurer that is not part of a diversified financial services entity is not currently a producer of systemic risk; although it may be subject to systemic risk from outside parties via its investments and risk mitigation practices, as well as the risks which may be assumed in the future. It should be noted that the traditional insurer also may be subject to systemic risk as a result of a multi-national ownership structure based on the difference in the quality and focus of regulation.

Whether or not insurers can cause systemic risk, regulatory and legislative bodies seem to agree that the market operation rules are worth the additional transparency, monitoring and regulatory costs. The IAIS stated in its position statement on key financial stability issues<sup>7</sup> *“Since interdependencies between the sectors may increase in the future through products, markets and conglomerates, the IAIS is promoting enhancements to supervision and supervisory processes, combined with stronger risk management and enhanced approaches to resolvability to minimize adverse externalities”*.

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<sup>7</sup> IAIS, Position statement on key financial stability issues, 4 June 2010

## **1.3 Overview of Sections of this Paper**

### **Section 2 Business Models**

This section starts with the analysis of the business models of banks and insurers and introduces the Basel Committee on Banking Supervision (BCBS) and IAIS approach for the identification of G-SIFIs. While it is widely accepted that traditional insurance activity does not create systemic risk, it is important to identify the major drivers of systemic risk since insurance is an important component in the financial system which contributes to financial stability by, for example, providing long term funding and its role as a risk mitigator for businesses and individuals.

### **Section 3 Approaches to Global Market Regulation**

In this section, approaches for regulation of the insurance markets are assessed. Globalization of insurance markets is also addressed. Insurers with strong incentives for risk and geographical diversification have led to comparative advantages for globalization of insurance market. Hence, global regulation for globalized insurance markets is needed. In this situation, the macro-prudential approach is probably a more efficient form of addressing global market concerns. It is also easier to obtain agreement on principles than it is to obtain detailed commitment to a specific set of operational rules.

### **Section 4 Market Frameworks and Insurance Markets**

Section 4 deals with the market framework and analysis of the insurance market based on the framework. One of the critical activities of systemic risk regulators is to determine when the risks of a designed product begin to approach systemic risk potential. This requires the systemic regulator to follow two characteristics of the product: the product information symmetry and the market clearing operations. Trends within markets, including product design innovation and behavioral risk, are also analyzed in this section.

### **Section 5 Macro-prudential Tools for Insurance Markets Designed to Decrease Systemic Risk**

Section 5 proposes some key indicators for systemic risk in insurance markets to enable the identification of the possible impact of the risk. Stress testing reveals the exposures of insurance groups in case of financial distress or risk event. Proper macro-prudential regulation is important for the soundness of the financial market.

### **Section 6 Actuaries in Systemic Risk Regulation for Insurance Markets**

This section describes that the role of actuaries in providing quantitative analysis aimed at maintaining financial stability in insurance markets. This paper extends actuarial activities to

assisting the macro-prudential regulator in the design of tools that can be applied to identifying and monitoring systemic risk scenarios in insurance markets.

## 2. Business Models

### 2.1 Bank Business Model and BCBS Approach for G-SIBs

Bank business is substantially funded by short term saving deposits and bank lending is often through long term or rolling loans. Bank business is based on maturity transformations and leverage of assets. Therefore liquidity risk and credit risk are major concerns in their business.

The Basel Committee on Banking Supervision (BCBS) has adopted reforms (Basel III for example) to strengthen banking sector regulation. The BCBS also adopted additional policy measures for Global Systemically Important Banks (G-SIBs)<sup>8</sup>.

*The broad aim of the policies is to reduce:*

- *The probability of failure of G-SIBs by increasing their going-concern loss absorbency; and*
- *The extent or impact of failure of G-SIBs by improving global recovery and resolution frameworks.*

The BCBS adopted an indicator-based measurement approach to identify G-SIBs. *The selected indicators reflect the size of banks, their interconnectedness, the lack of readily available substitutes or financial institution infrastructure for the services they provide, their global (cross-jurisdictional) activity and their complexity.*

### 2.2 Insurance Business Model and IAIS Approach for G-SIFIs

Essential characteristics of the insurance business model include underwriting of risks, contract limitations and exclusions, prefunding, method of claims settlement, risk management and risk transfers.

Underwriting is one of the first lines of defense for insurers. In assessing risk, the underwriter provides the proper assessment of risk, and restricts insurance market activity among speculators. Insurer obligations are triggered by the insurable event or prescribed by insurance contracts. Life savings products (for example, endowments) have fixed settlement dates. Surrender charges of certain life insurance products generally create disincentives for cancellation of the policies by policyholders. For certain (long tail) classes of general insurance, most claims are not payable instantly on occurrence of the insured event.

Insurance obligations are prefunded by premiums, charges and fees which are determined

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<sup>8</sup> BCBS, Global Systemically important banks: assessment methodology and the additional loss absorbency requirement, November 2011

according to forward looking methods. The development of premium rates appropriate to the product design, provisioning of liabilities (technical reserves), and adequate capital is the second line of defense.

While insurers can use risk transfer mechanisms, such as reinsurance, to control their risk exposures, they need to maintain a significant amount of exposure to the risks insured and therefore have the incentive to underwrite the insurance risk properly (skin-in-the game). Finally, enterprise risk management pulls together the various elements of the insured risks assumed, including reinsurance, premiums received, liabilities, capital adequacy and asset/liability management.

More detailed Comparison of Insurance and Financial Portfolios is included in Appendix A.

The nature of the insurance group business model also needs to be understood. Insurance groups consist of legal entities and a web of intra-group commitments (for example, intra-group reinsurance and guarantees). The legal entities of the group are also connected to external counterparties. To assess the group's interconnectedness to external counterparties, information on the group's legal entities is necessary because legally binding contracts and exposures are via legal entities, not via the consolidated groups. The structure of the group becomes particularly relevant in times of financial stress when the legal entity view becomes dominant.

Analysis of an insurer's interconnectedness within the groups requires the analysis of:

- Group structure, including the web of intra-group commitments;
- Risk exposures of the different legal entities comprising the group; and
- Exposures and situation in case of financial stress, taking into account potentially limited capital mobility within the group

One also needs to recognize the risk that extensive losses in a non-core entity (non-insurance) with the benefit of intra-group guarantees cannot only collapse the entity but also drive systemic effects. The risk of heavy interconnectedness with other part of financial sector needs also to be recognized.

The IAIS states in its paper on Insurance and Financial Stability<sup>9</sup> *“Insurance groups and conglomerates that engage in non-traditional or non-insurance activities are more vulnerable to financial market developments and importantly more likely to amplify, or contribute to, systemic*

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<sup>9</sup> IAIS; Insurance and Financial Stability, November 2011



*risk. “IAIS members are working on a methodology to identify global systemically important financial Institutions (G-SIFIs). The conceptual framework follows broadly the approach developed by the BCBS. ...non-traditional insurance business and non-insurance business are likely to play a pivotal role in the future G-SIFI methodology.”*

### **2.3 Insurance Activities and Systemic Relevance**

Insurance is an important component in the financial system and contributes to financial stability by, for example, providing long term funding and its role as a risk mitigator for businesses and individuals. Based on the definition of systemic risk by the FSB and the IMF, current thought is that traditional insurance activities represent low risk toward the initiation of any future systemic risk event. However, as financial products continue to evolve, it is important to identify the major risks of new financial products and the potential economic and financial drivers toward systemic risk for insurers. Non-traditional and non-insurance activities may include some level of financial risk into the insurance business model. Trends within financial modernization also lead to potential involvement of insurers in non-insurance activities and innovative financial products. It is important to periodically identify the major drivers of risk for insurers. In case of financial disruptions, expansions in non-traditional and non-insurance activities can lead or exacerbate the damage caused by systemic risk and increase the financial disruption in the markets. More detailed analysis of the systemic relevance of insurance markets by types of insurance activities is included in the Appendix B.

## 3. Approaches to Global Market Regulation

Regulatory approaches, be they rules/principles-based, are meant to provide an appropriate framework within which insurers need to operate in the interest of policyholders. In application, rules based regulation has been unique to individual jurisdictions; they are established only after substantial discussion and negotiation. As a result, any set of regulations developed under a rules-based approach would be extremely difficult to achieve global consistency. From a global market perspective, principles-based approach to regulation would be more practical and applicable over a longer time horizon.

### 3.1 Market Globalization and Insurance Market

Insurers have strong incentives to develop large insurance portfolios comprised of group classifications with homogeneous, insurable risks; portfolio diversification raises an insurer's interest in global activities. Such globalization seeks both the benefits of size and diversification arising from the stability theorem for risk. This in turn improves capital efficiency for the group. Insurance groups will continue to seek portfolio expansion and as a result, they will increase their participation in the global market place. The largest threat of systemic risk arises from the continued mismatch between local regulation and global financial market opportunities. Global regulation for globalised insurance markets is needed.

### 3.2 Micro-prudential Approach

The micro-prudential regulatory/supervisory approach is concerned with the supervision at the entity level. Traditionally, this regulatory approach has been focused within the individual jurisdictions with the objective of supervising solvency for the individual insurance entity and group. The micro-prudential approach remains an essential regulatory element. Insurance companies determine which risk to accept or to reject, and can control the price at which they offer insurance products. Once the insured accepts the insurance, the insurer becomes the dominant counterparty in the transaction. The micro-prudential approach is therefore important to ensure that the insurer can meet its commitment and is financially viable to fulfill the promise.

Market rules are primarily viewed at a micro-prudential level, i.e., at the firm level and within a restricted geographical area within a jurisdiction. Current legislation and regulation is often reflective of local political design. Political design is often implemented to achieve some form of social enhancement. Unfortunately, it can also result in misdirected financial designs that can destabilize and increase volatility within local economies. Examples include trade protectionism,

currency exchange intervention and fiscal policy. Market<sup>10</sup> participants, however, now have experience with the many local regulatory approaches. Participants become active in identifying and capitalizing on differences in conditions between markets (financial arbitrage). When these differences arise from legal and regulatory conditions, regulatory arbitrage is just as relevant.

### 3.3 Macro-prudential Approach

In the past, when insurers were not globally active, a regulatory response based on local geographical, political and prudential actions was adequate. However, the recent financial crisis demonstrates the potential for disruptions to global growth and prosperity. The elimination of all future systemic market failures does not seem plausible; especially with the mismatch between global market participants operating under domestic regulations of individual jurisdictions. However, it is possible to reduce the effects of such events through an appropriate macro-prudential approach under a cooperative global regulatory framework through, for example the use of supervisory colleges as promoted by the IAIS.

Rule-based approaches are difficult to implement uniformly across jurisdictions. Detailed rules can decrease the efficiency of market participants that operate across international borders. As a result, principles-based regulation is probably a more efficient to address global markets concerns. In addition, it is far easier to obtain agreement on principles than it is to obtain detailed commitment to a specific set of detailed rules. The approach of the IAIS, thus far, has been to follow a principle-based approach in defining international standards on insurance regulation.<sup>11</sup>

The largest threat of systemic risk arises from a continued mismatch between local regulation and global financial market opportunities. Global market participants need to tackle different local regulations. Local regulators are beginning to acknowledge (1) the trend toward global insurance markets, (2) their role in global markets, (3) the potential downside impact of regulatory inaction, and (4) the importance of appropriate global regulatory frameworks. As a string of crises<sup>12</sup> has demonstrated, there is an increased risk of even larger and more significant financial events in the future.

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<sup>10</sup> In addition to the more commonly considered financial markets ((stock, bond, options, foreign exchange, commodity, etc.), other markets such as real estate, insurance (life, annuity, health, property and casualty) are displaying greater indications of interdependency.

<sup>11</sup>IAIS, Insurance Core Principles, October 2011 (revised October 2012);, <http://www.iaisweb.org/index.cfm?pageID=795>.

<sup>12</sup> The Great Depression of 1933, London Market XSA Loss Spiral, Long Term Capital Management, Enron, the 2007/8 Mortgage and Credit Default Swap Crisis are Five (5) recent financial events with systemic risk implications at a global level. Not all increases in market uncertainty lead to total market failures as systemic risk events result from multiple underlying causes.

### 3.4 Global Market Stability and Trust

To enhance trust, market systems must project stability. A known set of transparent prudential rules must be established to outline the market goals, objectives, fundamental operating conditions and constraints. Market participants must also recognize a system attribute of fairness – i.e., a level playing field. One of the guiding principles for financial markets should be to design and enhance stability through increased competition. A significant risk is that without due diligence, regulation can also lead to abnormal rents under monopoly or oligopoly scenarios. Abnormal rents, either positive or negative, can lead to non-optimal economic market spirals. The purpose of macro-prudential regulation is to protect the public through a set of prudential rules designed to maximize market trust, increase stability, reduce the frequency and severity of spirals, and minimize entity/exit failures.

The functions of global market regulation should be to create and monitor a level playing field for the transaction of financial instruments around the globe. These functions include the identification, assessment, monitoring and mitigation of operational rules for market activities. For global regulators, communication, consistency and coordination are paramount to monitoring market conditions. Macro-prudential rules should be transparent as to functionality and operational stability for all market clearing activities. Markets based on transparent activities and consistent operations provide participant's with confidence in the market and assurance of a level playing field across jurisdictions. In such circumstances, entity conformity to market rules and financial strength can still be monitored and maintained at the jurisdictional entity level.

In establishing macro-prudential rules for a global market, a few basic questions include:

- What are the objectives of market regulation under global market conditions?
- Will macro-prudential rules introduce and enforce cooperative regulation within jurisdictional regulatory regimes?
- What macro-prudential rules are essential for financial markets to function efficiently and effectively over a variety of prudential conditions?

To develop these rules, the approaches to regulation as well as the characteristics of the individual markets to be regulated must be understood.

In 2010 the FSB published a report<sup>13</sup> which recommended a policy framework for addressing the systemic risk associated with SIFIs as follows.

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<sup>13</sup> FSB, Reducing the moral hazard posed by systemically important financial institutions – FSB Recommendations and Time Lines, 20 October 2010

1. *All FSB jurisdictions should put in place a policy framework to reduce the risks and externalities associated with domestic and global systemically important financial institutions in their jurisdictions.*
2. *The policy framework for SIFIs should combine:*
  - *a resolution framework<sup>14</sup> and other measures to ensure that all financial institutions can be resolved safely, quickly and without destabilising the financial system and exposing the taxpayer to the risk of loss;*
  - *a requirement that SIFIs and initially in particular global SIFIs have higher loss absorbency capacity to reflect the greater risks that these institutions pose to the global financial system;*
  - *more intensive supervisory oversight for financial institutions which may pose systemic risk;*
  - *robust core financial market infrastructures to reduce contagion risk from the failure of individual institutions and*
  - *other supplementary prudential and other requirements as determined by the national authorities.*
3. *Additionally, home jurisdictions for G-SIFIs should:*
  - *enable a rigorous coordinated assessment of the risks facing the G-SIFIs through international supervisory colleges;*
  - *make international recovery and resolution planning mandatory for G-SIFIs and negotiate institution-specific crisis cooperation agreements within cross-border crisis management groups (CMGs);*
  - *subject their G-SIFI policy measures to review by the proposed Peer Review Council.*

### **3.5 Market Characteristics**

Regulation of systemic risk must occur at the macro level of the market, rather than the micro level of insurance regulation. Systemic risk is dependent upon all sets of market rules applicable to the market activities. This allows the expansion/contraction of rules relative to the type of market, the mix of market participants, the economic structure, and market composition. Markets dominated by oligopoly/monopoly positions should result in substantially increased supervision for these market-makers. This approach provides the “level playing field” for all participants in the market. Markets are dynamic. Market regulation then consists of monitoring to assure that the market maintains its efficiency and effectiveness and changing market rules to assure continued equilibriums.

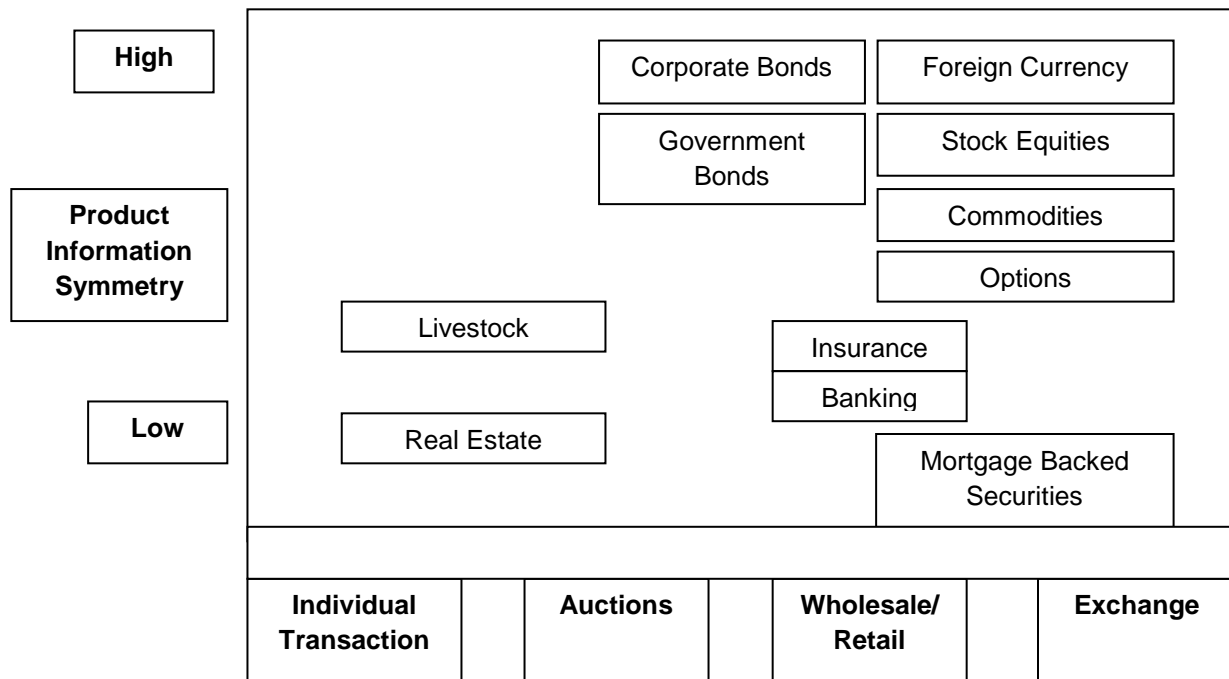
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<sup>14</sup> FSB, Key Attributes of Effective Resolution Regimes for Financial Institutions, November 2011

## 4. Market Frameworks and Insurance Markets

One of the critical activities of systemic risk regulators is to determine when the risks arising from a financial product or market begin to approach systemic risk potential, not only at the company level but at market operational and exchange levels, as well. This requires the systemic regulator to follow two characteristics of the product: the product information symmetry and the market clearing operations.

**Figure 1; Product Information Symmetry and Market Clearing Operations**



### 4.1 Information Symmetry

Products which entertain individual one-off transactions (real estate, livestock, etc.) generally will not compete for the systemic risk regulators' attention. Product modifications and innovations, however, can change the characteristics of the product's information symmetry. For example, real estate, which historically represented individual transactions with low information symmetry, high leverage, low liquidity and high transactional costs has been reconfigured through mortgage backed securities (MBS) to create a financial product with perceived higher information symmetry (homogeneous mortgage units), explicit risk leveraging (tranches) to match financial rewards (financial modeling), with greater liquidity and lower transactional costs provided through secondary markets (commercial banks).

## 4.2 Market Clearing Operations

The market clearing framework for financial products is generally found under four (4) open market formats: individual transactions, auctions, wholesale/retail, and exchanges. The path from individual transactions to exchange operations is characterized by the requirements for higher product homogeneity and larger exposure levels. Individual transactions are not generally a consideration for financial markets.

In the financial industry, products may perform multiple functions within society. For example, one use for put options is to provide downside protection (insurance) for a stock portfolio. Product innovations, or even new uses of established products, can blur the line between the traditional definitions of investment vs. insurance. Which market rules should apply?

Open market operations are distinguished by their distribution system, product development process, underwriting operations and portfolio management. Systemic risk regulations will need to vary by the type of open market operations. All regulations for the market operations will need some level of macro-prudential metrics and rules; however these metrics and rules will vary based on the market operations.

While market activities are generally determined by micro-economic decisions at the individual participant level, they rely upon macro-prudential rules to provide market stability: i.e., product definitions and participation boundaries of the market under consideration. Systemic risk regulators, however, must recognize the similarities and interdependencies that can arise both within and across various product markets.

## 4.3 Trends within Markets

As mentioned, even markets with strong jurisdictional boundaries are displaying wider global acceptance and usage. The following are a few of the trends leading to global market expansions:

- Financial strategies justifiably emphasize diversification, including global;
- Communications allow market participants to identify global opportunities;
- Technology has increased global access;
- Money is fungible;
- Foreign exchange markets assist money movements across currencies;
- Product innovations stress arbitrage opportunities, which result from financial products being repackaged, revalued and leveraged between global markets;

- Global markets reflect the *new world*<sup>15</sup> order, but also introduce greater interdependencies; and
- Global markets operating under jurisdictional regulations create an opportunity for regulatory arbitrage.

These trends are not short term but rather reflect the long term economic changes impacting the culture, education, experience and expectations of market participants beginning with the industrial revolution. They are integrated into market participant behavior. They can lead to long term market optimism, and through participant identification of global inconsistencies, arbitrage opportunities. Inconsistencies between short-term vs. long-term expectations have also led to bubbles and troughs. In periods of such inconsistency, market risk can increase substantially. One objective of the systemic risk regulator is to differentiate between normal market uncertainty and systemic risk situations.

#### **4.3.1 Product Design Innovation**

The financial risk exposure of some long duration general (P&C) insurance products is remarkably similar to other financial products (e.g. mortgage or other asset backed securities, such as credit card or automobile loan, securitizations). As regulators evaluate products with similar risk option criteria, either the traditional insurance product or a financial asset securitization, and begin to design similar market rules, insurance and financial markets will continue to converge. This issue has been most prominent with the current debate of credit default swaps, which look like insurance and are used like insurance (where held in connection with the underlying asset), but for an underlying financial rather than insurance risk. They all reflect both economic peril and/or investment risk components. A key distinction is how the regulators of various sectors choose to manage this exposure via various reserve and capital requirements. As alternative financing methods expand (e.g., securitization models become more widely accepted diversification methods as a spreading of risk for a wider variety of products), insurance exchanges are on the horizon.

New product designs may increase the use of derivatives in insurance products that result in expanded interconnectivity between insurance companies and non-insurance financial services groups. These new products will come with increased profit/loss potentials corresponding to an increase in market risks. More important thing is where insurers assume new financial risks without effective transfer, especially if from the financial sector.

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<sup>15</sup> Charles Amos Dice, "New Levels in the Stock Market", 1929



### 4.3.2 Financial Modernization

There is a natural blending between some insurance and financial (banking) risks. Bank product offerings are moving more toward insurance and insurer products are moving toward including greater financial and economic risks in their offerings<sup>16</sup>. For example, financial guarantee insurance and CDS have varying design levels reflecting traditional private and commercial insurance risk, but are more heavily dependent upon economic and financial scenarios to determine loss events. Another way of looking at the insurance transaction can be from the perspective of a “put option”. Similar to a put, the value of an insurance contract retains time value until expiration unless the insured condition is achieved.

Assuming the positive benefit of lower correlation across previously separate product silos (commercial banking, investment banking, financial hedging, insuring, etc.), there is an expectation of lower volatility and increased competition. Financial modernization legislation has supported the assumptions of risk reduction through large diversified organizations. One outcome has the “bigger is better” strategy. Under this strategy, corporations assume the position as “market-makers” in highly complex, consolidated-product markets. These market-maker positions require large capital bases and high credit ratings. Through horizontal<sup>17</sup> market integration, competition can be achieved if more large diversified organizations recognize the potential and begin to compete in multiple product markets. However, under these “bigger is better” strategies, lines of demarcation between financial and insurance markets blur as corporate market-maker activities overlaps with traditional market providers. In these revised markets size dominates the transaction pricing and positions unless controlled through market rules.

### 4.3.3 Behavioral Risk

Rational analytics too often lead to risk assessment solutions advocating asset concentrations or financial activities that bring the same yield with a lower risk charge or the same risk charge with a higher yield. When market conditions turn, all the players need to exit their positions at the same time, increasing the pro-cyclicality of systemic volatility.

Much of modern portfolio theory is based on the concept of the “rational” investor. However, the one problem in this theory is that rational thinking is not the sole determinant of market behavior. Portfolio theory for insurance models is also built on rational decision processes. For

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<sup>16</sup> See Appendix A.

<sup>17</sup> Horizontal market integration refers to expanding an entities strategy to integrate banking, insurance, hedge funds, dark pools, options, foreign exchange, securitizations, etc. operations. Vertical market integration would be an insurer expanding in insurance markets by operating in multiple markets such as direct write insurance operations, excess and surplus lines, and reinsurance, for example.

most market conditions, this assumption provides adequate understanding of the market supply and demand. In regimes where “hedgers” dominate the markets (e.g., insurance markets), the average of all market activity appears rational; in regimes where “speculators” can dominate the market (e.g., financial markets), market actions may come under conditions best described as “irrational exuberance”. The largest single source of behavioral risk arises from the “expectations” of the dominant market participants, whether it be hedgers or speculators.

In insurance (finance), if there is a strong expectation among product users as to the existence of a constant supply of insurance (finance) products; there can also be a strong systemic response if that supply is abruptly withdrawn. These actions can translate to real economic events. The insurance industry believes that it is its right to withdraw coverage regardless of the market chaos (systemic risk events) it may create. Some have even argued that it is a good thing for the market as withdrawal reflects markets where supply and demand are out of balance. Indeed, the markets may have become imbalanced due to political, judicial or regulatory interference in pricing. Unfortunately, to get to that market imbalance all participants are to blame: insurers, regulators, politicians, judges, etc., have led consumers to erroneous supply/demand/price assumptions. In this situation, the market has failed as a result of behavioral economics.

#### **4.3.4 Technology Developments**

Technology assists rapid flux in markets as it increases information flows. The 24-7 world of financial information can transform markets overnight. Informational shocks and revised data trends can cause massive shifts in a market’s supply/demand, yield or price expectations. Information flows expand expectations beyond the regional, state or nation level to the global markets. In addition, technology allows hedging or speculative actions to be implemented almost instantaneously. Market momentum can move prices in upward/downward spirals as buyer/seller “expectations” ebb and flow with the most recent e-communication. High volume electronic trading has already led to instant crashes and transformed stock market volume and volatility.

The rise in technology-related market transactions will influence the behavioral economics for all markets, including insurance markets. Insureds already shop on-line to develop pricing for their personal needs such as auto, homeowners, life, health, etc. Once an insured is at the insurer’s website, it is technically efficient for the insurer to maximize that link by adding value from alternative products such as banking, investment, retirement accounts, etc.

## 4.4 Future Insurance Markets

The insurance industry currently operates under an open market wholesale/retail structure. The traditional insurance underwriting view is from jurisdictional regulators. Regulation by the jurisdiction has played a major role through introduction of many market pricing and underwriting restrictions. Regulators also place limitations upon other risk transfer mechanisms, including reinsurance<sup>18</sup>. As a result, the regulator has contributed to an industry culture reluctant to engage in significant risk shifting through open market activities. The insurance markets have not evolved to the functional use of insurance exchanges.

The historical evolution of a global reinsurance market under the existing wholesale/retail structure has generally been successful for both the insurer and reinsurer. This success has minimized the demand for exchange clearing-functions in insurance. However, the development of alternative capital markets may have the possibility to transfer traditional insurance risks with lower frictional costs. Insurance participants are looking for broader coverage and costs more reflective of their exposures. Insured behavior is changing. Catastrophe bonds and securitizations, in response to larger catastrophic events and low economic returns, increasing pricing constraints, and rating agency capital requirements have caused movement toward risk distribution through capital markets. These trends also lead to reinsurance product innovations, such as greater use of securitizations or development of insurance exchanges, with increased potential for systemic risk.

With greater familiarity of new Non-Traditional and Non-Insurance activities, legislators and regulators may well develop confidence that the efficiency and effectiveness of financial entities will improve with the inclusion of banking, financial and insurance activities. In addition, financial and risk hedging will continue to offer opportunities to reduce an insurer's asset and liability risk profiles. Unfortunately, financial risk management benefits often come at a cost of greater product and market complexities. In such cases not only must the benefits and risks be simultaneously evaluated, monitored and regulated at the entity level, but the stability of the hedging instruments must also be monitored and regulated at the market level. The first represents the micro-prudential regulation of the firm, while the second depends upon the macro-prudential regulation of the markets.

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<sup>18</sup>Swiss Re, Reinsurance – a systemic risk?, Sigma No 5/2003

## 5. Macro-prudential Tools for Insurance Markets Designed to Decrease Systemic Risk

First step is to analyse the risk metrics of insurance markets and find indicators to identify focus entities or groups. The next step is to develop macro-prudential tools which lead to regulatory and/or management action.

### 5.1 Insurance Market Characteristics

To be effective, macro-prudential regulations needs to take into account essential characteristics of insurance and financial market operations.

Based upon the economic, statistical and regulatory foundations for insurance, the idiosyncratic risk of insurance products can be reduced through risk pooling. International insurance groups can benefit from risk diversification and internal risk transfer to further reduce their idiosyncratic risk to lower levels. The collapse of globally active insurance groups can threaten financial stability.

Insurance markets are displaying wider global reach. Expanded insurance markets may include non-traditional insurance activities. Risks inherent to these activities need to be analyzed and understood. For example, for insurance products built on risk financing principles rather than risk pooling principles, greater exposure requires greater capital demands as idiosyncratic risk cannot be reduced in these products.

### 5.2 Insurance Market Risk Metrics – A macro-prudential perspective

At the entity or group level, risk metrics should be based on an assessment of risk exposures, reflecting both on and off balance sheet items. These metrics should at least focus on the criteria for identifying the sources of systemic risk: size, substitutability, and interconnectedness.

From a market perspective, risk management metrics need to be summarized into macro-prudential models which identify sources of systemic risk. The two processes are intertwined. One possible approach is to identify the key indicators for systemic activities and interconnectedness, and then evaluate both horizontal (entity/group/competitors) and vertical (entity/markets/speculators) risks for possible source of systemic risk.

Followings are the indicators which can be used as macro-prudential metrics to monitor systemic risk of insurance markets:

- Revenues from non-traditional insurance and non-insurance business;

Revenues from insurance products which have some level of financial risks in their coverage

Revenues from commercial banking business

Revenues from investment banking business

Revenues from securities dealers

Revenues from other capital markets business

- Revenues outside the home country;
- Lending and borrowing from financial institutions;
- The risk in force of mortgage guaranty insurance (Total amount of mortgage insurance the firm is covering) and financial guarantee insurance; and
- Total amount of Derivatives (asset and liabilities) other than hedging purposes Gross amount of Credit Default Swap Protection sold

For regional example, American Academy of Actuaries (AAA) proposed in its letter<sup>19</sup> metrics to monitor insurance industry systemic risk in the US. Some metrics that can help gauge various aspects of company or group size, interconnectedness and market share were offered. The Office of Financial Research of U.S. Department of Treasury published a survey<sup>20</sup> which deals with quantitative measures of systemic risk including data requirement issues.

The IAIS consulted on indicator based assessment methodology<sup>21</sup> to identify G-SIIs:

*“ The IAIS’ proposed assessment methodology involves three steps – the collection of data, an indicator-based assessment of the data, and a process of supervisory judgment and validation, with 18 indicators under 5 categories: size, global activity, interconnectedness, non-traditional insurance and non-insurance activities, and substitutability.”*

### 5.3 Macro-prudential Tools

Since a new risk mitigation or hedging activity has not given rise to a past systemic event, stress testing/scenario analysis is one of several “bottom-up” methodologies that can be developed to evaluate the systemic risk potential. The results of stress testing /scenario analysis can be useful tools to identify the financial impact of various levels of accumulated risk. There are two kinds of stress scenarios to identify risks from exposures:

- Predefined scenarios to assess market wide risk exposure; and

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<sup>19</sup> AAA, Metrics to Enable FSOC to Monitor Insurance Industry Systemic Risk, 24 June 2011

<sup>20</sup> Office of Financial Research, A Survey of Systemic Risk Analytics, Working Paper #0001, January 2012

<sup>21</sup> IAIS, Global Systemically Important Insurers: Proposed Assessment Methodology, May 2012

- Company-specific scenarios to assess specific risks of single insurer

Stress testing reveals the total exposure if the specified adverse scenario occurs. The important factor for the successful implementation of this process is the proper setting of scenarios to identify the risks by supervisors and insurance companies or groups. Ideally the scenario should be set at a global level, applied to banks, insurers and securities firms, to assess their interconnectedness. This framework enables new risks, which cannot be uncovered through normal supervision, to be identified.

It is important in choosing stress tests for diverse financial services groups. Stress tests which are designed to test the impact on non-insurance financial services may have an adverse financial impact on the insurance operations of the group<sup>22</sup> and vice versa. The same concept holds true where there are diverse geographical activities in order to examine the impact of varying levels of supervision.

Regulatory methodologies that build off an Own Risk and Solvency Assessment (ORSA) can also be effective. This process may identify emerging risks not currently being captured within regulatory capital adequacy requirements. Other risk types may be identifiable through collection of qualitative information, such as through the ORSA dialogue between supervisors and insurance groups. In an ORSA, an insurer is required to consider all material risks that may have an impact on its ability to meet its obligations to policyholders. With bottom up information, econometric modeling can assist regulators in identifying, assessing, monitoring and mitigating risk in global markets.

In order to implement macro-prudential supervision successfully, there must be consistent coordination between supervisors at the global level. A cooperative supervisory framework, e.g., supervisory colleges, is essential for the efficient and effective supervision of global insurance groups. For example, analysis of an insurance group's interconnectedness with other financial institutions requires (1) the analysis of the group structure, including the web of intra and extra group commitments, (2) risk exposures of the different legal entities comprising the group, and (3) exposures in case of financial stress, taking into account potentially limited capital mobility within the group. Without the cooperative global framework, the macro-prudential supervision will not work effectively.

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<sup>22</sup> As an example, we note the negative impact of the credit default swap operations on American International Group's traditional insurance operations.

## 5.4 Effects of Macro-prudential Regulation

The means to meet objective of global systemic risk regulation should be to monitor the accumulation of risk, the expansion or contraction of global financial activities, the interrelationships within financial services groups, and then determine if these organizations risk management policies leave any residual risk for the development of systemic crises either as individual entities/groups or together. Systemic risk regulation requires the coordination among territories and different financial services players and cooperation for aggregating market metrics, monitoring for systemic risk events, and then acting upon that analysis at a jurisdictional level.

In order to implement effective systemic risk management on a global basis, regulators will need to work together towards a set of common objectives and goal regarding systemic risk. The IAIS is one such organization that can establish the necessary global regulatory structure to meet the organizational needs of systemic risk regulators. Global systemic risk regulation objectives should be principles-based. Regulations in each jurisdiction should be implemented at the company level and aggregate local and international metrics at the local and regional level. International companies whose size or complexity may contribute to systemic risk should remain under the oversight of the jurisdictional regulators but where necessary to ensure protection against systemic events with more intense supervision based on established global principles-based approaches. An important element in the successful implementation of effective global systemic risk regulation is the peer pressure applied within jurisdictional regulatory authorities. This requires all regulators of the jurisdictions to recognize insurance is a key component in the global economy and as such systemic risk can create serious negative externalities within their regulatory environment.

Approaches to managing systemic risk include imposing additional regulatory capital requirement. It is, however, important to strike the right balance between capital, rules, disclosure and monitoring. Disclosure, which is a key in Pillar III requirements of solvency system, can be equally applicable to macro-prudential regulation. Broad brush capital add-ons should be avoided in favour of capital adjustments designed to increase resilience for specific entity strategic activity. Increased capital in itself does not always provide added protection but may have undesired consequences such as rationing risk capacity.

Key market characteristics can provide identifiers for potential systemic risk events and enable regulators to identify the appropriate tools to estimate the potential impact of the risk. As an example, stress testing can identify exposures of insurance groups in case of financial distress. Proper macro-prudential regulation is important for the soundness in the financial market.

On the other hand, improper regulation may lead to worse outcomes in the financial market. Pro-cyclicality is one of the examples of the adverse effect of improper regulation. Another example could be where excessive regulatory risk-based capital charges for stock volatility could force insurance companies to sell during bad economic regimes which will lead to a worsening spiral of the financial market. Furthermore, excessive regulatory prudence will increase the cost of insurance, restricting economic activity.



## 6. Actuaries in Systemic Risk Regulation for Insurance Markets

Actuaries assumed a role to assess the soundness of insurance entities. In insurance operations, actuaries are usually involved in both the first and last lines of analysis for insurance risks. These analyses include portfolio risk evaluations (assets, pricing and reserving), risk leveraging (risk retention limits and risk mitigation through reinsurance), enterprise risk management (market, credit, and operational risks) and solvency level (asset/liability management, risk-based capital, economic capital and minimum prudential solvency levels). In the past, actuaries were mainly consulted by insurer management on firm-specific issues.

More recently, the legislative and regulatory emphasis on systemic risk has brought to the fore the role of actuaries with respect to the systemic risk regulatory process. In the future, actuaries are expected to be a part of the analytical team that recognizes systemic risk associated with the insurance market.

### 6.1 Actuarial View of the Systemic Risk Environment

This paper has discussed the global insurance markets and highlighted potential sources of systemic risk to the global insurance markets. This paper has also described the manner in which that information could be used in the global systemic risk regulatory system. Additional work must still be undertaken to:

- Define principles-based approaches which are consistent with prudential regulations at the jurisdiction level. One of the purposes of these regulations is to protect the system from systemic failure.
- Define market metrics that can highlight systemic risk scenarios, not just within the insurance markets, but also the interconnectivity between the insurance markets and the financial system.
- Develop regulatory methodologies that can embed systemic risk into the routine thought process of insurance market participants since behaviour could significantly influence systemic risk events.
- Develop methodologies which are effective in introducing realistic evaluations of systemic risk events (liquidity, leverage, behaviour, etc.) into the global insurance markets, but also cost efficient in their implementation.
- Develop methodologies to seek out the yet-to-be-experienced events or conditions that may contribute to the next wave of systemic risk.

While the measurement and management of systemic risks for the financial markets may be a new focus, there is value in leveraging tools that have proven effective. The actuarial

profession, by its focus on the need to balance the short-term and longer-term business and solvency needs in insurance, recognizes the importance of balancing the quantitative and qualitative aspects of risk management. Actuarial principles and approaches can provide an important perspective, as well as practical tools and skills, to the challenges of systemic risk regulation.

## **6.2 The Role of the Actuary**

Insurance products represent promises of future benefits (the insurance coverage) for an immediate payment (premiums). The insurance system requires a high degree of insurer responsibility towards the general public. The primary roles of actuaries are to identify financial and underwriting risks, maintain appropriate pricing and perform reserve analyses of insurance portfolios which contribute to maintaining the financial soundness of the carrier. The main goal in these activities, similar to those of the regulator, is to protect the financial viability of the insurance sector, including the interests of the general public.

Actuaries have traditionally assumed the role which protects the interest of general public by designing micro-economic analyses tools that recognize the risk characteristics of the insurance product, the behavioral characteristics of insurance market participants, and the insurer's operational processes. Regulators have recognized these skills as essential for the financial soundness of the insurer. Actuaries assume major roles in insurance product designs, underwriting and pricing, reserving and enterprise risk management. The "product" design is the development of long put options relevant to the supply and demand of market conditions. "Underwriting" is the study of the behavioral aspects of individual participants, the constraints established by regulatory rules and the economic realities of the insurance markets. "Pricing" assures equity among market participants through market "limits" on speculation, margins, etc. The actuarial mission is to be cognizant of the needs of all stakeholders in the insurance markets (buyers, insurers and their investors, third parties and regulators) having regard to the design and maintenance of a functioning marketplace and the monitoring of constraints, rules, data, metrics, etc.

Actuaries continue to undertake their role by providing quantitative analysis directed at maintaining financial soundness of the insurance and risk portfolio. This paper extends the actuarial activities that could assist macro-prudential regulators in the design of tools that can be applied to identifying and monitoring systemic risk scenarios in insurance markets. Traditionally, actuarial tools can deal with not just insurance risks, but also economic trends (such as inflation and supply/demand), social conditions, behavioral, biological (growth trends and potentials for "contagion" conditions) and political influences in the products of insurance markets. Macro-prudential regulations require similar knowledge and experience in the design of quantitative tools for the identification and monitoring of systemic risk in global markets.

These tools include the statistical analysis of insurance product trends and market risk aggregations, behavioral analysis of market participants, stress testing designs for risk factors and market conditions, and simulation models for market trends.

An important task for actuaries in systemic risk regulation is to support the insurance regulation and supervision in the identification of systemically relevant insurance companies and how systemic relevance can be measured. There are two approaches to measure systemic relevance:

1. Model-based approach; and
2. Indicator-based approach

The best known model-based approaches include Conditional Value at Risk (CoVaR<sup>23</sup>), Marginal Expected Shortfall (MES), Shapley-Value and further conceptual approaches like network models, calculation of fair insurance premiums for systemic risks in a portfolio-context etc..

The indicator-based approach is preferred by supervisory authorities, while the market-based measurements are primarily use as plausibility check. Closely connected with the indicator-based approach is the benchmarking of insurance undertakings. The benchmarking requirements of insurance undertakings for regulatory and supervisory purposes are conceptually different from the pure identification of systemically relevant insurance companies. The benchmarking has to consider both the political objective and the incentive effect of the chosen indicators.

One of the objectives of the insurance regulation and supervision is financial system stability. Therefore it is important to consider the resolvability of insurance entities one by one but also in significant numbers over a short to medium period, noting that overnight failure is not the norm. Reviewing existing regulatory process and tools will identify where any improvements are required so addressing any “too-big-to fail” problems, decreasing moral hazard and hence enhance the stability of the system overall. . For this purpose qualitative and quantitative factors should be taken into account to determine how likely it is that an insurance company

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<sup>23</sup> Adrian, Tobias and Markus K. Brunnermeier (2010), CoVaR Federal Reserve Bank of New York, Staff Reports No. 348, November 2010:

“Systemic risk has a non-linear character, for instance one can construct a measure for systemic risk, which is the value at risk of financial institutions conditional on other institutions being in distress (CoVaR). One could try to define an institution’s (marginal) contribution to systemic risk as the difference between CoVaR and the financial system’s VaR.”

falling into financial distress and failing to recover can be resolved in an orderly manner. To evaluate such factors is the role of the actuary in systemic risk regulation and supervision.

#### Afterword

Markets are evolving continuously. This paper should not be regarded as a fixed one but needs further development in the future.

# Appendix A; Comparison of Insurance and Financial Portfolios

Consideration of the differences of the business model between banking and insurance, leads to the conclusion that traditional insurance activities have not been identified as a cause for systemic risk. Insurance obligations are prefunded by premiums, charges and fees according to forward looking methods. Insurer obligations are triggered by the insurable event. Insurance regulatory system is acknowledged as being more helpful to prevent risk to the system than non insurance financial services regulation. A key priority in non-traditional insurance products is to identify any non-insurance exposures that could financially hurt the insurer. In today's market, such exposures are leverage, counterparty exposures and reliance on capital market products for financial risk mitigation. We see leverage in, for example, guarantees given to non-regulated entities, financial guarantee insurance and when writing Credit Default Swaps (CDS). Counterparty exposures including reliance on capital market products are best assessed by stress/scenario testing.

The absence of systemic risk with respect to traditional insurance activities of (re)insurers arises from the characteristics of insurable risks:

- (1) The peril to be insured is subject to a large exposure base;
- (2) Losses must be fortuitous, i.e., accidental and unintentional;
- (3) Claims must be independent, and are not subject to catastrophic hazards; and
- (4) The loss is determinable and measurable.

In addition, traditional insurance products provide protection against pure<sup>24</sup> risk, rather than speculative<sup>25</sup> risks events. Insurance products respond only when from a loss event arising from a pre-existing insured peril; hence, there is only a possibility of a financial loss to the insured, and basically no financial gain anticipated.

Financial products can respond to pure risks, i.e., long a put option on an owned equity position, but are most frequently associated with speculative risk events. Financial perils can arise from and respond to business, investment, or gambling risks. They anticipate either profit or loss positions. Similarly, insurance-like products can be designed to cover speculative risks. They suspend traditional insurable risk characteristics. For example, credit default swaps, options, or

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<sup>24</sup> The characteristics of a Pure Risk are exposure to an existing peril. There is uncertainty as to the occurrence of the loss but the result can be only in a loss, should the peril occur.

<sup>25</sup> The characteristics of Speculative Risk are exposure to a peril, either existing or not. There are uncertainty as to the occurrence of the peril and the results which can be in a loss or gain, should the peril occur

exotic derivatives, can function as insurance projects, but with a hidden cost from participation in systemic risk events.

Non-traditional insurance maintains lesser reliance upon these four risk characteristics and have been extended to entertain speculative risk events. Non-traditional insurance begin to bridge traditional insurance and financial products. They may provide insurance coverage with financial guarantees. In fact, they often rely on only two (2) of the four (4) characteristic:

- (1) Losses must not be intentional; and
- (2) The loss is determinable and measurable.

<b>Table 1 Comparison of Insurance and Financial Portfolios</b>		
	<b>Insurable Risks</b>	<b>Financial Risks</b>
<b>Risk Categories</b>	<ul style="list-style-type: none"> <li>• Hazard Events</li> </ul>	<ul style="list-style-type: none"> <li>• Business, Hazard, Credit, Gambling or Market Events</li> </ul>
<b>Risk Types</b>	<ul style="list-style-type: none"> <li>• Pure Risks Only</li> </ul>	<ul style="list-style-type: none"> <li>• Pure Risks</li> <li>• Speculative Risks</li> </ul>
<b>Risk Strategy</b>	<ul style="list-style-type: none"> <li>• Risk Pooling</li> <li>• Risk Diversification</li> </ul>	<ul style="list-style-type: none"> <li>• Risk Diversification</li> </ul>
<b>Portfolio Characteristics</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Classification: Risk Aggregation into “Homogeneous” Groups</li> <li><input type="checkbox"/> Diversification:               <ul style="list-style-type: none"> <li><input type="checkbox"/> Individual Risk Selection</li> <li><input type="checkbox"/> Multiple Product Offerings</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Diversification: Risk Spreading with unknown, but assumed low, correlations across “Heterogeneous” Asset Classifications</li> </ul>
<b>Portfolio Risks</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Pricing Risks</li> <li><input type="checkbox"/> Underwriting Risks               <ul style="list-style-type: none"> <li><input type="checkbox"/> Independent Risks</li> <li><input type="checkbox"/> Independent Events</li> <li><input type="checkbox"/> Concentration Risks</li> </ul> </li> <li><input type="checkbox"/> Behavioral Risks</li> <li><input type="checkbox"/> Correlation Risk               <ul style="list-style-type: none"> <li><input type="checkbox"/> Catastrophe</li> <li><input type="checkbox"/> Pandemics</li> <li><input type="checkbox"/> Concentration</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Idiosyncratic Risk</li> <li><input type="checkbox"/> Systematic Risk</li> <li><input type="checkbox"/> Market Risks</li> <li><input type="checkbox"/> Credit Risks</li> <li><input type="checkbox"/> Liquidity Risks</li> <li><input type="checkbox"/> Concentration Risks</li> <li><input type="checkbox"/> Systemic Risk - Correlation Risks</li> <li><input type="checkbox"/> Behavioral Risks</li> </ul>
<b>Product Management</b>	<ul style="list-style-type: none"> <li>• Underwriting: Stability Theorem</li> <li>• Real Options</li> </ul>	<ul style="list-style-type: none"> <li>• Contracting: Efficient Market Hypothesis</li> <li>• Real Options</li> </ul>
<b>Risk Management Techniques</b>	<ul style="list-style-type: none"> <li>• Risk Financing: Capital Markets</li> <li>• Risk Spreading: Reinsurance</li> <li>• Derivatives</li> </ul>	<ul style="list-style-type: none"> <li>• Capital Markets</li> <li>• Partnerships/Joint Ventures</li> <li>• Derivatives</li> </ul>

Risk management methods designed to handle insurance risks have also been equally applied for financial risks. Whether the risk is insurance or financial in nature, uncertainty regarding overall portfolio values is of a prime concern. The methods used to reduce portfolio uncertainty stem from statistical theories, and include risk combinations, risk transfer and risk diversification.

**Risk Combinations** – Combining risk-taking activities allows management to assemble, and with appropriate monitoring, reduce portfolio uncertainty (reduced volatility) by aggregation of exposures subject to similar, but independent, perils. Reducing uncertainty is often confused as being equivalent to reducing the loss amount; instead, statistical techniques only address the probability uncertainties surrounding the loss-not the size of loss. Increasing the size of the portfolio may also increase the absolute dollar amount of a loss. The absolute dollar loss for either, an Insurers or financial entity, is still limited by its capital position. Critical to the management of the portfolio is the use of risk transfer and risk diversification.

**Risk Transfer** – When portfolio exposures to a peril become too large for an entity level of capital, they can be shared by transferring the exposures and the risk to another entity. Under risk transfer mechanisms, losses are reduced for the transferor (insured) and assumed by the transferee (insurer). The success of risk transfer is based on the strength of the risk combinations (i.e., individual risk selection process) performed by the transferor. Statistical theory promotes a reduction in the volatility of the insured losses by increased size; risk transfer promotes a spreading of the financial consequences when portfolio risk becomes too large.

**Risk Diversification** – When portfolio exposures are subject to a single event peril, risk diversification reduces the impact to the portfolio. Under risk diversification mechanisms, exposures are drawn from multiple markets, i.e., coverage, geographical location, asset type, etc. Statistical theory assumes portfolio risk is reduced when exposures are assumed to be independent between individual events; risk diversification promotes a significant reduction from a single financial consequence when the portfolio risk becomes too concentrated.

As financial products innovate, the distinctions between insurance and financial instruments are more likely to blur in the future. To offset the uncertainty associated with product innovation, the use of statistical theories supporting portfolio growth will accelerate risk transfer and diversification techniques. Competitive players from banking, insurance or investments will look to diversify risks arising from insurance and financial products. The entities responsible for developing, marketing and distributing new products will expand to fill traditional market gaps arising from product innovation (note AIG's strategic move into CDS). If these trends expand rapidly traditional insurers (insurance groups) which were previously not systemically risky may become increasingly risky.

# Appendix B; Analysis on Insurance Activities and Systemic Relevance

This appendix analyzes the systemic relevance of insurance markets by types of insurance activities.

## B.1 Traditional Insurance

From an actuarial perspective, traditional insurance coverage, excluding guaranteed investment values, are assumed to be associated with hazard risks rather than financial risk events. Hazard events represent loss arising from perils that exist outside the control of the insured, i.e. death, survival disability, fire, accidents, etc. They represent only the potential for loss, not financial gain.

One of the first statistical principles closely tied to the insurance risk is the “Law of Large Numbers”. For the application of the law of large numbers, two necessary assumptions are that all individual risks are (1) identical and (2) independently distributed (i.i.d.). Through the application of the law of large numbers the insurance portfolio can achieve a reduction in claim volatility (risk). This statistical theorem is referenced as the bedrock for insurance activities.

While the exposure characteristics from life insurance and personal lines automobile insurance may display a closer affinity to and reflect i.i.d. risk assumption, most insurance portfolios for property and casualty coverage (commercial lines business) diverge, sometimes significantly, from these i.i.d. assumptions. Similarly, for many life/health risks, trends in longevity, overall health risks, such as the rise of an epidemic, may be directly counter to these independence assumptions as they increase correlation risks.

For property and casualty coverages, the “Stability Theorem of Risk”<sup>26</sup> provides for parallel results with the “Law of Large Numbers”, but without the i.i.d. assumption requirements; although the reduction of the variance is at a slower rate of convergence for the portfolio’s overall volatility. There is still a statistical benefit and a basis for insurance risk aggregations, but larger insurance portfolios are required to achieve the same reduction in volatility levels. There can be a significant competitive advantage for entities that can form larger portfolios when compared to its competitors. The move to larger portfolios requires larger markets. The focus on larger portfolios often leads to global market operations.

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<sup>26</sup>Hans Bühlmann, Mathematical Methods in Risk Theory, Page 32



For these types of insurers, the stability theorem leads to significant benefits arising from risk aggregations. In addition, it leads insurers to form larger and larger insurance portfolios. Traditional insurance coverage generally relate to hazards, which demonstrate pre-existing perils. Limiting the speed of a portfolio volatility convergence is (1) the strength of independence, i.e., correlations between insured events, and (2) the balance between homogeneity and heterogeneity among individual risks insured. A risk management tool to increase independence and reduce heterogeneity is the segregation of insureds by risk characteristics. The placement of individual risks into smaller, but more homogeneous, groups is used to achieve faster convergence to lower volatility levels. Aggregation across all such groups also moves to a faster convergence to a minimum volatility level. The benefits from large risk classification portfolios works significantly better when underwriting tightly monitors for similar individual risk characteristics within the individual risk classifications. This risk reduction operation is designated as a “risk classification” system and can be applied to the small individual risks markets – life insurance, personal lines automobile insurance, small commercial lines liability, main street workers’ compensation, etc.

There remains the basic assumption that all insureds are independent, although they are not assumed to be similar, but not identically distributed. The assumption of independent events leads to distributions which demonstrate no correlations between claims and smaller tail risk. It is noted that these insurance portfolios can retain significant tail risk if there are regimes during which time, the independence assumption is violated. During these extreme events, diversification benefits are lost.

In commercial insurance, where the insured is large enough to develop its own credibility regarding losses, traditional insurance relies on the assumption of similar underlying risk characteristics. This second actuarial pricing approach is “individual risk rating”. This pricing system applies to larger commercial lines coverage, including workers’ compensation, general liability, etc. In these situations, the insured are larger businesses and have multiple expected claims each year. It is noted that some insurance portfolios can retain significant tail risk.

In addition, insurers have a major role in the financial markets, primarily the fixed income markets. The management for insurers often assumes that there is also low correlation between the asset and liability side of an insurer’s balance sheet when there are no investment guarantees. Therefore, applying the assumption of independent risk events and low correlation between financial and hazards, the insurance firms which engage in the traditional insurance seem to have minimal potential to cause systemic risks. However, given their participation in

the financial markets, they may become subject to systemic risks arising from these same capital markets.

## **B.2 Catastrophic Risk**

The most often mentioned driver of systemic risk for the insurance industry is property catastrophe risks<sup>27</sup>. These catastrophic risk events are generally assumed to be limited to a geographical area and hence are highly jurisdictional-focused. In the past, it was thought that no single natural catastrophic event would be able to cause a disruption to the financial markets around the world. If it were to do so, it was argued that the event itself would have been so catastrophic that the financial system risk was a minor consequence.

However, the 2011 tsunami in Japan did disrupt real assets<sup>28</sup>. For example, the 2011 tsunami caused major global disruption in automobile parts distribution channels for car manufacturers. This disruption may have been greater than in the past due to the dependency on JIT (just-in-time) manufacturing strategies. Other events included financial impacts arising from “9/11” and the 2011 volcanic eruption in Iceland. In life insurance, it is recognized that pandemics have occurred in the past. The future potential disaster that science unravels is disease. Note however that the consequences of massive longevity improvement would be significant to insurance and separately to the real economy. Here it is essential to understand the nature, structure and magnitude of potential catastrophic events. When assessing such events it is important to understand the overall impact of an event on the world or an appropriate part of it and within that scenario test the impact on and from insurers.

While current scientific knowledge related to natural catastrophe risks (both medical and property events) indicates that such events are unlikely to cause a direct mapping to market disruptions, there remains potential for unknown environmental and medical changes to cause adverse impact to real markets. Such changes represent “unknown-unknowns” and therefore are impossible to predict. Therefore, while catastrophic risk could be considered a potential source of systemic risk, the risk can only be limited through mitigation, not eliminated by regulatory intervention.

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<sup>27</sup> CRS Report for Congress, “Financing Recovery from Large-Scale Natural Disasters, November 18, 2008, by Rawle O. King, Analyst in Financial Economics and Risk Assessment, Government and Finance Division. This report describes the potential catastrophic event in excess of \$100 billion.

<sup>28</sup> Real Assets are physical or identifiable assets such as gold, land, equipment, patents, etc. (This definition is provided by Investopedia [www.investopedia.com](http://www.investopedia.com))

### **B.3 Reinsurance**

Reinsurance performs two critical functions for the insurance industry: risk transfer and risk distribution. The insurance industry recognized very early the value of risk transfer and risk spreading mechanisms. Insurance products are based on real assets rather than financial assets. As such, insurers did not have direct access to capital markets. Instead, the illiquid insurance risks are transferred to other reinsurers. These transfers allow a level of liquidity to insurers for insurance risk.

The globalization of reinsurance has demonstrated the efficiency and efficacy of risk distribution mechanisms beyond jurisdictional borders. In fact, global reinsurance continues to display increased demands arising from increasing catastrophe exposures, and a steady upward trend in personal and commercial insurance limits. The reinsurance growth arising from property covers is a result of expanded real asset growth (and values) in catastrophe sensitive areas, which display perils such as hurricane, earthquake, tsunami, and other atmospheric conditions. Improved catastrophic risk modeling has provided a basis for pricing and risk management despite the growth in property values. Growth in personal and commercial insurance limits is often a result of financial inflation. Both have fueled extensive reliance upon risk transfer and risk spreading in the global (re)insurance system.

Financial risks in the growth of this global reinsurance system have also been seen. For example, in the 1980s, with an increase in the demand for reinsurance came an increase in the supply of small global reinsurers. The development of these new reinsurers, however, resulted in an increase in reinsurer failures due partly to naïve underwriting, regulatory arbitrage, and capital restrictions. In addition, problems within Lloyds of London have been well documented in the failure of the highly interrelated Lloyds syndicates. Fortunately, these events have not transferred to the financial markets. In addition, the size of the reinsurance markets is relatively small in comparison to the direct insurance business.

Today reinsurers are more likely to operate within large insurance groups and pose greater interconnectivity with the insurance and financial market. Some have been more involved with financial risk while others have sought to minimize it and focus resources on holding hazard risk. Risk exposure assumed by a (re)insurance group as a whole needs to be assessed. Future consolidation of the life reinsurance industry in some locations could lead to concentration of counterparty risk.

The IAIS stated in its policy paper entitled “Reinsurance and Financial stability”<sup>29</sup>:

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<sup>29</sup> IAIS, Reinsurance and Financial Stability, 19 July 2012

*“..traditional reinsurance is unlikely to cause, or amplify, systemic risk. This point holds also for the insurance of peak risks, the core business of reinsurers. The findings also apply to the bulk of non-traditional (re)insurance and particularly to ART (Alternative Risk Transfer) activities. While ART comprises characteristics of financial market products and derivatives, in most cases, ART does not intermediate credit. Consequently, the failure of a reinsurer engaged in ART will not undermine a larger credit pyramid, and it is unlikely to affect other financial market participants or the real economy. “*

#### **B.4 Emerging non-traditional insurance**

Some non-traditional insurance products, such as financial guarantee insurance or private mortgage insurance (PMI), entail some level of financial risk. Products which guarantee the performance of separate account, such as guaranteed minimum benefits for variable annuities, are another example of non-traditional insurance. These non-traditional insurance product designs are primarily meant to facilitate more efficient and effective funding techniques in managing key financial risk characteristics. In case of financial disruptions, these non-traditional insurance products can exacerbate the systemic risk and amplify financial disruptions in the markets. There is a need to monitor carefully the future trend of such activities.

#### **B.5 Non-insurance activities by insurers**

Certain non insurance activities within insurance groups can become sources of systemic risk. For example, in the United States, legislative<sup>30</sup> changes have removed certain restrictions between insurers, commercial banking and investment banking activities. The important factor, when identifying the source of systemic risk, is to consider the type of activities and not the traditional classification of entities. For example, if an insurance group has businesses characteristics similar to banking, these shadow banking<sup>31</sup> activities could result in a similar effect as a traditional banking business with respect to the financial market. Therefore, non-insurance activities undertaken by insurance groups, which are similar in nature to businesses with systemic risk potential, can be a source of systemic risk.

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<sup>30</sup> Graham-Leach-Bliley Act, Financial Services Modernization Act of 1999

<sup>31</sup> FSB, Shadow Banking: Strengthening Oversight and Regulation, October 2011

# Appendix C; Actuarial Responses to Systemic Risk

The IAA has produced positions on a number of issues relating to systemic risk<sup>32</sup>. Actuaries are seeking analytical approaches and processes which can instill theoretical considerations for systemic risk, but be implemented through reasonably cost efficient methodologies.

## 1. Chartered Enterprise Risk Actuary

Actuaries have expanded their scope to include the enterprise risk management and have established a world-wide, technically based, ERM designation, Chartered Enterprise Risk Actuary (CERA). The CERA designation is specifically targeted at risk management issues. In this role, actuaries are seeking methods and techniques which will address systemic risk assessment within the existing risk management frameworks.

## 2. Behavior dominates Systemic Risk Events

The first call for essays “*Risk Management: Current Financial Crisis, Lessons Learned and Future Implications*”<sup>33</sup> was published in December 2008. These 35 essays highlighted how operational risks can combine with other risks and manifest in the breakdown of the entire financial system. Risk systems consist of social institutions, laws, processes and products designed to facilitate the transfer, sharing, distribution and mitigation/hedging of risks between various buyers and sellers. Ultimately, it becomes a story of risk that manifests itself through the decisions and behavior of people, and not necessarily through exogenous events.

## 3. Liquidity in Systemic Risk

Asset liability analysis as applied by actuaries has developed into a well understood methodology for the study of liquidity issues within the life insurance industry. In systemic risk analysis, traditional decomposition of asset risks and liability risks are reunited to understand first the liquidity risk of the insurance entity. This analysis can be brought forward to develop a metric for the aggregation of liquidity risk within global markets. In many jurisdictions, actuaries have been producing reserve adequacy opinions for many years using this methodology which has proved extremely beneficial.

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<sup>32</sup> IAA, Dealing with Predictable Irrationality – Actuarial Ideas to Strengthen Global Risk Management, February 2009  
IAA, The Global Financial Crisis – What Next?, July 2009  
IAA, Insurance Market Risk Metrics, December 2010

<sup>33</sup> Society of Actuaries, Casualty Actuarial Society (CAS), Canadian Institute of Actuaries (CIA); a collection of essays written on the current financial crisis, lessons learned and future implications. (Published December 2008)

#### **4. Leverage in Systemic Risk**

Actuaries play a role in the development and implementation of regulatory leverage rules within insurance entities. In insurance, management controls for leverage include a series of operational statistics. Historically, these statistics include cash flow testing, premium to surplus levels, risk limits to surplus levels, risk based capital, minimum prudential solvency, etc. More recently, insurance actuaries have been implementing capital allocation methods, conditional value at risk, tail value at risk, etc., to evaluate the capital needs of insurers and insurance groups. Most important to systemic risk regulation is the integration of systemic risk events into the current system of minimum prudential solvency requirements. While there are considerable complexities of implementing systemic risk explicitly into an entity's solvency calculations, the need is for a simple, direct calculation that can meet regulatory goals for model efficacy (doing the right thing) and efficiency (doing it correctly).

#### **5. Prudential Risk Parameters**

Insurance represents different risk profiles between its assets and its liabilities than commercial or investment banking operations. An insurer's asset risks may be similar to those of other financial entities. These risks can be evaluated under current financial market values for similar asset groups. In a financial vernacular, an insurer's liabilities represent non-liquid, long durational (mainly life insurance protocols), put options. The methods for valuing insurance liabilities need to be consistent with that for valuing assets. The longer time horizons combined with significant potential for behavioural regime changes (arising from social, economic, medical, legislative, judicial and environmental conditions) make short-term, asset-based parameter assumptions unreliable for insurance liabilities. The time horizon and risk characteristics unique to insurance parameter selections are critical to understand insurance risks. Actuaries have the experience and understanding of these liability cycles to assist the global risk community in evaluating the implications of potential systemic risk events on insurance markets.