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Catastrophe Risk Financing in the United States and the European Union: A Comparative Analysis of Alternative Regulatory Approaches

Robert W. Klein
Shaun Wang

Abstract

The regulation of insurance companies in the United States and the European Union (EU) continues to evolve in response to market forces and the changing nature of risk but with somewhat different philosophies and at different rates. One important area where both economic realities and markets are changing is catastrophe risk and its financing. This article examines and compares regulatory and other government policies in the United States and the EU generally and their approaches to the financing of catastrophe risk specifically. It is important to understand the fundamental differences between the two systems to gain insights into their disparate treatment of catastrophe risk financing. Although policies could be improved in both jurisdictions, we argue that the much greater reform is needed in the United States relative to the EU regulatory policies that are being developed. We offer recommendations on how U.S. policies could be significantly improved as well as comment on issues facing the EU. We conclude with some observations on the needs for further progress in the U.S. and EU regulatory systems.

Introduction

The threat of "natural" and "man-made" disasters continues to grow in many parts of the world due to a confluence of factors, including population growth and economic development, climatic changes and weather cycles, geologic activity, and political unrest. At its core, the problem of catastrophe risk poses a number of challenges to

Robert W. Klein and Shaun Wang are at Georgia State University. Robert W. Klein can be contacted via e-mail: rwklein@gsu.edu. The authors express their appreciation to SCOR and the *Journal of Risk and Insurance* for sponsoring the conference at which this article was originally presented. We also thank Georges Dionne and J. David Cummins for their support and advice in the development of this article and the assistance of Janne Lipponen, Phillipe Trainar, and Morton Lane. The comments of anonymous reviewers also were helpful. Of course, the views expressed in this article are solely those of the authors and do not necessarily represent the views of any other person or organization.

mitigating its effects, financing the costs that are incurred, and responding to the needs of those affected.

The regulation of insurance and reinsurance companies, among other government policies, has significant implications for the management and financing of catastrophe risk. At present, the risk and costs of catastrophes are borne by many "stakeholders" in different ways through the interaction of the public and private sectors that affect their incentives and the efficiency of catastrophe risk management. This article examines the different regulatory systems and government policies of the United States and the European Union (EU) generally and how they address catastrophe risk financing specifically. The link between the fundamental philosophies and elements of these regulatory systems and their treatment of risk financing is important. Current policies and the prospects for reform depend on the government frameworks in which they reside.

The next two sections of this article review the basic regulatory philosophies and systems in the United States and the EU and how they differ. We then evaluate how regulatory policies in the United States and the EU address catastrophe risk financing and how these policies could be improved. We conclude with a summary of our analysis and a discussion of its implications for catastrophe risk management and the prospects for improving government policies.

SOLVENCY REGULATION IN THE UNITED STATES

Overview

Insurance regulation in the United States is rooted in its historical legacy. The states each retain the principal responsibility for regulating insurance—the federal government has the authority to supersede state regulation when it chooses but it has only done this selectively to date.[1] Principal responsibility for the *financial regulation* of an insurer is delegated to its domiciliary state but the other states still monitor (and can sanction) insurers operating in their jurisdictions. Each state is principally responsible for regulating the *market practices* of all insurers operating in its jurisdiction. The states use the National Association of Insurance Commissioners (NAIC) to coordinate and support their regulatory activities. The states are not compelled to adopt NAIC standards but have tended to do so in the financial regulation; with respect to market regulation the states have acted more independently.

The states apply a *prescriptive* or *rules-based* approach to regulating insurers' financial condition and market practices that is heavily influenced by an *accounting* perspective. This is reflected in a voluminous set of laws, regulations, rules, and other measures that govern insurers' activities and financial structure. Regulators focus on insurers' compliance with these prescriptions rather than the prudence of their management and their overall financial risk. U.S. regulators say that they are seeking to move toward a principles-based approach, but in reality, their policies are lagging far behind the evolution of insurance markets and insurer risk management.

[1] Klein (1995, 2005) provides more comprehensive and detailed reviews of the U.S. insurance regulatory system.

The emphasis on an accounting rather than a financial risk view in U.S. regulation affects insurers' incentives to use catastrophe risk financing devices. Because of the importance of obtaining "accounting credit" for risk transfer arrangements (explained further below), insurers are compelled to consider how these arrangements affect their financial statements in terms of valuing assets and liabilities, calculating losses and income, and estimating their risk exposure. If regulators placed more emphasis on financial risk assessment than accounting values, insurers would have greater incentives to use the most efficient methods and face fewer impediments.

Accounting Standards

Insurers are generally subject to two sets of accounting standards in the United States: (1) statutory accounting principles (SAP) and (2) generally accepted accounting principles (GAAP). SAP rules are determined by state insurance regulators through the NAIC, and insurers are required to file detailed financial statements and other reports in accordance with SAP. GAAP rules are determined by the Financial Accounting Standards Boards (FASB), and insurers are required to follow GAAP in their nonregulatory financial statements and Securities and Exchange Commission (SEC) reports.

Certain aspects of SAP and GAAP are particularly relevant to the regulation of cat risk financing. One such aspect is the "accounting credit" that insurers receive for reinsurance and other forms of risk transfer. "Credit" is obtained when an insurer is allowed to account for the amount of risk transferred by posting an asset or reducing a liability and decreasing estimates of their potential net losses. The resulting accounting values are reflected in the calculation of insurers' surplus and risk-based capital (RBC) requirements, among other financial regulatory measures. Current SAP and GAAP standards tend to take a very narrow view of transactions that qualify as risk transfer.

Capital Standards and Risk Analysis

The states impose two types of capital requirements on insurers.[2] Each state has its own "fixed-minimum" requirement.[3] Insurers are also subject to uniform RBC requirements based on a formula developed by the NAIC that is both complex and flawed.[4] An insurer is required to have capital that meets or exceeds the higher of the

[2] Harrington (2004a, b) addresses the topics of capital adequacy and market discipline involving insurance and reinsurance in the context of U.S. and EU regulatory initiatives and associated issues. Efficient regulation requires an optimal trade-off between the benefits of more stringent and accurate capital standards and the costs of greater regulatory stringency and complexity. These costs arise from distortions of insurers' capital management, compliance, and enforcement. Also, regulators should consider and promote market discipline that can lessen the need for stricter regulation, at least for some industry sectors. These principles are reflected in our evaluation of the U.S. and EU regulatory systems.

[3] The state-fixed minimum requirements are fairly crude and are not adjusted for the size of an insurer or factors associated with its financial risk. Among the states, they range from $500,000 to $6 million, with the median requirement in the area of $2 million (Klein, 2005).

[4] See Cummins, Harrington, and Klein (1995) for an evaluation of the U.S. RBC methodology. Eling and Holzmuller (2008) also compare U.S. RBC standards with capital standards in other countries and discuss some of its deficiencies.

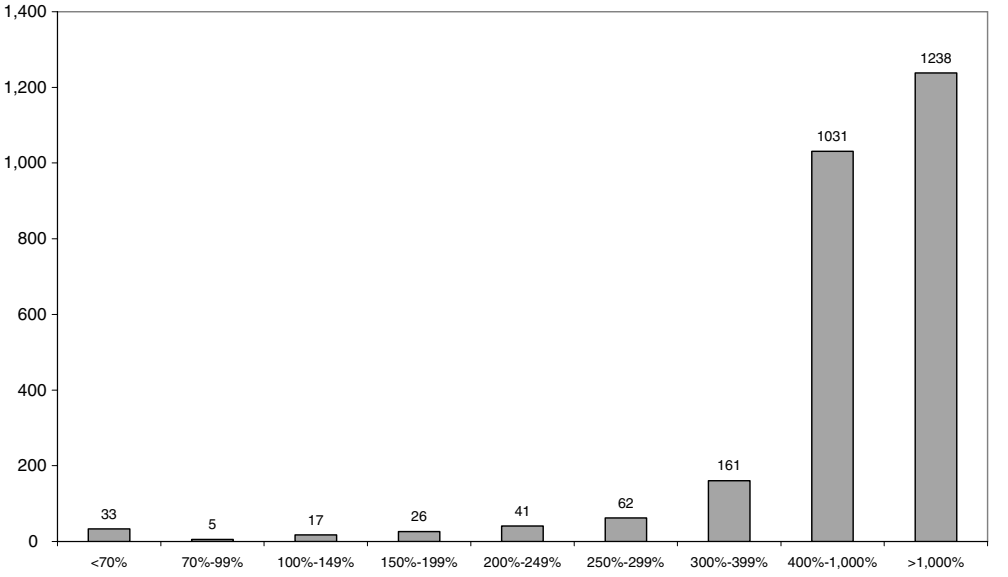
two standards. All of the "charges" used to calculate an insurer's RBC requirement involve the application of selected factors to various accounting values. The charges are summed into several baskets and subjected to a covariance adjustment to reflect the independence of certain risks, using the basic formula shown below:

$$\text{RBC} = 0.5[R0 + \sqrt{R1^2 + R2^2 + R3^2 + R4^2 + R5^2}],$$

where $R0$ is investments in affiliates, $R1$ is fixed income assets (interest rate and credit risk), $R2$ is equity assets ("market value" risk), $R3$ is credit (risk associated with reinsurance recoverables), $R4$ is loss reserves (risk associated with adverse loss development), $R5$ is premiums (risks of underpricing and rapid growth). Currently, the current risk-based capital requirement for U.S. insurers does not consider catastrophe risk explicitly.

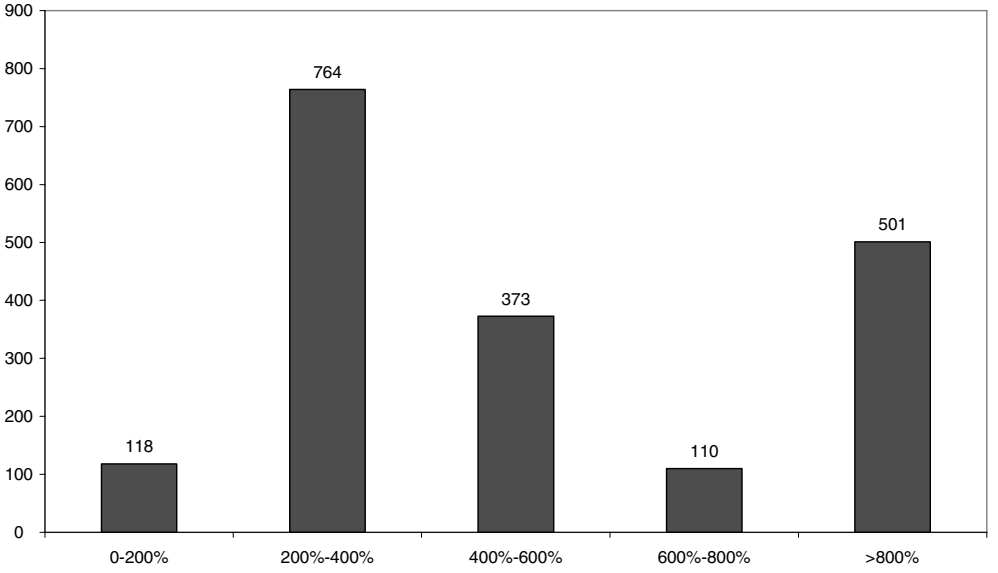
Under the U.S. RBC system, certain company or regulatory actions are authorized or mandated according to the relationship of an insurers' total adjusted capital (TAC) to its RBC requirement. TAC is essentially equal to an insurer's actual surplus with minor adjustments for determining its RBC compliance. Because the U.S. RBC system does not allow a great amount of regulatory discretion, its imperfections and stringency are significant considerations. U.S. regulators have tended to set the RBC bar fairly low to avoid being forced to take actions against insurers that are unwarranted. As reflected in Figure 1, relatively few insurers (3.1 percent) fall below their authorized control level RBC requirement (the 200 percent level) and many of these insurers are already under some form of regulatory supervision. Regulatory RBC requirements are also substantially lower than rating agencies' capital standards. This is reflected

FIGURE 1
Distribution of Property-Casualty Insurers by TAC/RBC, 2006



Source: NAIC Financial Data, authors' calculations.

FIGURE 2
Ratio of TAC/RBC to BCAR: Property-Casualty Insurers 2006



Source: NAIC Financial Data & A.M. Best, authors' calculations.

in Figure 2, which groups insurers into several classes according to the relationship of their TAC/RBC ratio to their Best's Capital Adequacy Ratio (BCAR)—a capital adequacy measure developed by the rating agency A.M. Best. Figure 2 reveals that most property-casualty insurers have TAC/RBC ratios considerably higher than their respective BCARs.[5]

It may be appropriate for rating agencies to have tougher capital standards, but the magnitude of the disparity raises the question of whether regulatory capital standards are sufficiently stringent as well as accurate.[6]

Currently, U.S. property-casualty insurers are not required to perform internal risk modeling or allowed to use it as an optional approach to demonstrate the adequacy of their capital and financial risk management. U.S. regulatory standards also have not yet embraced an enterprise risk management (ERM) perspective in requiring insurers to evaluate the full range of risks they face and their interaction. Consequently, regulators do not provide any incentives for insurers to employ internal risk modeling or ERM. This, in turn, diminishes insurers' regulatory incentives to optimally manage and finance their catastrophe risk. Many insurers, especially larger companies, may have adequate market and internal incentives to manage their risk; the concern lies with insurers that do not have sufficient nonregulatory incentives to do so.

[5] A.M. Best has developed its own BCAR, as other major U.S. rating agencies have developed their own capital standards. In Best's explanation of its system, a BCAR of less than 100% is considered "inadequate."

[6] Rating agencies only issue opinions of insurers' financial strength and capital adequacy, and while important, they do not have explicit regulatory consequences.

Solvency Monitoring, Intervention, and Market Conditions

A comprehensive approach to financial regulation also encompasses solvency monitoring, regulatory intervention, and market conditions that promote solvency and curtail excessive insolvency risk. The United States has a highly developed monitoring framework that is necessitated in part by its relatively low capital requirements. The NAIC has created several tools for financial monitoring, including early warning systems and a set of applications that state regulators can use and customize to analyze an insurer (Klein, 2005). State activities are augmented by additional monitoring and financial analysis performed by the NAIC using the same basic systems and methods. However, these are static "ratio-based" systems and involve no dynamic testing or modeling.[7] Hence, they are inadequate for accurately gauging an insurer's financial risk.

We should also note that each state has two guaranty associations—one for property-liability insurers and the other for life-health insurers—that cover some of the claims obligations of insolvent insurers.[8] These mechanisms provide a welcome safety net for policyholders and claimants, but they can also reduce insurance buyers' incentives to impose market discipline on high-risk insurers (see Cummins, 1988; Lee, Mayers, and Smith, 1997). Consequently, regulatory discipline must compensate for diminished market discipline, which has not always been the case (Grace, Klein, and Phillips, 2002).

Finally, many states still regulate personal auto and homeowners insurance rates as well as other aspects of insurers' market practices. Rate regulation tends to be tighter in states and markets subject to strong cost pressures, for example, home insurance in catastrophe-prone states (Klein, 2007). This practice reduces the supply of insurance and exacerbates "availability" problems in these markets. Consequently, state residual market mechanisms are forced to fill the gap. Also, coastal states have encouraged a number of small insurers to write significant amounts of catastrophe exposures.[9]

SOLVENCY REGULATION IN THE EU

Overview

The roots of the EU were established following World War II and it has continued to evolve and coalesce over the last five decades.[10] The "Treaty on European Union" was signed by member states in 1992 and was quickly followed by initiatives aimed at creating a "single market" and the free movement of goods, services, people, and money. From a jurisdictional standpoint, countries in the EU face some of the same challenges as the states in coordinating and harmonizing their insurance regulatory activities. However, the circumstances are different—the EU is composed of sovereign countries

[7] Cummins, Grace, and Phillips (1999) demonstrate how this can be done in a U.S. context, and the EU is developing a standard model as an element of its Solvency II initiative.

[8] These mechanisms tend to provide more protection for individual buyers and small businesses than large commercial buyers. Hence, market discipline tends to be greater in commercial insurance markets with limited or no insolvency guarantees.

[9] This policy resulted in the insolvency of five insurers in Florida after the 2004–2005 storm seasons, generating more than $750 million guaranty association assessments to date. Rather than correcting this problem, Florida is encouraging more insurers to engage in the same behavior (Klein, 2007).

[10] See http://europa.eu/abc/history/index_en.htm for a history of the EU.

and the EU's authority and influence differs from that of the federal government in the United States. The EU must achieve a consensus among its members in support of its regulatory standards and other policies. At the present time, EU member states are subject to some common, minimum standards (based on the Solvency I EU Directive adopted in 2004) beyond which the majority of jurisdictions are applying their own additional standards.

A principal goal of EU policies has been to facilitate cross-border trade within the EU and make it easier and more efficient for an insurer domiciled in one member country to sell insurance in other member countries, either across borders or through the establishment of branch companies, as well as engage in trade beyond Europe. EU member countries will continue to regulate the insurers domiciled in their respective jurisdictions, but each will do so according to EU policies and standards.

The two most important aspects of the EU's regulatory approach is its guiding philosophy and its program to develop a stronger and more effective approach to insurance regulation, reflected in the Solvency II initiative (see International Actuarial Association, 2004; Trainar, 2006; Eling, Schmeiser, and Schmit, 2007). The EU took a major step when the European Commission published its long-awaited proposal for a Solvency II Directive in July 2007. The proposal articulates a view for a new regulatory framework reflecting the economic substance of insurance, focused on the management of risk, and grounded in risk-sensitive capital requirements. The proposal follows the high-level three-pillar philosophy developed for bank regulation in the Basel II accords, but the proposal has some substantial differences with Basel II as well as innovations (Commission of the European Communities, 2007). The Proposal will need to be adopted by the Ministries of Finance (Ecofin Council) and the European Parliament.

The framework directive will be supported by technical implementing measures that will have the force of law. The new regime is scheduled to be in place and operational in late 2012 or early 2013. This new framework will establish a more advanced and uniform approach to solvency regulation among EU countries, effectively supplanting the different regulatory systems and policies currently employed by different countries. However, a number of issues still need to be resolved in reaching agreement on the technical specifications for Solvency II.

Unlike the United States, many European countries have been moving much more quickly to apply a *principles-based* and prudential approach to insurance regulation. In a prudential system, emphasis is placed on insurers' maintaining an adequate "solvency margin" and the competence and judgment of an insurer's management with an insurer's financial risk being the ultimate point of focus for supervisors. Many EU countries have also more quickly embraced a financial/economic perspective to insurer regulation than their U.S. counterparts. Hence, although Solvency II will advance and harmonize regulatory standards, it is consistent with the regulatory philosophy in many EU countries.

Accounting Standards

The Solvency II directive suggests that EU insurance accounting standards will be broadly compatible with international accounting standards, although it does not indicate how closely EU standards will conform. There are several issues in melding EU accounting standards with international standards. One is that International

Financial Reporting Standards (IFRS) are compulsory only for companies that have to establish consolidated accounts, that is, insurer groups. Hence, IFRS is not compulsory for stand-alone companies. The second problem is that there are currently no International Accounting Standards Board (IASB, 2007) standards for insurance liabilities. Hence, the Solvency II directive has to be further developed without the articulation of what international standards for insurers' reserves will be.

In the international accounting and regulatory community, there are still no final agreements on the exact definition of the fair value of insurance liabilities (which is the sum of the present value of expected payouts plus a market risk margin). Accountants are called in to perform tests of whether a contract carries enough elements of risk transfer to qualify for reinsurance accounting or hedging accounting. One of the key issues is whether a risky liability should be valued within the context of the entity's own portfolio or should be valued with respect to an average third-party "market" portfolio. It appears that the accounting rules that will be finalized will have an impact on insurance-linked securities.

Capital Standards and Risk Analysis

The EU philosophy is reflected in its approach to capital requirements. The current Solvency II initiative for insurance explicitly establishes a two-level capital requirement, specifying a minimum capital requirement (MCR) and a solvency capital requirement (SCR), that utilizes a three-tier approach:

- The MCR represents an absolute regulatory minimum level of capital needed by an insurer. The calculation method for and the calibration of MCR will be set by the legislators.
- The SCR will be the "normal" operating requirement level of capital for an insurer. This capital level may be derived either through a firm's own internal capital model or through a standard model formula set out in the implementing legislation adopted by the EU.

The MCR standard has two components: (1) an absolute minimum (also called the "minimum guarantee fund") and (2) an additional solvency margin. For nonlife insurers, the absolute minimum is equal to 18 percent of the first €50 million of premiums and 16 percent for premiums above that level. The margin component is based on claims—26 percent for the first €35 million and 23 percent for claims above that amount. The MCR factors will only apply during the transition period until Solvency II is implemented. In the long term, the MCR is expected to be within a certain "confidence margin" or a certain fraction (e.g., one-third) of the SCR.

The SCR is the most important contribution of Solvency II. It is intended to be the amount of capital that an insurer needs to remain viable from a business perspective and maintain its default probability (using a value-at-risk approach) below a certain level.[11] If an insurer fails to meet its SCR standard, it does not trigger a set of mandatory actions *per se*, but does require the insurer and its regulatory supervisor to evaluate and correct the deficiency if deemed necessary. In this sense, the SCR

[11] The current proposed directive has set this at a 0.5 percent level.

standard does not carry the prescribed company and regulatory actions embodied in the U.S. RBC standards. At the same time, the SCR standard is based on a much more sophisticated approach to determining an insurer's capital needs than U.S. RBC and is likely to be a more stringent.

The ability of an insurer to use an internal risk model rather than a standard formula to determine its SCR is a significant forward step in insurer solvency regulation. An internal model, properly designed and estimated for a given insurer, should provide a more accurate assessment of an insurer's risk and capital needs and enable it to more efficiently manage that risk. The efficiency of the SCR standard will depend on its stringency and how much discretion insurers will be allowed in meeting it. The design of the standard model and associated rules could have a greater effect on compliance costs, which regulators must carefully weigh against their benefits.

The internal model used by an insurer must be validated and its use monitored and performance periodically checked by its regulatory supervisor. The issue of whether regulators may require certain insurers to use internal modeling is still a matter to be resolved in EU deliberations. Some are concerned that allowing all insurers to opt for either the standard model or an internal model would promote "adverse model shopping."

Insurers that do not use a validated certified internal model must use a standard model that is being developed by supervisors collectively in the EU. The rules that will govern whether an internal model will be strictly optional for all insurers necessarily have implications for the importance of the standard model and how it is designed. In its current stage of development, the structure of the EU formula borrows heavily from a formula developed by the German Insurance Association, although other formulas may also influence what is adopted (see Eling, Schmeiser, and Schmit, 2007).[12] Also, the calibration of the standard model will be determined by the EU. Standard models have their limitations, and there are numerous design and specification issues in developing the best possible model for its intended purposes.

The basic elements of the standard model (formula) and the specific risks they address are summarized in Table 1. The basic elements include underwriting risk, market risk, credit risk, and operational risk. It appears that the EU standard model will have several advantages over the U.S. RBC formula. First, it will use a more sophisticated approach in accounting for diversification effects and the interactions among different risks. Second, the model will allow the use of "undertaking-specific" parameters rather than standard ones applied to all insurers. Third, the model will also include a catastrophe risk component.[13] Hence, it will likely be more "accurate" in measuring risk than its U.S. analog. Whether it will create higher compliance costs for insurers is unclear.

In general, the EU approach embraces a more comprehensive approach to determining whether an insurer has adequate capital and is appropriately managing its overall financial risk. This kind of approach should lead to greater regulatory acceptance and recognition of alternative catastrophe risk financing methods by assessing their

[12] Schubert and GrieBmann (2007) outline the German formula.
[13] See European Commission (2007).

TABLE 1
SCR Risk Categories and Components (Nonlife)

Category	Components
Underwriting risk	Premium, reserve, and catastrophe risks
Market risk	Interest rate, equity, property, spread, currency, and concentration risks
Credit risk	Risk-mitigating schemes, reinsurance, securitization, derivatives, and receivables risks
Operational risk	

ultimate effect on an insurer's financial risk rather than the attributes of a particular method or device in isolation.

Solvency Monitoring, Intervention, and Market Conditions

Solvency monitoring will also be important beyond the capital requirements imposed on insurers (see Eling, Schmeiser, and Schmit, 2007). This is an area that will be subject to further development as the EU process continues. In a principles-based system, solvency monitoring will likely be more "informal" and rely on both qualitative and quantitative analysis. This offers a number of potential advantages relative to the U.S. system. At the same time, the effectiveness of this approach depends heavily on the authority, competence, and diligence of regulators.

As presently contemplated, insurers would be required to demonstrate to supervisors that they have adequate systems and controls in place to manage current and future risks. In addition, the so-called own risk and solvency assessment would require firms to analyze and report to supervisors on how they see their current and future position for all risks, not just for those risks captured by the standard model. This is a significant development and is already in place in the United Kingdom in the form of its Individual Capital Adequacy Standards (ICAS) assessment.

Solvency II also includes considerable supervisory reporting and public disclosure, which is aimed at ensuring that informed market participants will be in a position to evaluate and question various aspects of insurers' operations, for example, an insurer's risk management practices or business plans, and to reward or punish those firms that they believe to be lacking or not engaging in best practices. This promotes the market discipline objective articulated by Harrington (2004a). If EU members embrace this philosophy, it should help to promote efficient and viable markets and insurers and avoid the problems created by excessive market regulation in the United States. We should note that the EU has essentially eliminated the regulation of insurers' rates. However, it would be unrealistic to believe that EU governments are fully insulated from political pressures to artificially lower the cost of insuring catastrophe risk. More favorable treatment of broad risk diversification and alternative forms of catastrophe risk financing could reduce some of this pressure.

Finally, several EU member countries currently have insolvency guaranty mechanisms analogous to insurance guaranty associations in the United States, including the United Kingdom and Germany. However, the matter of "guarantee schemes" has

not been an issue identified for consideration in Solvency II documents.[14] Hence, the future role of insolvency guarantees may be essentially left to each country to determine.

EVALUATION OF U.S. AND EU REGULATION OF CATASTROPHE RISK FINANCING

In terms of its economic implications for an insurer's catastrophe risk, securitization can offer risk transfer benefits similar to a reinsurance contract at a potentially lower cost for higher layers of risk. However, the implications of securitization for an insurer's regulatory capital calculations and regulatory assessments of its financial condition and risk can vary considerably among regulatory systems depending on their standards and policies. Hence, regulatory policies can have significant effects on insurers' ability and incentives to employ alternative risk financing devices.

Markets for alternative forms of cat risk financing appear to be strong and are growing (see Lane and Beckwith, 2007a, b). Lane and Beckwith (2007b) estimate that outstanding securitizations using cat bonds are in excess of $12 billion and industry loss warranties account for another $5–$10 billion. Our purpose, however, is not to divine all of the factors influencing alternative cat risk financing and estimate the effects of regulatory policies on the amount of securitization. Clearly, a number of U.S. and EU insurers have engaged in cat risk securitization with the assistance of or despite their regulatory treatment in their host jurisdictions. Our objective is to examine regulatory policies and comment on their reasonableness and efficiency.

U.S. Regulatory Approaches

Overview. Regulators can influence the use of risk financing mechanisms in several ways. First, they can impose constraints or bar insurers from using certain instruments or create other impediments. Second, regulation can either facilitate or inhibit catastrophe risk financing in terms of the rules governing accounting for and financial reporting of cat risk transactions. Further and very importantly, there is the question of whether an insurer's use of catastrophe risk financing is considered in regulatory assessments of its capital adequacy and financial risk that would tend to "boost" insurers' motivation to use efficient risk financing devices. Finally, other regulatory/government policies, such as the regulation of insurers' rates and market practices, the creation of government insurers/reinsurers, and tax rules, also influence the economic viability of these catastrophe financing instruments. Certain government actions, such as the creation of public insurance/reinsurance mechanisms, can reduce the demand for private risk financing.

Surplus and Catastrophe Reserves. Holding additional surplus to handle catastrophe losses has served as a conventional catastrophe risk financing mechanism and is an insurer's first layer of protection—any catastrophe losses it retains essentially must come out of surplus and special catastrophe reserves if allowed. U.S. regulators do not discourage this practice, but government policies have made this a more

[14] For more information on this topic, see the Organisation for Economic Co-operation and Development (2002).

costly technique than it would need to be. First, insurers are generally compelled to keep catastrophe funds in their general surplus account, which makes it subject to depletions arising from other contingencies. Second, regulators may treat "extra surplus" as something that would justify greater restrictions on an insurer's prices. A third problem is that additions to surplus are taxed as income and the investment earnings on this surplus are also taxed that retards its accumulation (this is determined at the federal level).[15] Under U.S. SAP and GAAP accounting rules, there is no provision for catastrophe reserves, that is, reserves for future losses.

The idea of allowing insurers to set up tax-favored "catastrophe reserves" has been endorsed by insurers and state regulators, but the necessary accounting and tax provisions to facilitate such reserves have not been enacted (Davidson, 1996; Harrington and Niehaus, 2001). In concept, an insurer would be allowed to contribute up to a certain amount of its income every year to a reserve intended to fund future catastrophe losses—the reserve would be reported as a liability in an insurer's financial statement. It is also presumed that contributions to the reserve and investment earnings associated with the reserve would not be taxed. Accounting and tax rules would govern contributions to and withdrawals from the reserve. Such a provision for catastrophe reserves would allow insurers to more readily set aside and accumulate additional funds to cover retained catastrophe losses.

The primary barrier to catastrophe reserves appears to be the federal government, which has been cool to the idea because of concerns that such reserves would be manipulated to reduce the tax liability of an insurer. This contrasts with tax policies in EU countries that typically allow insurers to deduct contributions to and investment earnings on catastrophe reserves from their income in determining their tax liability (U.S. General Accountability Office, 2005). Giving favorable tax treatment to catastrophe reserves would reduce federal tax revenues and does present some challenges in crafting rules that would prevent their abuse. Further, tax-favored catastrophe reserves alone will not satisfy those who have concerns about the supply of cat risk financing.

The NAIC has also been working on adding a catastrophe risk component to its RBC requirement. The current formula only reflects catastrophe risk to a limited degree to the extent that "underwriting risk" charges (reflected in the R5 component) are based on 10 years of historical experience.[16] The NAIC P-C RCB Working Group has recommended that a catastrophe risk charge be added to current RBC formula. Initial regulatory proposals contemplated a cat risk charge equal to the "one-in-250-year level" of expected annual losses (net of reinsurance) generated by an approved catastrophe risk model. The creation of an RBC catastrophe risk charge could be associated with accounting provisions to enable insurers to establish catastrophe reserves. However, such an approach has generated a number of concerns among insurers and industry actuaries.[17] Given the issues associated with an RCB cat risk

[15] Harrington and Niehaus (2003) estimated that the tax cost of holding additional capital to cover catastrophe losses could exceed 100 percent of the "expected cost of claims" at higher layers of an insurer's catastrophe risk exposure.

[16] Insurers with higher loss ratios during the previous 10 years have a higher factor applied to their premiums to determine the amount of the R5 charge.

[17] Industry comments suggest that the EU approach would be more acceptable.

charge and the lack of consensus, the prospects for catastrophe risk assessment in the United States are uncertain.

U.S. rating agencies are strengthening their assessments of insurers' capital requirements with respect to their catastrophe risk exposures, primarily due to the increased risk of hurricane losses (A.M. Best, 2006).[18] These strengthened requirements are set within a context of the agencies' more extensive analysis of insurers' catastrophe risk exposure and management than that performed by regulators. These changes, combined with other initiatives discussed earlier, are increasing insurers' motivation to utilize conventional and alternative catastrophe risk financing measures.[19]

Reinsurance. Reinsurance continues to be the primary vehicle used by insurers to diversify their catastrophe risk. The primary issue in the United States has been the disparate treatment of domestic versus foreign reinsurers. Insurers are allowed "full credit" for contracts placed with reinsurers domiciled and regulated in the United States and some "approved" foreign insurers that deposit funds in U.S. financial institutions according to regulatory collateral requirements. These rules require foreign reinsurers to provide collateral equal to their gross liabilities to ceding U.S. insurers.

This policy affects insurers' accounts and reported income in several ways. First, insurers are not allowed to subtract premiums ceded to unauthorized insurers in calculating their net premiums, which is used as a proxy measure of their potential future liabilities and risk. Second, insurers are not allowed to count recoverables from unauthorized reinsurers as an asset except to the extent that ceding insurers hold or have access to collateral deposited by the reinsurers. U.S. insurers are only allowed to value reinsurance recoverables up to the amount of collateral provided. All other things equal, this has the effect of increasing insurers' net losses incurred and decreasing their income, assets, and surplus. This would be the case for all types of reinsurance contracts. Of all the U.S. regulatory policies, its treatment of foreign reinsurance may be having the most adverse effects on the cost and extent of cat risk financing.

Cummins (2007) strongly criticizes the U.S. policy as being antiquated, unnecessary, and inefficient. He argues that insurers have access to information and diversification measures to manage the counterparty risk associated with reinsurance contracts—resources that were not available in the 1940s and 1950s when the U.S. rules were established. Cummins cites three major sources of inefficiencies associated with U.S. collateralization requirements: (1) collateralization is expensive for foreign reinsurers, (2) the requirements reduce the supply of reinsurance for U.S. insurers, and (3) collateralization reduces incentives for U.S. reinsurers to assess the credit quality

[18] See also Casualty Actuarial Society (2006).

[19] It is our impression that this "strengthening" is focusing on revised models of insurers' catastrophe risk exposure rather than changing the associated minimum PMLs that have been set at 100-year events for hurricanes and 250-year events for earthquakes. We should also note that U.S. regulators are voicing increasing complaints about the rating agency standards because they are affecting insurers' rates and decisions to reduce their catastrophe exposures.

of foreign reinsurers. Cummins also notes that the U.S. requirements are inconsistent with global insurance/reinsurance markets and are directly opposed to the EU reinsurance directive that effectively abolishes collateralization.[20]

Although U.S. reinsurance policy has not caused U.S. insurers to avoid contracts with "nonapproved" foreign reinsurers, it is likely to have had some chilling effect on the demand for such contracts. U.S. insurers and foreign reinsurers have continued to push U.S. regulators to adopt a more reasonable, "merit-based" policy. The most recent proposal from the NAIC would establish a rating system for foreign reinsurers and their collateral requirements would vary with their ratings. Cummins argues that even this proposed approach would be a "second-best" solution that is overly bureaucratic, insufficient, and less preferred to eliminating collateral requirements for all reinsurers, except for those in default. We should note that Congress is considering legislation that would preempt state reinsurance collateral requirements.

Catastrophe Options and Swaps. As noted in Klein and Wang (2007), attempts to establish markets for catastrophe put options for natural disasters have not proved to be successful in the past, but there are recent efforts to reestablish viable options markets. The New York Mercantile Exchange and the Chicago Mercantile Exchange have recently created mechanisms for the trading of cat futures and options. U.S. regulators allow insurers to use options for risk hedging purposes, but there are no provisions for valuing such transactions in financial reporting prior to their triggering, and the secondary importance of financial risk assessment among U.S. regulators further diminishes insurers' incentives to use such devices. Presumably, if a catastrophe option was triggered, an insurer could report its expected payoff as an asset, pending the receipt of a cash payment. Of course, this is a hypothetical discussion as no U.S. insurer has purchased a catastrophe option that has been triggered to date.

Another problem is that U.S. regulators tend to take a dim view of insurers taking the "risk assumption" side of such options—at least anything that would constitute more than a very small fraction of their investments. Admittedly, insurers would not provide the lion's share of the capital for such instruments but some may be in position to play a bigger role than they currently do. Insurers' familiarity with catastrophe risks and their varying levels of catastrophe exposures suggest that at least some may be in a good position to take a speculative position that would not unduly increase their financial risk. It would offer insurers without primary catastrophe exposures to undertake some catastrophe risk at a profit. Also, insurers with catastrophe exposures in one part of the country could hedge that risk and assume catastrophe risk in other regions as an alternative form of geographic diversification that would involve lower transactions costs. Unfortunately, the current U.S. regulatory system does not appear to be equipped to evaluate insurers' positions in catastrophe options or assess their overall impact on their financial risk.

Regulators have allowed insurers to engage in catastrophe swaps, albeit without associated financial accounting provisions or recognition of its favorable impact on their

[20] See European Parliament (2005) and Evans (2007).

financial risk. As with a catastrophe option, we presume that if an insurer ultimately experienced losses that created an expected payoff from a catastrophe swap, it would be allowed to book the payoff as an asset pending receipt of a cash payment. There are no publicly available data on the level of swap activity in insurance markets, but there are anecdotal reports that they play a significant role for international reinsurers. More favorable regulatory treatment in the United States would increase U.S. insurers' incentives to use swaps when their underlying attributes would make them economically desirable.

Catastrophe Bonds

Regulatory and Tax Treatment. Historically, U.S. regulators had made "onshore" issuances of catastrophe bonds difficult because of the lack of an accepted regulatory framework that would govern and provide insurers accounting credit for such transactions, as well as permit favorable tax treatment.[21] Starting in the late 1990s, a number of U.S. insurers and some reinsurers sought to make the use of onshore cat bonds easier under an acceptable and uniform set of rules and favorable federal tax treatment.[22] Due to these efforts, in 1999, the NAIC adopted a model act for a protected cell and in 2001 it adopted a model act for a special purpose reinsurance vehicle (SPRV) to facilitate "onshore" or U.S.-regulated issuances of cat bond or other catastrophe securities. From a statutory accounting perspective, cat bond transactions using U.S.-regulated entities (i.e., protected cells or onshore SPRVs) would be treated essentially like reinsurance transactions with U.S. reinsurers.

SAP accounting rules have been developed for protected cell securitizations.[23] These rules allow insurers to reduce their written and earned premiums by the amount paid to the protected cell to underwrite the risk that has been securitized. Hence, for accounting purposes, these payments would be treated like premiums ceded in authorized reinsurance transactions, which would reduce an insurer's net premiums as a proxy measure for its potential liabilities. Further, any "recoverables" from the protected cell as the result of an indemnity-based securitized event are recognized as a reduction of the insurer's gross incurred losses and loss adjustment expense incurred. Consequently, securitizations through a protected cell would be treated in a manner very similar to conventional authorized reinsurance transactions. Unfortunately, despite favorable regulatory accounting treatment of onshore securitizations, unfavorable tax treatment and other factors have discouraged the use of these onshore vehicles—to our knowledge there have been no onshore securitizations since these models were adopted.

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[21] "Onshore" securitization refers to transactions that would be accomplished through a U.S.-regulated entity or mechanism. "Offshore" securitizations refer to transactions that are conducted using non-U.S. entities or mechanisms.

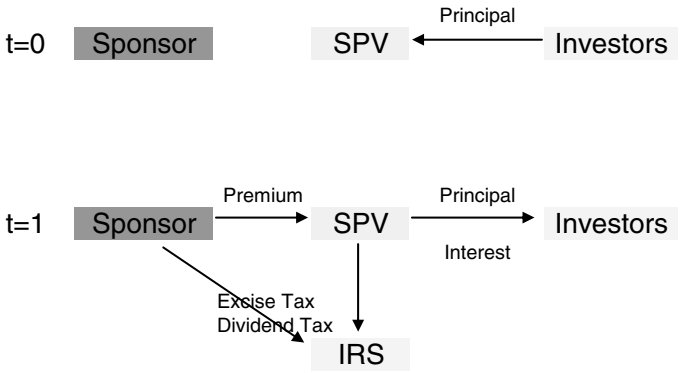
[22] While offshore SPRVs were readily available, promoters of onshore SPRVs contended that they would be advantageous to some insurers and perhaps viewed more favorably by regulators and other stakeholders in an insurer.

[23] See NAIC, "Statement of Statutory Accounting Principles No. 74: Accounting for the Issuance of Insurance Linked Securities Issued by a Property and Casualty Insurers through a Protected Cell," January 1, 2001.

Interestingly, many U.S. insurers issuing cat bonds through offshore SPRVs have the trust funds associated with these instruments held their deposits in U.S.-certified institutions. This effectively provides the collateral required for the "reinsurer" (i.e., the SPRV) to be treated as authorized under U.S. regulations without the SPRV actually being located and regulated in the United States. Consequently, regulatory accounting rules have not been an issue for U.S. insurers that have issued cat bonds through offshore vehicles.

Hence, the principal inhibitor to onshore SPRVs appears to be their tax treatment. This factor, combined with the regulatory requirements for these entities, may help to explain why no onshore securitizations have occurred.[24] Currently, profits earned by offshore reinsurer affiliates of U.S. insurers are not taxed in the calculation of the consolidated profits of U.S. insurers.[25] However, premiums paid to an offshore reinsurer (affiliated or not) are subject to an excise tax based on the gross premiums paid "regardless of the eventual outcome of the coverage." Offshore SPRVs also have much lighter regulatory burdens and the transactions can be completed more quickly. The boom of SPRV facilities in Bermuda and the Cayman Islands has promoted the establishment of specialized law firms and professional services for such facilities.

Illustration of Taxation for Onshore Versus Offshore Securitizations. Below we illustrate the tax implications of an onshore versus an offshore cat bond issuance using a hypothetical example.[26] All assumptions used in this example are based on discussions with experts knowledgeable of cat bond issuances. There are three parties involved in the cat bond: the sponsor, investors, and the issuer (SPV).



In our illustrative example, we assume that the cat bond has a $200 million face value covering U.S. hurricane losses and there is a 1 percent probability of loss to the cat bond. The cat bond has a 1-year maturity and offers investors a 9 percent yield (i.e., a 4 percent yield spread over the 5 percent London Interbank Offered Rate [LIBOR] rate). At time $t = 0$, investors contribute $200 million in principal to the SPV trust

[24] Cummins (2008) observes that the NAIC Model Act still imposes a number of regulatory hurdles in forming and using onshore SPRVs.

[25] The tax treatment of offshore reinsurance (and by implication offshore SPRVs) has attracted the attention of the IRS and Congress at the urging of U.S. reinsurers.

[26] We thank Mike Remmes and Mark Cavanaugh for their advice that helped us in developing this tax illustration. However, any omissions remain the responsibility of the authors.

TABLE 2
An Illustration of Tax Treatment for Onshore Cat Bond

Cat bond details	
Exposure covered	U.S. wind
Cat bond face amount	$200,000,00
Probability of loss	0.01
Maturity (year)	1
LIBOR (trust fund growth rate)	5%
Yield spread over LIBOR	4%
Trust fund	
Fund level at $t = 0$	$200,000,000
Interest income on the trust fund	$10,000,000
Sponsor pays premium at $t = 1$	$8,000,000
Excise tax (none)	–
Total trust fund at $t = 1$ (before payment to investors)	$218,000,000
Trust fund at time $t = 1$ required to pay investors	$218,000,000
Total trust fund at $t = 1$ (after payment to investors)	–
Assume there is no loss to the cat bond	
SPV facility tax liability	
Portion of trust fund treated as equity for U.S. tax purposes	20%
Amount of trust fund treated as equity for U.S. tax purposes	$40,000,000
Total gross income of the issuer	$18,000,000
Interest cost reduction	$14,400,000
Total taxable income of the issuer	$3,600,000
Corporate tax rate	35%
Issuer tax liability	$1,260,000
Additional contribution needed from sponsor at $t = 1$ to pay tax	$1,260,000
Trust fund at $t = 1$ after additional sponsor contribution	–
Total cost to the sponsor	*$9,260,000*

Source: Authors' calculations.

fund, which will grow at the LIBOR rate of 5 percent per annum.[27] We first consider the case of a U.S. domestic onshore SPV facility (see Table 2). We assume that there is no loss to the cat bond over the year. At $t = 1$, the sponsor contributes the 4 percent yield spread to the SPV trust fund and the SPV pays investors the full principal and 9 percent interest.

According to IRS rules, part of the SPV trust fund must be treated as equity. The IRS rationale is that "equity investments" are more likely to suffer a loss than "debt." The more remote is the likelihood of loss to the cat bond, the larger the portion of the trust fund that is treated as debt. To minimize the portion of "equity" treatment, it is common for the issuer to divide the cat bond into a series of tranches so that the higher rated tranches can be qualified mostly as debt.

For the cat bond in this illustrative example, a simple rule of thumb used by tax professionals is that 20 percent of the trust fund is treated as equity and the other 80 percent of trust fund is treated as debt. Over the course of 1 year, the initial

[27] The sponsor does not contribute to the trust fund at time $t = 0$.

TABLE 3
An Illustration of Tax Treatment for Offshore Cat Bond

Cat bond details	
Exposure covered	U.S. wind
Cat bond face amount	$200,000,000
Probability of loss	0.01
Maturity (year)	1
LIBOR (trust fund growth rate)	5%
Yield spread over LIBOR	4%
Trust fund	
Fund level at $t = 0$	$200,000,000
Interest income on the trust fund	$10,000,000
Sponsor pays premium at $t = 1$	$8,000,000
Excise tax (1%)	$80,000
Total trust fund at $t = 1$ (before payment to investors)	$218,000,000
Trust fund at time $t = 1$ required to pay investors	$218,000,000
Total trust fund at $t = 1$ (after payment to investors)	–
Assume there is no loss to the cat bond	
SPV facility tax liability	
Portion of trust fund treated as equity for U.S. tax purposes	0%
Amount of trust fund treated as equity for U.S. tax purposes	–
Total gross income of the issuer	$18,000,000
Interest cost reduction	$18,000,000
Total taxable income of the issuer	–
Corporate tax rate	35%
Issuer tax liability	–
Additional contribution needed from sponsor at $t = 1$ to pay tax	–
Trust fund at $t = 1$ after additional sponsor contribution	–
Total cost to the sponsor	*$8,080,000*

Source: Authors' calculations.

$200 million SPV trust fund receives a total of $18 million in income (reflecting the total 9 percent yield). With 20 percent of the SPV trust fund being treated as equity, $3.6 million (20 percent of $18 million) of income is subject to corporate taxation. At a corporate tax rate of 35 percent, the tax on $3.6 million income is $1,260,000, which has to be covered by the sponsor. Thus, the total cost to the sponsor has increased from $8,000,000 to $9,260,000.

Now consider the case of an offshore SPV facility (as shown in Table 3). There is no corporate tax liability incurred by the SPV. For an offshore SPV facility, in most cases, there is no flow-through income to the cat bond issuer. The facility is not owned or controlled by the sponsor; instead, the trust fund owns the offshore facility and has its own board of directors. However, the U.S. sponsor will need to pay a 1 percent excise tax to the IRS. The total cost to the sponsor will be $8,080,000 ($8,000,000 and the 1 percent excise tax). When we compare the total cost to the sponsor, the onshore SPV would incur a total tax liability of $9,260,000, which is 14.6 percent more than the tax liability $8,080,000 for an offshore SPV.

TABLE 4
Summary of Tax Rates for Cat Bond Investors

Investor Type	U.S. Onshore Issuer	Offshore Issuer
U.S. domestic taxable investor	35% tax on interest income; 10.5% tax rate on dividend	35% tax rate on both interest income and dividend
U.S. domestic tax-exempt investor	0	0
Foreign investor	No U.S. tax on debt interest due to portfolio interest exemption; however, it will likely be subject to tax on equity dividend (5–30%)	Not subject to U.S. tax

Source: Discussions with securitization experts.

For U.S. corporate investors, investing in an onshore SPV would have some tax advantages due to dividend deductions on the equity portion of the SPV. However, for tax-exempt investors (such as pension funds), there is no difference between an onshore and an offshore SPV.[28] Given the diversity of investors with different tax situations, we focus our comparison on the tax liability of the sponsor, rather than investors. In Table 4, we summarize the different tax rates for domestic versus foreign investors and for onshore versus offshore SPVs. In our illustration we assume that investors are U.S. domestic taxable corporations.

It is possible that regulatory treatment of alternative triggers for catastrophe instruments may or will have a greater impact on cat risk securitization and the devices used. It appears that securitizations that effectively replicate indemnity-based reinsurance arrangements (that also meet other regulatory requirements) are recognized by regulators. It does not appear that cat bonds or other instruments using nonindemnity triggers would be recognized by regulators. This may be a minor issue at present if insurers and reinsurers have a strong preference for instruments that utilize indemnity triggers. However, this could become a problem if other factors change and there is greater interest in alternative instruments. Further, it should be noted that a significant proportion of cat bonds in the global market are not indemnity based (Lane and Beckwith, 2007a).

Regulation and Government Insurance/Reinsurance Programs. In the United States, many aspects of primary insurers' market activities related to the underwriting, financing, and management of catastrophe risk are regulated by the states. Various government insurance/reinsurance schemes further undermine private risk financing. A detailed treatment of these policies and their implications are beyond the scope of this article, but some comments are warranted.

[28] According to Cummins (2008), cat bonds are presently being treated by many U.S. taxpayers who invest in the bonds as passive foreign investment companies (PFICs). Accordingly, income from CAT bonds is currently being included in taxable income as dividends rather than interest. It is possible that some foreign investors are treating bond income as interest. We do not attempt to resolve the question of how bond income is defined for investors (our focus is on the tax liability for sponsors) and we summarize tax rates in Table 4 for both dividend and interest payments for different groups of investors.

The severity of regulatory constraints in a given state tends to vary directly with the severity or cost of catastrophe risk. All Atlantic coast and Gulf coast states have experienced significant rate increases and insurer retrenchment following the 2004–2005 storm seasons, with the greatest market pressure in Florida. Florida has placed tight constraints on insurers' rates and has moved a substantial portion of catastrophe risk to state government mechanisms. Such actions have been less severe in other coastal states that face less market pressure (Klein, 2007).[29] The objective of these kinds of regulatory actions is to significantly lower the price and increase the availability of insurance for property owners in high-risk areas. Unfortunately, these measures also tend to discourage and crowd out private financing of catastrophe risk and spread the burden of funding catastrophe losses to all insurance consumers and taxpayers within a state.

Catastrophe-prone states and groups with interests in lowering the price of insurance are also pushing the establishment of a federal catastrophe reinsurance fund.[30] Some large writers of property insurance also support this proposal, but many other insurers and reinsurers oppose it. The most prominent overall plan has three elements:

1. The establishment of state/regional catastrophe funds would cover lower layers of risks.
2. A national (federal) backstop mechanism would provide reinsurance for higher layers of risk above that covered by state/regional funds (and private reinsurance).
3. Various provisions for education, financial assistance, and other measures to mitigate catastrophe risk and improve disaster recovery.

Other proposed national catastrophe insurance/reinsurance plans with differing characteristics have been placed on the legislative table. The different plans and the varying opinions on their merits will likely continue to generate considerable debate and preclude any action in the near term.

These proposals would be on top of the U.S. National Flood Insurance Program (NFIP), a federal entity that covers residential and commercial property up to certain limits. The NFIP has been plagued by inadequate rates and lax underwriting, which has required large bailouts from federal taxpayers. These bailouts will likely increase as flood losses associated with hurricanes and other storms continue to rise.

Finally, there is the problem associated with the demand for large amounts of federal disaster aid following catastrophes because of the lack of pre-event insurance and other financing by those affected. Government insurance/reinsurance schemes are often sold with the fiction that they will reduce the amount of federal disaster

[29] Several areas of the United States also face significant catastrophe risk from earthquakes. California has especially struggled with maintaining the supply of earthquake insurance and established a government earthquake insurance program—the California Earthquake Authority—to shore up that supply. Unfortunately, the purchase of earthquake insurance in the state has plunged from 30 percent in 1994 to 14 percent currently, according to Insurance Information Institute (2008) estimates.

[30] See Watkins et al. (2007) for one evaluation of a national catastrophe program that concludes that it could produce significant costs savings for insureds. It is important to stress that there are different views on the merits of such a plan and experts that might take issue with the conclusions of the cited study.

aid. Hurricane Katrina resulted in more than $100 billion disaster aid payments to affected areas.[31] However, the unfortunate reality is that increased subsidization of government insurance has been accompanied by rising amounts of disaster aid, that is, the worst of all possible worlds. A recent working article by Cummins, Suher, and Zanjani (2007) conservatively estimates that the net present value of the federal government's liability for disaster aid for natural catastrophes (over a 75-year period) is between $1.2 and $7.1 trillion.

In sum, the current U.S. government posture toward catastrophe risk and its financing is a growing disaster in itself. There is essentially little support for and encouragement of conventional or alternative private catastrophe risk financing. Further, state regulatory policies and management of special catastrophe funds as well as residual market mechanisms further depress the demand for and supply of private capital and have increased government underwriting of catastrophe risk at inadequate prices. The proposal for a national cat fund would likely exacerbate the underpricing of insurance and government absorption of catastrophe risk. Together, these policies and proposals are moving in the wrong direction—they are discouraging efficient risk management by property owners and other stakeholders.

EU Regulatory Approaches

Overview. EU regulatory treatment of catastrophe risk and its financing, particularly in the context of Solvency II, has not yet been fully specified. This lack of specificity is, in part, due to its principles-based approach that tends to shy away from setting detailed rules that would establish regulatory treatment of a particular risk financing device *ex ante*. Another factor is that Solvency II is still taking shape and some of its more detailed elements have not been developed. Ultimately, the treatment of cat risk financing devices will unfold as various transactions are reviewed by regulators. Despite these generalities and uncertainties, it is possible to discuss certain established or likely regulatory policies and speculate on others that will affect catastrophe risk financing.[32]

Securitization and Cat Bonds. Although risk transfer through securitization has not yet received extensive policy development, the issue has received attention. For example, the EU reinsurance directive allows member states to permit the establishment of special purpose vehicles (Evans, 2007). The EU reinsurance directive recognizes that an SPV can "assume risks from insurance or reinsurance undertakings and which fully funds its exposure to such risks through the proceeds of a debt issuance or some other financing mechanism where the repayment rights of the providers of such debt or other financing mechanism are subordinated to the reinsurance obligations of such a vehicle." This will also be possible under Solvency II. Further, the movement to a risk-sensitive solvency system across the EU that recognizes economic reality should mean that firms will have even a greater motivation to securitize risk, use SPVs, and purchase reinsurance by receiving appropriate credit for it. It should be noted that

[31] It should be noted that a large portion of disaster aid payments to local and state governments to assist them in repairing damages to their infrastructure, but anticipation of these payments discourages government entities to insure or set aside funds to cover natural disasters.

[32] See Butt (2007) and De Mey (2007) for further discussion of the implications of Solvency II for insurer risk financing and their use of capital markets.

the Solvency II directive will consider all risk mitigation schemes without limits and collateralization obligations but will include credit risk. Hence, the directive could be viewed as more "liberal" than the reinsurance directive that could still allow national constraints.

Although the directive tends to provide insurers with greater flexibility and greater recognition of alternative risk transfer, greater specification of EU policies will likely take several steps. After the most recent Solvency II directive distribution and approval, further development will occur in terms of calibration, implementation measures, and the actual enforcement of the new standards by EU regulators. Finally, some discretion will be left to EU members in terms of specific regulatory requirements governing SPVs and cat bonds.

Some clues as to how EU policies will be further developed might be gleaned from the positions taken by its members. For example, in the United Kingdom, the Financial Services Authority (FSA) has specified the regulatory treatment of securitization as part of its national implementation of the reinsurance directive. Currently, an insurance special purpose vehicle (ISPV) in the United Kingdom would be treated the same way as reinsurance in terms of recognizing its risk transfer, although an ISPV would not be regulated like a reinsurer. An ISPV must be authorized, supervised, and taxed, and maintain a regulatory capital surplus level as would be required of an insurance company. At the same time, the FSA recognizes that there is a relatively lower level of risk associated with the structure of ISPV transactions than certain other securitization transactions.

FSA supervision will take place through the oversight of the ceding company rather than through separate supervision of the ISPV. In a speech in late 2006, the FSA regulator Adam (2006) stated:

> It is often said that reinsurance is insurance between consenting adults, and we believe that our approach to ISPVs is an extension of this general principle. By placing the onus for risk identification and mitigation on firms' senior management, and deliberately not prescribing in advance structures that we will and will not accept, we hope to encourage innovation in the market, and we believe that we are creating the opportunity for a significant new market here in the UK.

The FSA will examine to what extent risks are mitigated or transferred from the ceding company to the ISPV. This reflects a principles-based approach that will assess ISPV arrangements on a case-by-case basis and the appropriate credit will depend on how risks are managed. This approach is based on the FSA principle of senior management responsibility.

The FSA is concerned that some ISPVs might be established merely to achieve a form of regulatory arbitrage. For all ISPV transactions, the FSA will assess whether there is sufficient and genuine risk transfer. The FSA is conscious that for intragroup ISPVs, risk transfer may not be the only driver—achieving a particular tax outcome or a desired corporate structure may be other factors behind the transactions. For such intragroup ISPVs, the FSA will look at how the proposed risk transfer takes effect at

both an entity and a group level. Although the assessment of risk transfer will need some risk modeling demonstration associated with coverage attachments and limits, there are other important considerations. These considerations include whether the ISPV contracts specify forced commutation clauses and whether ISPV transactions are unwound in exactly the same way as established in the contract.

For an ISPV, like a reinsurance contract and over-the-counter derivatives, the specific contract terms are fundamentally important for assessing whether there is a real risk transfer. In addition to coverage limits, it is important to determine how triggers will function in stressed circumstances and how the indemnity coverage will operate in response to differing events. The precise nature of the contracts involved will influence what we will see and this is another rationale for the FSA's nonprescriptive, case-by-case approach. However, a case-by-case approach, at least early on, could create some uncertainty among insurers as to how a specific transaction will be treated by regulators. Over time, the precedents set in terms of the regulatory treatment of past transactions may provide greater guidance to insurers as to what they might expect in terms of future transactions.

France offers another example of an EU country that has established policies on the issuance of cat bonds. Based on communications with French industry experts, it is our understanding that cat bonds can cover risks either through a derivative mechanism or through a reinsurance contract between the SPV and the reinsured. If a French insurer uses the reinsurance approach, the legal structure of the SPV and the reinsurance contract with the SPV must be recognized under French law.

The adoption of the EU directive will establish the principles for the SPV in French law, but its supervisory authority will still be responsible for determining certain regulatory standards for SPVs. For example, in France, it is not yet clear how the French supervisory authority will treat SPVs and their insurance-linked securities, particularly concerning their solvency requirements. Further, for a cat bond issued through an SPV to be accepted as reinsurance, the arrangement must be "indemnity based." This can raise issues with respect to cat bonds with parametric or other triggers not based solely on the issuing insurer's actual losses. The concern arises with bonds that would pay an insurer more than its actual losses. This may require greater use of "ultimate net loss" clauses that limit the payment to the issuing insurer to no more than its actual losses.

Capital Standards and Catastrophe Risk. The discussion of capital standards in the proposed Solvency II directive does contain some elements related to catastrophe risk that will undergo further development in the next stage of the Solvency II process. The directive states that the SCR should contain a catastrophe risk component. The directive also appears to indicate that the use of various "loss-absorbing" instruments will be considered in determining an insurer's SCR and whether it meets this requirement. The specification of these provisions, of course, will occur in the further delineation of Solvency II policies and their implementation. We should note that the proposed directive sets a 0.5 percent default probability (equivalent to a one-in-200-year probable maximum loss) as the standard or goal in determining an insurer's SCR.

Harmonization of the Treatment of Hybrid Capital and Securitization. Banks and insurance companies have shown substantial interest in the broader hybrid category

(including securitization), which can count toward their capital-reserve requirements with minimal damage to their credit ratings or equity base. This kind of debt or equity financing boosts the financial capacity of an insurer in a manner that significantly subordinates the claims of these lenders and equity investors to other claims against a bank or insurer. Currently, EU regulatory treatment of contingent capital is still evolving.[33] Indeed, the EU is undergoing a process of consultations with the industry and member states with the main goal of harmonization across sectors and member states. The recent Solvency II directive should provide further insights as to how alternative risk financing will be treated, but hopefully experience as well as further articulation of policies in this area will provide additional guidance to insurers.

In the current Solvency II initiative, there has been a debate as to how to count certain types of loan capital in determining regulatory solvency capital. Certain types of loan capital have the characteristics of equity and have the capacity to absorb losses, which are commonly referred to as deeply subordinated debt (DSD) and are not currently covered by any EU directive. The directive fully recognized subordinated debt in Tiers 1–3. Discussion has ceased on this policy and only the limits for Tier 1 remain a matter of contention. Some EU states (e.g., France) argue that DSDs are adequate for solvency purposes and should be counted toward part of the Tier 1 capital.

Although Solvency II has not made any new rules on the treatment of hybrid capital, one development seems to be clear—regulators are moving toward a principles-based approach. The principles-based approach can facilitate greater harmony and improvement. This should be beneficial to insurers' and reinsurers' use of alternative methods to financing catastrophe risk as well as other types of financial/underwriting risk.

In a letter submitted by the European Securitization Forum (ESF) to the CEIOPS regarding securitization and Solvency II, the ESF recommends that securitization, reinsurance, and credit derivatives be treated in a similar way from a capital relief perspective, irrespective of the legal form of transfer. The ESF contends that this will help harmonize regulatory treatment across different financial sectors.

Some insurers believe that one of the greatest benefits that Solvency II could offer would be greater clarity that would allow them to establish structures more easily and a framework for buyers to work within. This could allow additional countries to enter the securitization market, which has been dominated by the United Kingdom and the Netherlands, and further increase the supply of such instruments (see Watson, 2007).

As a final observation, it is important to stress that under the EU system, the specific accounting treatment of risk financing devices is not as critical as it is under the

[33] Note that catastrophe risk financing devices, broadly defined, may or may not involve risk transfer. There are some potential financing mechanisms such as finite risk/reinsurance arrangements and letters of credit that provide liquidity to an insurer suffering a catastrophe loss shock but ultimately provide little or no risk transfer—funds obtained must ultimately be paid back. The issues for regulators are proper disclosure and transparency and the long-term implications of how much risk is actually transferred versus just purely financed under favorable terms.

U.S. system. In the U.S. system, accounting treatment is important because it significantly affects all aspects of the financial assessment of insurers and directly affects the U.S. formula-based approach to measuring capital adequacy. In the EU system, accounting values are not the only input in the modeling approach to determining the SCR component. In other words, in determining whether an insurer meets its SCR requirement, whether a particular instrument is reflected in an insurer's capital or alternatively determined to reduce the potential demands on an insurer's capital, the ultimate effect is essentially the same. The standard model may ply some middle ground in terms of reliance on accounting values versus other measures of an insurer's financial risk.

Government Insurance and Catastrophe Reserves. The U.S. General Accountability Office (GAO) reviewed six European countries—France, Germany, Italy, Spain, Switzerland, and the United Kingdom—to examine their approaches to managing and financing catastrophe risk (see U.S. GAO, 2005). The GAO found that all six countries have developed and employed a combination of public and private approaches to deal with catastrophes but only three impose government-mandated insurance that covers disaster risk.[34] The perils covered differ by country and typically include flood coverage, but the coverage of other perils, for example, earthquakes and windstorms, vary. The differences presumably reflect the nature of the perils to which each country is most exposed.

France and Spain have national programs that require property owners to purchase catastrophe coverage that is backed with unlimited government guarantees. Switzerland mandates natural catastrophe coverage but does not provide any explicit government financial guaranty. The other countries rely on optional private insurance to cover natural disasters. In the United Kingdom, flood coverage is typically included in private property insurance policies.

All six countries allow the use of catastrophe or equalization reserves for natural disaster risks.[35] However, equalization reserves are no longer allowed at the consolidated level. The specific policies in each country are summarized in Table 5. All six countries allow for some form of tax deductibility for these reserves. However, it should be noted that international GAAP standards do not currently recognize equalization reserves, which is an issue that will need to be addressed.

Opportunities for Improving Government Policies

Given current limits aggregate capacity of the insurance/reinsurance industry, the remaining uncovered exposure to large catastrophes requires other financing vehicles. Although additional capital has flowed to conventional reinsurers, it is inefficient to finance the higher layers of catastrophe risk using the equity held within reinsurers.

[34] Freeman (2004) also reviews government catastrophe insurance programs in EU countries.

[35] Catastrophe reserves are generally built up over the years from premium income, sometimes following a prescribed formula, until a specific limit is reached. Catastrophe reserves are intended to be used for future catastrophic losses covered by current or future contracts for events such as nuclear accidents and terrorism. Equalization reserves are intended to cover random fluctuations of claim expenses for some types of insurance contracts such as hail insurance, using a formula based on multiyear claims experience (see GAO, 2005).

TABLE 5
Catastrophe Reserve Policies in Selected European Countries

Country	Reserve Policy	Standards Governing Contributions and Withdrawals
France	Catastrophe and equalization reserves can be used for storms and hail	No
Germany	Equalization reserve is required for natural disasters	Yes
Italy	Catastrophe reserve is required for natural catastrophes, for example, earthquakes and volcanic eruptions; equalization reserve is required for hail and other climate risks	No
Spain	Catastrophe reserve can be used for natural catastrophes and terrorism risks	No
Switzerland	Catastrophe reserve is allowed in Switzerland for all types of catastrophes approved by the Swiss insurance supervisory authority	No
United Kingdom	Equalization reserve is required for property and other types of insurance	Yes

Source: U.S. GAO (2005).

Indeed, both insurers and reinsurers have increased their use of alternative risk financing to augment their capacity. The use of such vehicles could be further facilitated and encouraged by appropriate regulatory policies, especially in the United States, which is lagging behind the EU in terms of moving toward a principles-based approach to solvency regulation and a more supportive environment for alternative risk financing. Further, greater use of alternative risk financing could increase the supply of catastrophe insurance and lower its price.

Our discussion begs the question of whether U.S. regulatory treatment of cat risk financing really matters given that many insurers greatly exceed their RBC requirements. It is difficult to assess the extent to which solvency regulatory policies have affected securitization because we cannot peer into a crystal ball to see what would happen under different rules or a new paradigm. We do know that several prominent U.S. insurers have issued cat bonds despite the existing system. Still, even if regulatory impediments have not had a significant effect to date, this is not an excuse for maintaining the *status quo*. Our arguments for a more efficient system and rational policies are based on their inherent merits. Under such a regime, markets would operate more freely and there would be greater assurance that cat risk management and financing would be optimized.

In the United States, several constraints and other policies potentially retard the more extensive use of alternative catastrophe risk financing. The expansion of the recognition of alternative risk transfer could encourage insurers of sufficient size to transfer catastrophe risk at higher layers and increase their level of protection. The NAIC has adopted model acts that would regulate and recognize onshore securitizations, but the lack of favorable tax treatment (among other factors) for these arrangements has

inhibited their utilization. Regulatory recognition of offshore securitizations could further encourage insurers to use this approach to better manage their catastrophe risk. The same could be said for other devices such as the use of cat options and swaps. Regulatory reforms in these areas would prove to be beneficial when the United States is struck by a large catastrophe. They could also help to improve the affordability and availability of property insurance at a primary level if insurers can utilize and achieve credit for these transfers due to their lower cost.

Finally, if insurers were allowed to demonstrate their capital adequacy and proper risk management through approved internal risk models (and/or more sophisticated standard models), in lieu of other regulatory requirements or constraints, it could encourage broader use of this approach as well as risk financing devices that would be reflected in their internal modeling. This should be an ultimate goal of U.S. regulators and its adoption would avoid industry opposition if it was an option for insurers rather than a requirement. The replacement of arbitrary, prescriptive rules in favor of a principles-based, risk-focused regulatory approach could be an attractive trade-off to many insurers and increase their national and international competitiveness.

The EU has progressed much farther in developing such an approach to solvency regulation that should help to encourage EU insurers to efficiently manage their catastrophe risk. The main issue for EU insurers may be how specific risk transfer transactions (and potentially different contract structures) will be viewed by regulators in their application of EU policies. This issue is coupled with broader issues to be resolved, which also could affect cat risk financing, directly or indirectly. To some degree, uncertainty about how specific transactions will be treated inherently arises from the principles-based approach. EU regulators may understandably be reluctant to "approve" transactions in advance, but as their experience develops they may be able to develop guidelines for various instruments and transfer/financing structures. Ultimately, over time, insurers will be able to see how previous transactions have been treated that will help them in considering new transactions or instruments with "new" features, but additional regulatory guidelines could be helpful to insurers and reinsurers.

All of this said, the public, legislators, and even some insurers may perceive that there are limits to the amount of protection that can achieved through private markets alone or harbor concerns about the cost of that protection (Freeman, 2004). This is a particular issue in the United States where property owners in high-risk areas are vociferous in their criticism of insurance rate increases. Advocates of government insurance/reinsurance argue that there is a gap in the supply of private cat risk financing which the government needs to fill. However, there is a fierce debate over whether such a gap really exists and convincing evidence of deficiencies in private financing has not been presented (see Grace and Klein, 2008). The principal motivation for political support of government insurance/reinsurance mechanisms in the United States among coastal politicians appears to be the desire for lower insurance rates.

Regardless of whether there is a true or a perceived gap in private financing of catastrophes, government catastrophe insurance/reinsurance may become a more pervasive phenomenon in the United States and continue in the EU in those countries that already have such institutions. Political pressures for such policies could rise in

EU countries in the face of increased catastrophe risk and losses, although favorable treatment of alternative cat risk financing should reduce such pressures. The danger associated with such schemes is that government entities are subject to political pressure to charge inadequate premiums to cover the risk they are assuming. The ultimate consequence of such practices could be substantial taxpayer subsidies when the catastrophes hit. Hence, stakeholders in both the United States and the EU must be attentive to the lure of subsidized catastrophe insurance/reinsurance schemes.

In terms of public solutions, for those committed to the idea of government reinsurers, one might propose that they issue pre-event cat bonds rather than engage in post-event borrowing and assessments that run a greater risk of taxpayer subsidies. For example, pre-event financing is being used by the recently established, multicountry Caribbean Catastrophe Risk Insurance Facility (CCRIF).[36] Government purchase of catastrophe options also might be more feasible given that its portfolio of exposures would be aligned with the parametric triggers that would be used for such options. Private insurers and reinsurers could help to facilitate the aggregation of policies (by providing fronting, pricing, and claims handling services, as well as underwriting lower layers of risk) and cede higher risk layers through excess of loss reinsurance with a government reinsurer. The primary advantage of this approach would be that the government would pay for the cost of issuing of catastrophe bonds (and/or buying options) up front, which in turn should be reflected in the premiums paid by those (property owners) who are ultimately receiving the protection. The emergence of some alternative proposals that utilize this kind of approach in the United States is a positive development.

CONCLUSIONS

Natural disasters present a substantial and growing threat to many countries and warrant efficient risk management. The financing of catastrophe risks requires an economically sound and collaborative approach among private insurers/reinsurers, capital markets, and governments. In our opinion, private sector solutions should be fully utilized to their maximum capability before government mechanisms play a role. Obviously, there are different opinions and preferences on the dimensions of the appropriate private–public partnership. The removal of unnecessary and welfare-diminishing regulatory and tax constraints could substantially boost the capacity of the private capital markets to assume more catastrophe risk. The U.S. regulatory and tax framework does not promote the development of the markets for catastrophe bonds and other alternative financial instruments. Further, the government absorption of catastrophe exposures in the United States unnecessarily crowds out private risk financing. EU regulatory and tax policies appear to be more favorable to catastrophe risk financing although further regulatory guidance in this area could be helpful to insurers and reinsurers.

Movement to a principles-based regulatory approach—as reflected in the evolving EU system—would be a substantial and beneficial advance in the United States. At the same time, we acknowledge that some regulators and other experts may not believe that a principles-based approach is superior. The EU does face regulatory issues

[36] See World Bank (2006) for a discussion of the CCRIF. The Mexican government has also issued a cat bond and Turkey has established a catastrophe risk facility (see Freeman, 2004).

that will need to be addressed, and some EU countries have opted for government solutions to catastrophe risk financing. Hence, there is room for improvement in both jurisdictions. Unfortunately, as demonstrated in the United States, there is the danger for politicians to court public favor with shortsighted measures that distort incentives and encourage excessive risk taking rather than optimal risk mitigation. The counterstrategy is public education of those who stand to lose from unwise government policies. This is an enormous challenge but a better strategy is not obvious. Hopefully, wisdom will prevail before the United States or other exposed countries suffer a mega disaster.

We also acknowledge that the impact regulatory reforms would have on the use of alternative devices for catastrophe risk financing is a matter of speculation and potentially different opinions. Simply removing tax and regulatory constraints in the United States might have only a small impact if most insurers have found it relatively easy and cost efficient to circumvent these constraints. A greater emphasis on private financing of catastrophe risk and insurers' management of this risk could have greater effects, but again this is a matter of speculation. Ultimately, the goal should not be to promote alternative risk financing for its own sake. Rather, the goal should be to establish the best and most efficient regulatory policies and market forces, subject to appropriate governmental oversight, will determine how catastrophe risk is managed and financed.

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