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Financing Natural Catastrophe Exposure: Issues and Options for Improving Risk Transfer Markets

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Summary

The federal government has an established institutional framework for disaster preparedness, reduction, prevention, and response—mainly disaster assistance. However, concerns have been expressed about the nation's increasing exposure and vulnerability to natural hazards. The rising cost of financing recovery and reconstruction following natural disasters, reports of the nation's increasing vulnerability to coastal hazards, questions concerning the capacity of state and local governments and private insurers to deal with the rising costs, and disagreements concerning the appropriate role of the federal government in dealing with these costs have all become major topics of congressional debate.

The financial consequences of catastrophic natural disasters, such as Hurricanes Katrina (2005) and Sandy (2012), are largely a result of increasing population growth and the rising concentration of property assets in vulnerable disaster-prone areas. According to the National Oceanic and Atmospheric Administration (NOAA), Hurricane Katrina caused more than $80 billion in economic losses (both insured and uninsured) to private property and infrastructure and, more recently, Hurricane Sandy caused more than $65 billion in economic losses. New York and New Jersey—two of the nation's most populous states—were especially affected by Hurricane Sandy-induced storm surge and coastal flooding. Sandy also triggered a sustained and heightened policy interest in the potential effects of climate change and population growth on the National Flood Insurance Program (NFIP), the feasibility of innovative public-private sector catastrophe risk management and financing initiatives, and consideration of cost-effective and practical adaptation strategies to make society more financially resilient.

In the wake of Hurricane Sandy, a key policy question for Congress is whether the federal government should intervene in U.S. risk transfer markets to ensure the continued availability and affordability of homeowners' insurance for all residents. Advocates of federal intervention in property catastrophe insurance markets argue that an inevitable mega-catastrophe event will exceed the financial capacity of private insurers and reinsurers, as well as state insurance programs. Thus, they argue, the federal government should consider establishing a national catastrophe risk-financing program to transfer diversified pools of risk to the capital markets to help states achieve better terms with regard to the cost of insurance protection.

In essence, advocates argue that state residual property insurance pools would benefit from global diversification by transferring government's catastrophe risk to capital market partners through catastrophe swap or directly to capital market investors through (catastrophe) bond issuance, or the purchase options on their exposure to extreme weather events (weather hedge). These options would presumably reduce pressure on public budgets and help improve insurers' access to capital to ensure adequate capacity and solvency of the insurance industry to meet consumer needs.

Opponents of federal intervention argue that the insurance and reinsurance industry—with access to existing innovation for risk-financing transactions—has withstood unprecedented recent extreme natural disaster events with minimal disruption.

As will be discussed, several catastrophic risk-financing legislative options are before the 113th Congress. For example, H.R. 737, the Homeowners' Defense Act of 2013, would establish a National Catastrophe Risk Consortium to facilitate multistate pooling of catastrophe exposures (covering a variety of event probabilities and types) and transferring such risk through catastrophe-linked securities and insurance derivatives directly to investors in the capital markets.

H.R. 240, the Homeowners Insurance Protection Act of 2013, would create the National Commission on Catastrophe Preparation and Protection to provide for reinsurance of state disaster insurance programs. Under this proposal, the Treasury would auction excess-of-loss reinsurance contracts to public and private catastrophe risk-bearers, insurers, and state funds to improve the availability and affordability of coverage for homes. H.R. 549, the Homeowner Catastrophe Protection Act of 2013, would amend the Internal Revenue Code to allow insurers to establish pre-tax reserves by creating disaster protection funds for claims arising from future catastrophic events. Income allocated to the catastrophe reserves would be taxable as income only when withdrawn for the payment of losses.

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Introduction: Defining the Problem and Current Challenges

The four major types of natural environmental hazards[1] that can result in property damages or lost lives are (1) *geophysical events*, such as earthquakes, tsunamis, and volcanic eruptions; (2) *meteorological events*, such as hurricanes and tropical storms, typically generated in the Caribbean Sea and Atlantic Ocean; (3) *hydrological events*, such as floods; and (4) *climatological events*, such as extreme temperature, drought, and wildfires.[2] Economic losses (both insured and uninsured) from natural environmental hazards, especially from meteorological and climatological events, have increased in recent decades and have occurred with large spatial and interannual variability. For example, 8 of the 10 most costly catastrophes[3] in the United States have occurred since 2000, including Hurricane Katrina (2005), which caused more than $80 billion in economic losses (both insured and uninsured) to private property and infrastructure and, more recently, Hurricane Sandy (2012), which caused more than $65 billion in economic losses.[4]

Most observers agree that it is highly likely that the United States will continue to experience increasing losses from natural catastrophes and that those losses will place increasing fiscal pressure on federal, state, and local governments as well as private risk transfer markets, which are currently responsible for a sizeable share of the total cost of financing recovery and reconstruction.

The rising cost of financing recovery and reconstruction following natural disasters, reports of the nation's increasing vulnerability (and resilience) to coastal hazards, questions concerning the capacity of state and local government officials and private insurers to deal with the rising costs, and disagreements concerning the appropriate role for the federal government in dealing with these costs have all become major topics of congressional debate.

The financial consequences of severe natural disasters, such as Hurricanes Katrina (2005) and Sandy (2012), are largely a result of increasing population growth and the rising concentration of property assets in vulnerable disaster-prone areas, such as coastal regions exposed to windstorms, river basins exposed to floods, and urban areas exposed to earthquakes. Climate change may also play a role. Moreover, the hazards posed by extreme weather-induced coastal hazards—namely

[1] Scientists define a natural environment hazard as a threat of a naturally occurring event that will have an adverse effect on people or the environment.

[2] This report does not address human-induced catastrophes. The Terrorism Risk Insurance Program provides a financial backstop for private insurers exposed to terrorism risks. For more information, see CRS Report R42716, *Terrorism Risk Insurance: Issue Analysis and Overview of Current Program*, by Baird Webel. In addition, the National Flood Insurance Program provides property insurance for flood risks facing property owners and small businesses in the United States.

[3] The U.S. insurance industry defines a catastrophe as an event that causes $25 million or more in insured property losses and affects a significant number of property/casualty policyholders and insurers.

[4] For information on estimates of total economic losses from Hurricane Katrina, see National Ocean Atmospheric Administration, National Weather Service, "Service Assessment, Hurricane Katrina, August 23-31, 2005," p. 1, located at http://www.nws.noaa.gov/om/assessments/pdfs/Katrina.pdf. For information on estimates of total economic losses from Hurricane Sandy, see National Ocean Atmospheric Administration, National Climate Data Center, "U.S. Billion-dollar Weather and Climate Disasters: Data Sources, Trends, Accuracy and Biases," located at http://www1.ncdc.noaa.gov/pub/data/papers/smith-and-katz-2013.pdf.

sea level rise, storm surge, coastal flooding, and erosion—could prove challenging, not only for individuals and businesses, but also for affected state and local governments, especially given concerns about private insurers' ability and willingness to manage and finance low-probability, high-consequence events. For example, New York and New Jersey—two of the nation's most populous states—were especially affected by Hurricane Sandy-induced storm surge and coastal flooding. Sandy triggered a sustained and heightened policy interest in the potential effects of climate change and population growth in coastal areas for the National Flood Insurance Program (NFIP), the feasibility of innovative public-private sector initiatives for managing and financing catastrophic risks, and consideration of cost-effective and practical adaptation strategies to make society more resilient to damages from natural environmental hazards.[5]

This report opens with an examination of the current role of private insurers in managing disaster risk and their capacity and willingness to deal with the rising cost of financing recovery and reconstruction following natural disasters. This discussion focuses on the traditional mechanisms insurers use to hedge risk (e.g., reinsurance and retrocession) by arranging for the right to receive some level of reimbursement or indemnification when losses actually occur.

The report then examines the current role of federal, state, and local governments in managing disaster risk and dealing with the rising cost of financing recovery and reconstruction following natural disasters. This discussion focuses on the federal disaster recovery framework, which includes policies concerning disaster relief, insurance, and mitigation.

The report also examines various alternative risk (ART) financing options in light of the current level of uncertainty concerning the probability of catastrophic losses and the increased exposure and vulnerability of coastal areas to natural disaster damages. Some of these risk-financing options include state-sponsored loss-sharing financing mechanisms and private ART methods, such as insurance-linked securities (e.g., catastrophic bonds and contingent capital securities).

The report concludes with an examination of the rationale for and against government intervention in risk transfer markets and other legislative options currently under congressional consideration. For example, H.R. 737, the Homeowners' Defense Act of 2013, would establish a National Catastrophe Risk Consortium to facilitate both multistate pooling of catastrophic risks (covering a variety of event probabilities and types) and natural disaster-linked securitization, thereby strengthening the financial capacity of these programs. H.R. 240, the Homeowners Insurance Protection Act of 2013, would create the National Commission on Catastrophe Preparation and Protection with the authority to establish a federal reinsurance program to make reinsurance coverage available to eligible state natural catastrophe insurance programs to improve the availability and affordability of coverage for homes and the solvency and capacity of homeowners' insurance markets. H.R. 549, the Homeowner Catastrophe Protection Act of 2013, would allow insurers to make tax-deductible contributions to a tax-exempt policyholder disaster

[5] In response to Hurricane Sandy, Congress passed the Sandy Recovery Improvement Act of 2013, which was included as Division B of P.L. 113-2, the Disaster Relief Appropriations Act, 2013. It provided $50.7 billion in disaster assistance. Congress also passed legislation (P.L. 113-1) to temporarily increase the National Flood Insurance Program's borrowing authority by $9.7 billion (from $20.725 billion to $30.425 billion). For more information on P.L. 113-2, the Sandy Recovery Improvement Act of 2013, see CRS Report R42991, *Analysis of the Sandy Recovery Improvement Act of 2013*, by Jared T. Brown, Francis X. McCarthy, and Edward C. Liu. For more information on Hurricane Sandy funding for disaster assistance see CRS Report R42869, *FY2013 Supplemental Funding for Disaster Relief*, coordinated by William L. Painter and Jared T. Brown.

protection fund established for the payment of policyholders' claims arising from certain catastrophic events.

Advocates of federal intervention in catastrophe insurance markets argue that an inevitable mega-catastrophe event will exceed the financial capacity of private insurers and reinsurers, as well as state insurance programs. Thus, they argue, the federal government should consider proposals for improving insurers' access to capital in the reinsurance, banking, and securities markets to ensure adequate capacity and solvency of the industry to meet consumer needs. Opponents of federal intervention, on the other hand, argue that the insurance industry has withstood unprecedented recent natural disaster events with minimal disruption and insurers have the financial engineering tools and instruments to transfer insurance risk to investors in capital markets.

The Role of Private Insurers

There is general agreement that disaster risk and uncertainties must be cost-effectively managed and financed to ensure economic growth and maximize social welfare. People and organizations typically purchase an ordinary insurance policy, the most common risk management technique, to reduce uncertainty and worry from their inability to predict individual future outcomes. The insured pays a fee in exchange for the insurer's promise to pay a certain sum of money provided a stipulated event occurs. The insurer is able to offer protection against financial loss by pooling the risks from a large group of independent and identically distributed risks. In many cases, however, the risks to different individuals are not independent. For example, in a major hurricane, earthquake, or flood, many people may suffer at the same time. Economists refer to this situation as correlated losses. Insurers spread such risks not only across individuals (geographically or spatially) but also across time (intertemporal) through reinsurance contracts placed with separately capitalized reinsurers or loss reserves (surplus) built up in good years to offset unusually high losses in catastrophic loss years.

An understanding of the role of private insurers in the economy must begin, therefore, with the concepts of *risk* (or the variation in possible outcomes of a situation) and *uncertainty*, which is one of the decisive determinants of individual behavior. Economists observe that the goal of individuals is to maximize expected utility, and this has meant mitigating uncertainty with the purchase of an insurance policy.

Under a typical insurance transaction, individuals transfer risk to an independent pool and, via the law of large numbers,[6] insurers convert risky contracts into almost sure things. This pooling process permits the systematic accumulation of funds that provide for payment of losses in accordance with the terms of the ordinary insurance contract. Individuals in the group pay a specific premium rate instead of risking the uncertainty of a (potentially large) loss. The premium rate is equal to the actuarial value of the loss plus an amount to compensate the insurer for assuming the risk.

[6] The *law of large numbers* is an important statistical theorem that, in essence, says the larger the number of exposure unites, the more closely will the actual results obtained approach the probable results expected from an infinite number of exposures. The theorem is important to the prediction of losses by insurance company actuaries and risk managers.

Economists observe that when risk transfer occurs in an uncertain environment, two basic problems arise: *moral hazard*[7] and *adverse selection*.[8] Both are founded on imperfect information. Moral hazards in insurance, for example, occur because the insurer does not have costless access to information possessed by the insured and therefore does not know whether the loss is caused by the insured's carelessness or by chance. The insurer typically will reduce moral hazard by requiring the insured to bear some of the costs of the contingency, for example, by requiring a deductible. Insurers have addressed the adverse selection problem with proper risk identification and assessment, risk segmentation, risk-based premiums, and effective underwriting.

The traditional insurance mechanism is not sufficient for diversifying the risk of loss arising from large-scale natural disasters—a problem that became increasingly apparent to policymakers following Hurricane Hugo (1989), Hurricane Andrew (1992), and the Northridge earthquake (1994). The problem is that catastrophic natural disaster losses tend to be correlated, unpredictable, and costly when the events occur. Insurers traditionally protect themselves against catastrophic losses through reinsurance agreements with separately capitalized reinsurers. Reinsurers, like insurers, pool risk and diversify (spread) risk by writing many unrelated policies, and sometimes purchase reinsurance themselves, called "retrocession," or enter into reciprocal loss-sharing agreements with other reinsurers to manage their risk portfolios.

Given the relatively small capital and surplus of the reinsurance industry—compared with probable maximum losses from a potential mega-catastrophic event—insurers recognized during the 1990s that the global reinsurance industry might not have been capable of funding large-scale catastrophic losses in the United States. Concerns expressed by policymakers ranged from the adequacy of insurance capital to the liquidity and transparency in the U.S. risk transfer market. By the mid-1990s, insurers and reinsurers began issuing insurance-linked securities, namely catastrophe bonds, to augment underwriting capacity and effectively hedge against potential catastrophic losses.

During the 1990s and 2000s, Congress held relatively frequent oversight and investigation hearings into the competitive nature and solvency of the insurance industry and possible causes for market dislocation, especially pertaining to the availability and affordability of property insurance (and reinsurance) in high-risk areas following a major catastrophic event. More recently, Congress has held relatively few hearings on the subject, perhaps because of the increased use and availability of competitively priced (property) catastrophe bond issuance (i.e., insurance linked securities) that complement traditional catastrophe reinsurance. The main factor contributing to these relatively recent developments—with implications for reinsurance pricing, availability, and structure—is sustained capital growth in 2012 and 2013, and downward pressure on rates in the traditional reinsurance market to remain competitive, driven by an influx of capacity from alternative or "convergence" capital sources.[9] As will be discussed later, institutional asset managers (primarily pensions) and sophisticated institutional investors (e.g., endowments and multi-strategy hedge funds) have increasingly shown an interest in accessing catastrophe risk on a liquid basis and stable, modest returns on investments that are non-

[7] Specifically, in economic theory, moral hazard refers to a tendency for an individual (or entity) to be more willing to take a risk, knowing that the potential costs or burdens of taking the risk will be incurred, in whole or in part, by others.

[8] Adverse selection, in economic theory, refers to the tendency for those exposed to a higher risk to seek more insurance coverage than those exposed at a lower risk.

[9] Guy Carpenter & Company LLC, "Influx of Convergence Capital Triggers Downward Pressure on Pricing at June 1 Renewals, June 3, 2013, located at http://www.gccapitalideas.com/2013/06/03/influx-of-convergence-capital-triggers-downward-pressure-on-pricing-at-june-1-renewals/.

correlated to the balance of their portfolios.[10] The result is that—for the first time—insurance linked securities (ILS) pricing is delivering a more cost effective risk transfer solution than traditional (reinsurance) vehicles.

Separately, a new potential catastrophic risk financing challenge appears to be emerging. Even if there is a sufficiently large and growing catastrophe risk transfer market—as most observers would argue appears to be the case—property insurers exposed to hurricane-driven, storm-surge damage to residential property risk along the Atlantic and Gulf coasts might still choose to restrict supply in favor of other, potentially more profitable, investments.[11]

In summary, with respect to the role of private insurers in financing natural catastrophic risks, Congress faces several policy issues and questions, including

1. **Uncertainty concerning the probability of catastrophic losses.** Uncertainty about how often catastrophic natural disasters occur (frequency), the geographic patterns, and the magnitude of these events (severity) poses a challenge to the financial management of catastrophic risk and a test of the effectiveness and reliability of existing prevention, protection, and compensation mechanisms in place. What is the scientific basis for assessing natural hazard risk? How well can the private sector and government predict natural disaster risks? How reliable and valid are current risk assessment models/methodologies and what are their implications for the pricing and availability of insurance and other risk spreading mechanisms?

2. **Reducing potential natural disaster losses.** A mega-catastrophic event striking a coastal region of the United States could impede interstate and foreign commerce and cause widespread economic hardship adversely affecting both the national and international economies. What is the current level of risk and its distribution between public and private sectors? What are the most cost effective ways to mitigate losses?

[10] Guy Carpenter & Company, LLC, "Catastrophe Bond Update: First Quarter 2013," May 2013, located at http://www.guycarp.com/portal/extranet/insights/briefingsPDF/2013/Catastrophe%20Bond%20Update%20First%20Quarter%202013.pdf;JSESSIONIDGCPORTALWCPORTALAPP=pjRQR2ZMLy5n2ppDpPxyl9lj5L5TdLYz4KTzdryXCkHpjs2bZg1p!-2116277995?vid=5.

[11] Having insurance capacity does not ensure private insurers will choose to sell insurance. Other factors like rates of return on investment (cost of capital) remains a key determinant in whether insurers will offer insurance coverage in a particular geographical area or state.

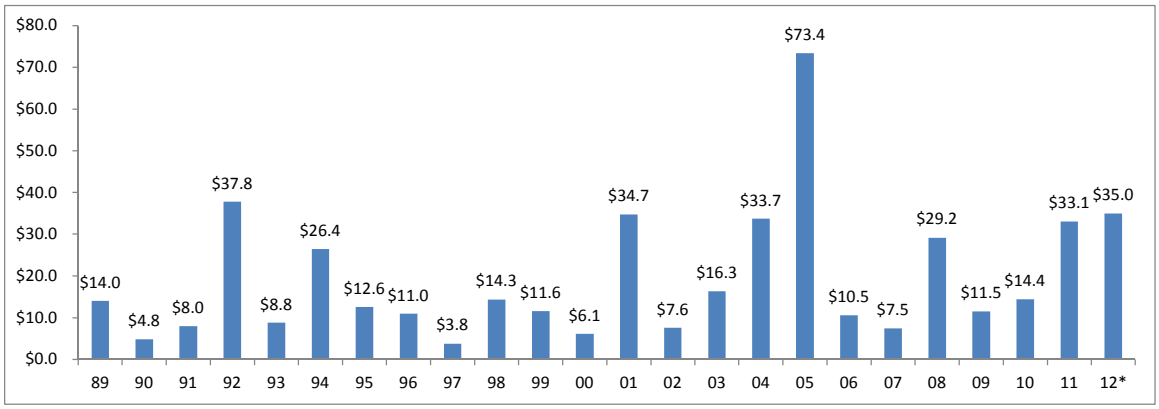
3. **Rethinking catastrophic risk management and financing strategies.** Is the present mix of private market and public policies the most efficient and equitable way of sharing risk? What is the potential for financial instruments to transfer risk, including insurance risk options/futures (e.g., weather derivatives), government-backed contracts, and state or regional insurance pools? Given the insurance risk transfer market's need for transparency and liquidity, what are the implications for regulation and federal intervention? Should Congress allow insurers to establish pre-tax reserves by creating disaster protection funds for claims arising from future catastrophic events? Income allocated to the catastrophe reserves would be taxable as income only when withdrawn for the payment of losses.

The U.S. Exposure to Natural Catastrophic Risk

As stated earlier, the United States faces several types of natural catastrophic risk exposures that could result in lives lost and property and infrastructure damages. **Figure 1** shows private insured catastrophe property losses in the United States from 1989 to 2012.[12] Total losses are greater, sometimes more than two times greater, than insured losses.[13]

Figure 1. Total U.S. Catastrophe-Insured Property Losses, 1989-2012

($ billions, as of January 2, 2013)



Source: Insurance Services Office's (ISO's) Property Claims Service and Insurance Information Institute

Note: 2001 figure includes $20.3 billion for 9/11 losses reported through December 31, 2001 ($25.9 billion in 2011 dollars). This figure includes only business and personal property claims, business interruption, and auto claims. Non-property/business insurance losses equal $12.2 billion ($15.6 billion in 2011 dollars). The $35.0 billion loss figure for 2012 includes $18.8 billion in gross loss estimate for Hurricane Sandy.

Table 1 shows the 10 costliest catastrophes—natural and technological—in the United States. Seven of the 10 most costly catastrophes were weather-related events affecting coastal states along the Gulf and Atlantic coast regions.

[12] Uninsured or underinsured public losses from natural catastrophes, including destruction of public buildings, infrastructure, and transportation systems are either retained or reimbursed by the public expenditure of funds or tax relief.

[13] For example, the National Hurricane Center typically doubles the estimated insured losses for an estimate of total damage losses in the United States.

Table 1. Top 10 Most Costly Catastrophes in United States

($ in millions; as of January 18 , 2013)

Rank	Date	Peril	Estimated Insured Property Losses	
			Dollars when Occurred	In 2012 Dollars
1	Aug. 2005	Hurricane Katrina	$41,100	$48,317
2	Sept. 2001	Fire, explosion: World Trade Center, Pentagon terrorist attacks	18,779	24,345
3	Oct. 2012	Hurricane Sandy	18,750	18,750
4	Aug. 1992	Hurricane Andrew	15,500	25,364
5	Jan. 1994	Northridge, CA, earthquake	12,500	19,365
6	Sept. 2008	Hurricane Ike	12,500	13,329
7	Oct. 2005	Hurricane Wilma	10,300	12,108
8	Aug. 2004	Hurricane Charley	7,475	9,085
9	Sept. 2004	Hurricane Ivan	7,110	8,641
10	Apr. 2011	Flooding, hail, and wind including the tornados that struck Tuscaloosa, AL, and other locations	7,300	7,451

Source: The Property Claim Services (PCS)—a unit of Insurance Services Office, a Verisk Analytics company.

Note: Does not include flood damage covered under the National Flood Insurance Program.

Recently, the series of weather-related events—Hurricanes Sandy and Isaac (2012), Irene (2011), Ike (2008), and Katrina and Rita (2005)—demonstrated the nation's vulnerability to coastal hazards. Sandy was the second-most costly natural disaster in U.S. history, behind Hurricane Katrina (2005) and close to Hurricane Andrew (1992). Sandy's torrential rainfall and flooding in 14 states in the Mid-Atlantic and Northeast, from North Carolina to Maine, caused significant property and infrastructure damages in the affected areas. Coastal areas of New York, New Jersey, and Connecticut were especially hard hit.

Types of Natural Disaster Losses

Table 2 and **Figure 2** show U.S. insured catastrophe property losses from 1992 through 2011 by type of natural hazard in table format and pie chart, respectively. According to the Insurance Services Office's Property Claims Service, an insurance industry group that collects data on catastrophes, the main types of natural catastrophes posing potential economic cost to the private insurance industry are hurricanes, tornadoes, earthquakes, and winter storms. Hurricanes and tornadoes resulted in 76% of all catastrophe losses. Wind and hail damage from hurricanes are also major contributors to insurance claim losses.

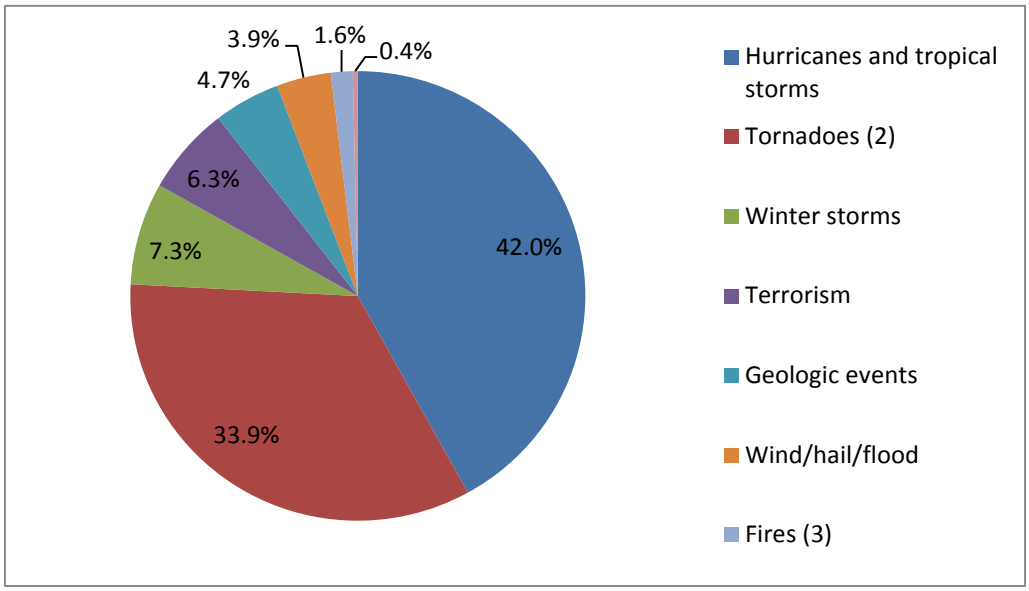
Table 2. Inflation-Adjusted U.S. Catastrophe-Insured Losses by Cause of Loss, 1992-2011

	Percentage	Losses ($ billions)
Hurricanes and tropical storms	42.0%	$161.3
Tornadoes	33.9	130.2
Winter storms	7.3	28.2
Terrorism	6.3	24.4
Geologic events	4.7	18.2
Wind/hail/flood	3.9	14.8
Fires	1.6	6.0
Other	0.4	1.4
Grand Total	100.0	384.5

Source: ISO's Property Claim Services (PCS) and Insurance Information Institute.

Notes: Adjusted for inflation through 2011 by ISO using the GDP implicit price deflator. Excludes catastrophes causing direct losses less than $25 million. Does not include flood damage covered by the federally administered National Flood Insurance Program. Includes losses from civil disorders, water damage, utility service disruptions, and any workers compensation catastrophes generating losses in excess of Property Claims Services threshold after adjusting for inflation.

Figure 2. U.S. Catastrophe-Insured Losses by Cause of Loss, 1992-2011



Source: ISO's Property Claim Services (PCS) and Insurance Information Institute.

Notes: Includes $18.8 billion gross loss estimate for Hurricane Sandy, as of January 2, 2013.

The rising cost of financing recovery and reconstruction following natural disasters is largely a result of increasing population growth and the rising concentration of property assets in vulnerable disaster-prone areas. For example, according to CoreLogic, a company that produces property information, analytics, and other services, more than 4.2 million homes along the U.S. Atlantic and Gulf coasts are located within storm-surge risk zones, totaling more than $1.1 trillion

in property exposure.[14] CoreLogic indicated that, based on theoretical future rises in sea level, there has been a significant increase in both the total number of properties at risk of potential destruction associated with storm-surge flooding and the total value.[15]

Historically, floods were considered the most frequent and costly natural peril in the United States. In 1968, Congress established the National Flood Insurance Program (NFIP) to manage and finance the nation's flood risks at a time when the nation's flood hazards were largely associated with riverine (not coastal) flooding.[16] The NFIP is the second largest financial risk and liability of the federal government behind Social Security.[17]

Today, the costs associated with extreme weather and climatic events can overwhelm the NFIP. In short, from a cost perspective, the perils of coastal hazards now rival, and perhaps surpass, riverine flooding.[18]

Climate Change, Risk Management, and Adaptations

Most observers agree that climate change is a global phenomenon, with far-reaching economic, environmental, and fiscal implications for governments, risk management, and sustainability. A recent global-warming/climate-change study published by the United Nations World Meteorological Organization indicated that both land and ocean surface temperatures between 2001 and 2010 were the warmest since measurements began in 1850, and the global mean sea levels rose about twice as fast as the trend in the last century.[19] The analysis also suggested that greenhouse (carbon dioxide) gases are changing the climate such that the world is experiencing an extended period of accelerated global warming. Scientists report that global warming accelerated in the four decades of 1971 to 2010, and the decadal rate of increase from 1991 to 2000 and 2001 to 2010 was unprecedented.[20] Global warming, and its impact, has emerged as a pivotal, yet highly controversial issue in the disaster policy debate. Since the 1990s, and a series of increasingly costly natural disasters associated with extreme weather events, the potential impact of climate change on relevant natural hazards—hurricane-induced wind damage, coastal flooding, storm surge, thunderstorms/tornadoes, droughts, wildfires, and inland flooding due to both hurricanes and non-topical systems—has drawn increased attention from the public and U.S. policymakers. For instance, after Hurricane Sandy in 2012, there has been a growing awareness of the potential financial consequences of climate change and population growth in coastal shoreline counties (directly adjacent to the open ocean, major estuaries, and the Great Lakes) and U.S. coastal watershed counties (where the land area intersects coastal watersheds).

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[14] CoreLogic, "The 2013 CoreLogic Storm Surge Report," May 31, 2013, located at http://www.corelogic.com/research/storm-surge/corelogic-2013-storm-surge-report.pdf.

[15] Ibid.

[16] For more information on the National Flood Insurance Program see CRS Report R42850, *The National Flood Insurance Program: Status and Remaining Issues for Congress*, by Rawle O. King.

[17] Timothy Beatle, David J. Brower, and Anna K. Schwab, *An Introduction to Coastal Zone Management* (Washington, DC: Island Press, 2002), pp. 94-95.

[18] National Ocean Atmospheric Administration, National Climate Data Center, "U.S. Billion-dollar Weather and Climate Disasters: Data Sources, Trends, Accuracy and Biases," located at http://www1.ncdc.noaa.gov/pub/data/papers/smith-and-katz-2013.pdf.

[19] United Nations World Meteorological Organization, "The Global Climate 2001-2010: A Decade of Climate Extremes," located at http://www.unep.org/pdf/wmo_report.pdf.

[20] Ibid.

Unlike the effects of climate change on the erosion of beaches that are observable and easily measured, the broader impact of climate change on coastal hazards—that is, sea level rise, storm surge, and coastal flooding—and the U.S. economy is arguably less apparent and remains controversial. The issue is not whether climate change affects people and the environment. Instead, the policy challenge appears to be twofold. First, there is no consensus on an objective scientific basis for determining (and agreeing on) the magnitude and scope of the effects of global warming and climate variability/climate hazards on the U.S. economy. Second, there is no consensus concerning what to do about the adverse impact of global warming and climate adaptation (and resilience) in communities along vulnerable U.S. coastlines.

While the impact of global warming—especially the impact of climate-induced changes on natural disasters—remains controversial, a consensus seems be emerging around two major climate risk and disaster management strategies issues. *First*, there appears to be a growing consensus among policymakers in favor of enacting national climate adaptation and risk management strategies, such as retrofitting or raising existing structures and building dikes, levees, and pumping facilities, rather than requiring the abandonment of the present sites of climate hazards (coastal areas and waterfronts).[21] Opponents of the abandonment strategy argue that the coastal regions of the United States are economically vital to the nation's long-term economic growth.

Second, there is arguably a limited U.S. capacity for financing catastrophic risks. What has become clear in the post-Sandy rebuilding and recovery phase designed to produce a more sustainable coastline is that risk transfer and financing for public infrastructure, buildings, transportation systems, and communities against the impacts of climate change could involve significant costs to governments at all levels due to added storm protection needed from rising sea levels and protection from coastal erosion. Insuring increasingly vulnerable residential private property risks will likely require a substantial increase in risk transfer capacity that is currently beyond the existing property and casualty (P&C insurer) insurance industry's total claims paying capacity. Policymakers are currently examining the costs and benefits of comprehensive disaster risk management strategies that include possible private-public sector partnerships for producing new technologies, financial innovation in climate risk-assessment tools for determining damage potential, better planning in view of vulnerability (and recent storm histories), and catastrophe risk financing.

Financial Management of Catastrophe Losses

The federal government has an established institutional framework for disaster preparedness, reduction, prevention, and response. Within this approach to disaster risk management, three programmatic elements stand out: disaster relief, insurance, and mitigation. Disaster relief assistance, for instance, meets the uninsured needs of disaster victims. The financial and technical resources provided through government relief are funded by annual and emergency supplemental congressional appropriations to the Disaster Relief Fund in the U.S. Treasury on behalf of (managed by) the Federal Emergency Management Agency (FEMA). Insurance is purchased by recipients in the private market or through state-sponsored, risk sharing programs. Mitigation

[21] For more information on New York's effort to rebuild and recover from Hurricane Sandy see New York City Mayor's Office, the "Special Initiative for Rebuilding and Resiliency," June 11, 2013, located at http://www.nyc.gov/html/sirr/html/report/report.shtml.

consists of measures taken to prevent future losses, such as discouraging development in certain areas, or to reduce the losses that might otherwise occur.

Concerns about the financial burden of the rising response and recovery costs that may be anticipated from more severe future natural catastrophic events has led both Congress and the Obama Administration to explore alternative approaches to strengthen the nation's capacity to prepare for, respond to, and recover from natural catastrophic losses. Policymakers, for example, are rethinking existing U.S. preparedness policies and strategies for managing catastrophic disaster risks in the context of the *National Disaster Recovery Framework* designed to ensure a unified, collaborative, and effective recovery support to disaster-affected states, Tribes, Territorial and local jurisdictions. *The Presidential Policy Directive (PPD)-8* calls for FEMA to work with interagency partners to publish a recovery framework. This policy directive outlines specific steps to achieve the objective of "a shared understanding and a common, integrated perspective across all mission areas—Prevention, Protection, Mitigation, Response, and Recovery—in order to achieve unity of effort and make the most effective use of the nation's limited resources."[22]

Risk Mitigation and Risk Transfer

There are two main ways to reduce net economic losses from natural disasters: mitigating or reducing physical vulnerability to economic damage and managing the residual risk (financial vulnerability) with financial risk strategies, such as risk transfer instruments, securities, and federal disaster assistance.

Private insurance and federal disaster relief are complementary mechanisms to compensate disaster victims and provide for recovery after a natural disaster. Risk management theory, however, suggests at least three reasons why private insurance is more efficient than federal disaster relief for allocating the risk of large catastrophic losses:

- Federal tax and disaster relief assistance create negative incentives for risk mitigation (moral hazards) because the disaster victim's eligibility for compensation is not dependent on whether they have taken steps to reduce their exposure to loss. This inefficiency results in higher social and federal costs of disasters.
- From a welfare economics or resource allocation perspective, federal disaster relief is inequitable because taxpayers pay the costs of disasters regardless of their exposure to risk.
- Federal disaster relief is less efficient than private insurance and inclined to misjudgment because property owners oftentimes do not fully understand the risks they face, make risk management decisions based on inaccurate information, and intentionally rely on disaster relief for compensation. Historically, insurance has been an efficient mechanism to deal with natural catastrophes; it establishes a price on the hazard, based on actuarial information, and creates economic incentives to mitigate losses.

[22] For more information, see CRS Report R42073, *Presidential Policy Directive 8 and the National Preparedness System: Background and Issues for Congress*, by Jared T. Brown.

The Limits of Insurability of Catastrophic Risks

The financial markets, which consist of the market for financial securities such as stocks, bonds, futures options, and insurance, allow the exchange of assets in the form of paper contracts and claims. They also allow the transfer and allocation of risk among different actors. Financial markets, however, are often "incomplete," which means they provide only a limited capacity to pool risk and shift or allocate that across individuals.

The unique characteristics of natural disasters represent a challenge to mitigating risk incident to economic activities (property damages), financing the remaining residual risk, and compensating disaster victims. The key policy question that emerges is whether catastrophe losses are insurable. Traditional insurance principles suggest that a risk is insurable if the insurance market is able to cover potential losses reliably—and profitably—at a premium rate that customers are willing to pay. The problem is that to cover catastrophic risk, insurers must (1) assemble a sufficient number of similarly insured objects to allow a reasonably close calculation of probable future losses; (2) estimate the probability of the risk events (timing, frequency, intensity); and (3) limit an exposure to simultaneous destruction (where many policyholders experience losses at the same time).

In the past, the solution to the catastrophic risk-financing problem has been for insurers to limit their overall catastrophic risk exposure to an acceptable level out of concerns about solvency and the cost of capital. Insurers accomplish this by means of (1) reinsurance, (2) pricing insurance rates using "catastrophe loads" to account for potential disaster-related losses,[23] and (3) alternative risk transfer instruments that allow insurers to transfer fully collateralized liabilities through insurance-linked securities (ILS) to the global capital markets. However, insurance securitization—ILS issuance and trading—lacks a clear, transparent, and tradable platform.

The Role of Traditional Reinsurance

Reinsurance is a form of insurance for insurance companies. Insurers usually hedge (or take offsetting risk positions) all or part of the risk assumed with the transfer ("cede") of that risk, along with the associated premiums, to a reinsurance company. Reinsurance companies, in turn, are free to purchase protection against catastrophe losses from other reinsurers ("retrocessionaire") and financial institutions.

Before discussing reinsurance transactions, four points are worthy of mentioning. First, reinsurance contracts are not standardized and the contractual terms and conditions can vary

[23] To price their products so that rates do not have to increase significantly whenever a catastrophe occurs, primary insurers estimate future expected losses from insured catastrophic events and calculates catastrophe loadings applicable to all property insurance rates. All homeowners' insurance rates include a component for this special catastrophe loading. Insurers offering insurance for catastrophic risk charge this load to build up reserves and purchase reinsurance. Catastrophe ratemaking procedures require the actuary to evaluate 30 years to 50 years of actuarial reported incurred loss data from many states subject to similar types of events, isolate the atypical catastrophic element, and then measure that catastrophic element against total losses. Data from the experience period losses rarely have direct impact on the catastrophe loading calculation for the current policy year, or in the state where the event occurred; instead, the recent catastrophe loss data are used to update the catastrophe loading calculation, which would be applicable to policies issued after the disaster. This process of spreading catastrophe losses on a state, regional, or national basis over a multiyear period has led in the past to the least disruption in insurance markets, in terms of price increases, insurer pullouts, and coverage restrictions.

widely from line-to-line and from market-to-market. Second, primary insurers will transfer risk to a reinsurer for five basic reasons:

1. Stabilize underwriting results;

2. Provide protection against catastrophic losses;

3. Increase underwriting capacity or the limits of coverage an insurer can prudently assume based on its surplus and the nature of the business written;

4. Enable an insurer to write a greater number of policies by reducing the size of the company's liabilities; and

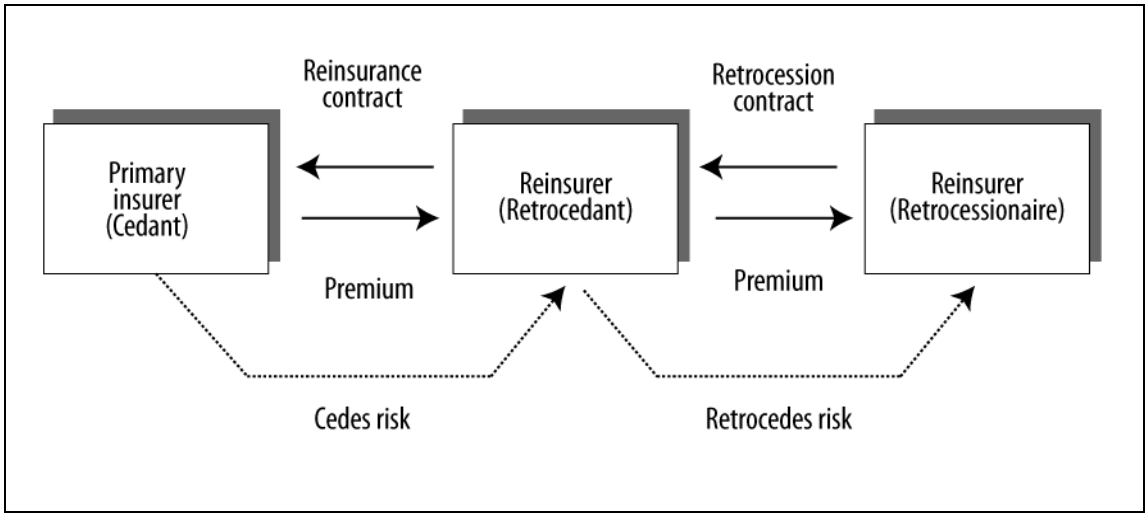
5. Provide a form of financing by increasing policyholder's surplus.

Third, insurers typically purchase reinsurance from three sources: "professional" reinsurers, whose exclusive business is reinsurance; reinsurance departments of primary companies; and various organizations, such as reinsurance pools or syndicates, Lloyd's, and government-owned companies.

Fourth, the regulation of reinsurance transactions is limited. Regulation occurs in the state insurance regulator granting credit for reinsurance on the balance sheets of the primary or ceding insurer. However, professional reinsurers domiciled in the United States must meet statutory licensing requirements (e.g., solvency and annual statement filing) similar to those required of a primary insurer in the state in which it is applying for permission to do business.

Figure 3 illustrates the basic financial hedging strategy of insurers using a reinsurance contract. Under a typical reinsurance agreement, the primary or direct insurer (cedant) transfers to the reinsurer (retrocedant) a portion of the risk the primary insurer accepted in issuing insurance policies. The primary insurer agrees to pay the reinsurer a premium in exchange for the reinsurer's promise to indemnify the insurer, according to a specific formula. The expectation of indemnification (reinsurance "recoverables") from the reinsurer enables the primary insurer to plan for contingencies more effectively by limiting the liabilities they assume. This, in turn, allows the insurer to provide greater amounts of insurance coverage on a direct basis. The reinsurer, in turn, may transfer to another reinsurer (retrocessionaire) a portion of the risk they have taken on from the primary insurer.

Figure 3. Illustration of Reinsurance and Retrocessionaire Transaction



Source: CRS presentation.

Types of Reinsurance Agreements

There are two forms of reinsurance, which differ in the way primary insurers and reinsurers determine premiums and losses: proportional ("treaty") and non-proportional ("facultative"). Proportional reinsurance covers broad groups of policies. Proportional reinsurance arrangements cover all of a primary insurer's business or group of policies.

Proportional reinsurance agreements obligate the insurer and reinsurer to share losses and premiums in fixed proportions. The reinsurer retains the "faculty" or power to accept or reject all or part of any policy offered to it, and the insurer has the option to purchase reinsurance for a certain policy, and if so, when and from whom.

Non-proportional or "excess of loss" reinsurance agreements cover specific, individual risks. Under the arrangement, the ceding insurer is indemnified for the portion of a loss that exceeds a specific amount (the ceding insurer's net retention), subject generally to a fixed limit of reinsurance. The premium paid by the insurer for excess-of-loss reinsurance typically bears no proportional relationship to the original premium paid by the policyholder. The rate is usually based on the potential for loss. Excess-of-loss agreements may cover policies on an individual basis or an occurrence, such as a tornado, an earthquake, or an aggregate of losses incurred over a period of time, usually a year.

The two types of proportional plans are "quota share" and "surplus share." Under a quota-share agreement, the insurer cedes a fixed percentage of each policy written in a certain line or class of business and receives a commission from the reinsurer for the business ceded. Under a surplus-share agreement, the primary insurer's retention is stated as a dollar amount. If the amount of insurance under a policy is less than the retention, no liability is ceded. If it is greater than the retention, the excess—the remainder of liability up to the liability limits—is reinsured. The premium is shared in the ratio of the retained liability to ceded liability.

The catastrophe insurance market includes risk transfer through insurance and reinsurance contracts as well as risk financing alternatives to reinsurance, namely, the securitization of insurable risk and insurance derivatives such as futures and options.

The next section analyzes the private insurance industry's risk transfer capacity; it excludes underwriting capacity from the reinsurance market and alternative risk transfer instruments.

Insurer Claims-Paying Capacity

The insurance industry's capacity to assume catastrophic natural disaster risk depends on how much capital and surplus exist on their balance sheets to absorb the annual variance in unexpected catastrophe losses. Within the context of a potential mega-catastrophic event, several scenarios could overwhelm the catastrophe insurance industry's claims-paying capacity. For example, according to Aon Benfield, a reinsurance intermediary, global reinsurance capital stood at $505 billion in 2012.[24] Although this level of capital might suggest the catastrophe insurance market industry is well capitalized, not all the global reinsurance capital is dedicated to financing U.S. catastrophic risks. Moreover, most disaster insurance experts agree that reinsurers appear no longer able to provide complete diversification of catastrophic risk both because catastrophic natural disasters appear to be correlated across risk and estimates of the probable maximum loss (PML) from catastrophes have risen dramatically.[25] Most experts argue that for the very highest layers of catastrophe risk, federal disaster relief (and consequently the taxpayer) is now, by default (due to limited private-sector capacity in the traditional reinsurance market), the insurer of last resort, particularly for uninsured property owners.

At the Congressional Research Service's (CRS's) request, AIR Worldwide Corporation, a catastrophe-modeling firm based in Boston, provided simulated estimates of potential insured catastrophe losses caused by U.S. hurricanes, earthquakes, and the fires that follow earthquakes. Loss estimates for the 1%, 0.4%, and 0.2% annual occurrence probabilities are illustrated in **Table 3**, which correspond to return periods of 100-, 250-, and 500-year losses, respectively.

[24] Aon Benfield, "Reinsurance Market Outlook: Reinsurance Capacity Growth Continues to Outpace Demand," January 2013, located at http://thoughtleadership.aonbenfield.com/Documents/20130103_reinsurance_market_outlook_external.pdf.

[25] Hurricane Hugo was an unexpected but manageable $4 billion catastrophic loss event. After Hugo, the industry's probable maximum loss (PML) for a catastrophic hurricane event was $8 billion. Many disaster insurance risk experts say the market for catastrophic risk changed after Andrew and the Northridge earthquake in 1994. Insurers began to use computer simulation modeling in their pricing, requiring hurricane deductibles, and generally began to withdraw coverage from high-risk coastal areas if they could not price risk to cover significantly higher future expected catastrophic natural disaster losses.

Table 3. Estimated Insured Hurricane and Earthquake Losses Nationally and for 10 States for 1-in-100-Year, 1-in-250-Year and 1-in-500-Year Catastrophes

($ in millions)

Rank	Area/State	100-Year Expected Loss (1%)	250-Year Expected Loss (0.4%)	500-Year Expected Loss (0.2%)
	United States	$108,387.18	$164,525.21	$217,031.79
1	Florida	87,764.37	144,249.92	200,125.61
2	California	38,955.37	66,317.74	94,020.46
3	Texas	21,314.38	32,808.29	44,156.20
4	Louisiana	12,121.11	18,552.82	24,530.98
5	New York	9,331.85	24,587.73	35,829.62
6	North Carolina	9,326.91	15,343.76	21,395.14
7	South Carolina	7,706.53	14,629.53	20,559.48
8	Alabama	6,022.22	11,402.77	16,255.20
9	Massachusetts	4,968.07	9,134.62	13,793.45
10	New Jersey	4,003.32	10,699.68	17,597.08

Source: AIR Worldwide, Inc.

As shown in **Table 3**, AIR Worldwide Corporation found that the national PMLs for hurricanes and earthquakes are $108.4 billion for the 1% return period, $164.5 billion for the 0.4% return period, and $217 billion for the 0.2% return period. The corresponding numbers for earthquakes and fire (combined) losses are $50 billion for 1% events, $90 billion for 0.4% events, and $119 billion for 0.2% events.

Table 4 shows the operating financial budget for the U.S. property and casualty insurance industry—both commercial and residential—for 2008 through 2012. As shown in the table, the U.S. property and casualty industry had a $586.9 billion surplus in 2012. At first, it would appear that this surplus for unexpected losses would be sufficient for the property and casualty insurance industry, as a whole, to be able to underwrite the levels of catastrophe insurance needed to address the level of losses estimated in **Table 3**. However, only about 20% of the industry-wide policyholder surplus, a measure of capacity, is generally considered to be allocated to catastrophe property insurance lines of business. The remaining 80% is used (some would argue needed) to support non-catastrophic risks. This suggests that approximately $108 billion of policyholders' surplus is available for catastrophic property losses nationwide. When comparing this amount of insurer claim-paying capacity to the PML, arguably the insurance industry's financial resources could be insufficient to cover anything more than a 1-in-100 year loss.

Table 4. U.S. Property and Casualty Operating Results, 2008-2012

($ billions)

	2008	2009	2010	2011	2012
Net Earned Premiums	$438.1	$419.0	$420.5	$433.9	$449.4
Incurred Losses & Loss Adjust Expenses	339.2	306.7	309.1	344.5	335.0
Expenses	118.1	113.4	119.5	124.0	129.0

	2008	2009	2010	2011	2012
Policyholder Dividends	2.0	2.0	2.3	1.9	2.1
Net Underwriting Gain (Loss)	(21.2)	(3.1)	(10.4)	(36.5)	(16.7)
Investment Income	51.2	47	47.2	49.0	47.7
Other items	(0.1)	0.8	1.0	1.2	2.3
Pre-Tax Operating Gain	29.9	44.7	37.8	14.8	3.3
Realized Capital Gain (Losses)	(19.8)	(8.0)	5.7	7.2	6.2
Pre-Tax Income	10.1	36.7	43.5	22.0	39.5
Taxes	7.7	8.4	8.9	2.9	6.0
Net After-Tax Income	**2.4**	**28.3**	**34.7**	**(19.2)**	**33.5**
Surplus (End of period)	455.6	511.5	556.9	550.3	586.9
Combined Ratio[a]	105.1	101.0	102.4	108.2	103.2

Source: Insurance Information Institute.

Notes: Figures may not add to totals due to rounding.

a. Insurers use the term "combined ratio" as a measure of underwriting profitability. It reflects the percentage of each premium dollar an insurer spends on claims and expenses. The combined ratio does not take investment income into account. A combined ratio above 100 indicates an underwriting loss.

To some, this line of reasoning arguably suggests federal intervention in catastrophe property insurance markets to address potential market failure in the range between the 0.4% to 0.2% return periods.[26] Some finance experts may also be concerned about projections that catastrophic losses will likely double every 10 years and the present government insurance approach might not be adequate.[27] John Seo, co-founder and managing principal at Fermat Capital Management, LLC, has asserted that a government insurance program might become challenged in its ability to cover losses for less than one generation's worth of exposure growth.[28] As an illustration, a $100 billion exposure is anticipated to become $200 billion after 10 years; $400 billion after 20 years; and $800 billion after 30 years. Ten years ago, a 1-in-100 event would have cost insurers $55 billion. Ten years from now a 100-year event could cost $220 billion.

In light of the concerns about the capacity of insurers to pay claims after mega-catastrophes, primary insurers have increasingly turned to private capital markets for risk-transfer capacity to complement traditional reinsurance markets. Professor Kenneth A. Froot of Harvard University

[26] This analysis simplifies the complex worldwide market for catastrophe property insurance and is intended only to provide an indication of the industry's overall claims-paying capacity. This analysis, for example, does not determine the potential effect of natural catastrophes on the financial strength of insurers nor does it consider offsets from the broad spread and syndication of risk through heavy use of reinsurance, much of it foreign. A significant share of the impact on surplus associated with a mega-catastrophic event would be transferred to the insurance industry balance sheet in foreign countries like Germany, Great Britain, Switzerland, and Bermuda. In addition, the analysis does not consider the total amount of catastrophe reinsurance provided by state residual markets or state catastrophe funds that would increase the overall ability to insure catastrophic risks. As stated above, some insurers and reinsurers are able to raise new capital after a major catastrophic event.

[27] Insurance Services Office, "Catastrophe Losses Will Double About Every 10 Years, Says Leading Catastrophe Modeling Expert at PCS Conference," located at http://www.iso.com/index.php?id=2276&option=com_content&task=view.

[28] John Seo, "Telephone communication with the author," May 16, 2007.

has suggested that one reason for the search for alternatives to reinsurance has been the supply restrictions associated with capital market imperfections and market power exerted by traditional reinsurers.[29] This situation is a matter of basic economics of supply and demand: a limited number of reinsurers with specialized knowledge and unique access to global capital markets can exert substantial control over prices and supply. Given recent historical losses and concerns with future mega-catastrophes, there is some concern that catastrophe reinsurance capacity may be insufficient to meet societal demand.

State-Sponsored, Loss-Sharing Financing Mechanisms

The exclusion of wind, water (flood), and seismic perils in the standard homeowners' insurance policy led some states, beginning in the 1970s, to establish state pooling systems to finance natural hazard risks. These state-sponsored, so-called residual or involuntary property insurance pools include Fair Access to Insurance Requirements (FAIR) or Beach or Windstorm Plans and catastrophe funds that operate as insurers or reinsurers of last resort.

California, Florida, and Texas have created insurance companies—Florida Windstorm Underwriting Association, the Florida Citizens Property Insurance Company (CPIC), Texas Windstorm Insurance Association, and the California Earthquake Authority (CEA)—that provide wind and seismic insurance to high-risk property owners who may have difficulty obtaining such coverage from the voluntary property insurance market. Industry assessments support these entities.

FAIR Plans often provide property insurance in both urban and coastal areas, while state-run Beach and Windstorm Plans cover predominantly wind-only risks in designated coastal areas in states along the Gulf of Mexico and the Southeast Atlantic coast region. The CEA covers only primary residential buildings and provides limited coverage for building contents. Financing for the CEA comes from a combination of up-front and contingent insurer contributions, traditional reinsurance, and revenue bonds.

Florida has a unique program for financing catastrophe losses through implicit reinsurance contracts backed, in part, by the state's taxing authority. The Florida Hurricane Catastrophe Fund (Cat Fund) is a mandatory, state-sponsored catastrophe-reinsurance pool for property insurers writing business in Florida. Property insurers are required to maintain a retention—responsibility for a first dollar amount—against qualifying catastrophes in the state, but they may select to participate at one of three reinsurance coverage levels. The Cat Fund has the authority to spread the burden of unusual losses intertemporally through deficit financing—essentially imposing an intergenerational tax on future generations of state taxpayers.

In the wake of recent catastrophic losses, uncertainties surround the growing residual liabilities in state-run insurance pools and incentives to redistribute disaster losses to future generations (deficit financing). Some disaster insurance experts have proposed multistate pools on a regional or national level as a more effective mechanism for spreading and sharing disaster losses.[30]

[29] Kenneth A. Froot, "The Market for Catastrophe Risk: A Clinical Examination," *Journal of Financial Economics*, May 2, 2001, pp. 529-571.

[30] George L. Priest, "The Government, the Market, and the Problem of Catastrophe Loss," *Journal of Risk and Uncertainty*, 12: 219-237, 1996.

Alternative Risk Transfer Techniques

After Hurricane Andrew in 1992 and the Northridge earthquake in 1994, there was recognition among insurers that existing capital within the insurance industry was inadequate to finance insurance risks. Some insurance industry participants were beginning to view the capital markets as a potential source of additional capacity. Deregulation of financial markets, the globalization of business, and innovation and technological advances in the 1980s and 1990s led to the evolution of derivatives as a risk management tool, and the application of securitization (the financial practice of pooling various types of assets into a security that can be purchased) to new insurance product lines, especially involving more esoteric or unique forms of insurance risk.

Consequently, capacity constraints in the insurance and reinsurance markets, corporate demand for more efficient risk financing (hedging) strategies, and the arrival of innovative capital market financial instruments created the market conditions whereby the insurance markets began to rethink the management of risk across traditional boundaries. This led to the development of alternative risk transfer (ART) techniques that could package insurance risk into discrete securities with finite risk, such that insurance risk could be traded and hedged in much the same way that interest rate risk is traded today.

In general, there are two categories of ART methods for financing catastrophic risk: (1) insurance-linked securities (catastrophe risk bonds) and exchange-traded insurance derivatives (catastrophe options and swaps); and (2) contingent risk financing. These ART techniques, driven by the need for risk management ("hedging"), balance sheet management, and capital management, have blurred the traditional distinction between insurance, securities, and banking.

The first catastrophe risk securitization was the introduction of insurance derivative contracts (index-linked catastrophe futures and catastrophe put and call options) traded on the Chicago Board of Trade (CBOT). By the late 1990s, several exchanges had introduced futures-and-options contracts on U.S. hurricane risk. Insurance securitization now represents a major risk-financing tool for transferring (hedging liabilities) windstorm and earthquake risk to investors in the capital markets.

Insurance-Linked Securities and Derivatives

Insurance-linked securities (ILS) permit the transfer of event risk assumed by insurers directly to investors through event-linked issuance of debt. For example, catastrophic risk (CAT) bonds are ILS that performs a risk transfer function similar to that of insurance and reinsurance. CAT bonds are purchased in the capital markets. With a Cat bond, investors place cash into a trust account from which they receive interest payments. The funds in the account are transferred to the insurer only on the occurrence of a defined catastrophic event. Also, exchange-traded insurance derivatives enable the trading of standardized, catastrophe event-linked futures and options contracts linked to some index to improve risk sharing.

Contingent Risk Financing

Contingent risk financing enables insurers and reinsurers to use contingent credit facilities to bridge financially the period between natural disaster events and the execution of post-event financing. Contingent financing instruments are designed to pre-finance insurance–related losses

but without a transfer of the underlying insurance risks from insurer to capital market investors. The insurer only receives an inflow of capital to replenish its policyholders' surplus after it pays for the loss. The insurer pays a capital commitment fee to the party that agrees in advance to buy the equity or debt securities following a loss. Contingent capital can be available to insurers immediately after a catastrophe, when the insurer most needs that capital, through a wide range of alternative capital sources, such as contingent surplus notes, catastrophe equity put options, sidebars, or industry loss warrants.

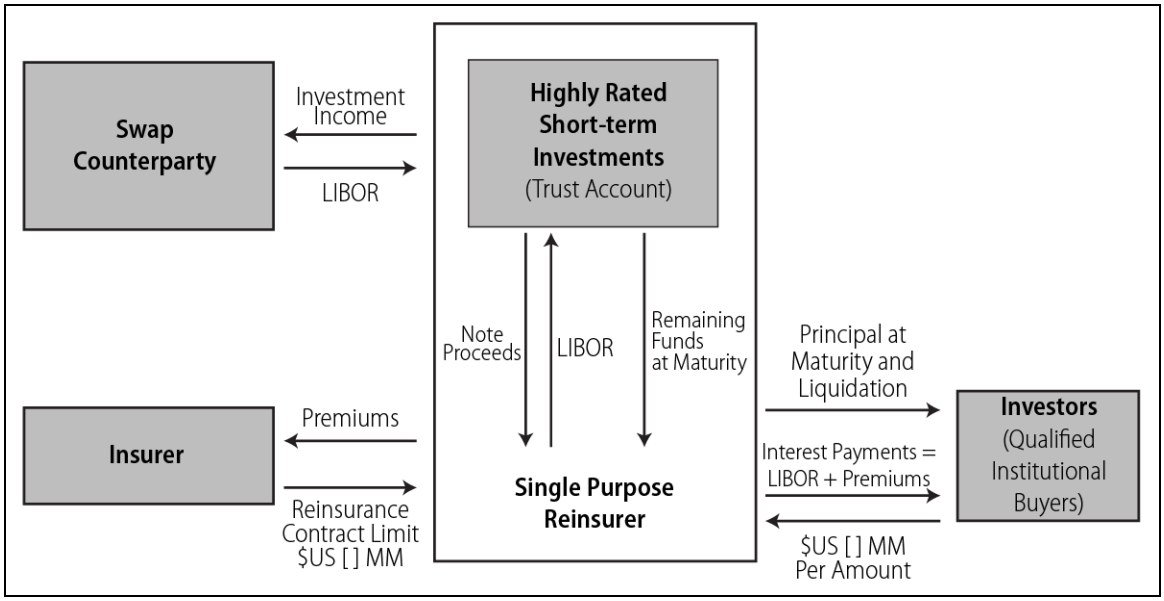
The following discussion of ART instruments provides more in-depth information on the innovative uses of capital markets instruments, which are designed to achieve greater efficiency in catastrophic risk financing.

Catastrophic Risk Bonds

The most common form of insurance linked securities is a catastrophic risk (CAT) bond used to supplement the traditional reinsurance marketplace. The securitized structure of a CAT bond is modeled on asset-backed securities transactions, such as mortgage loans, automobile loans, and student loans. The bonds are fully collateralized (eliminating concerns about credit risk), multi-year risk transfer financial (intertemporal diversification) instruments that allow for the direct transfer of catastrophic insurance risks from insurers, reinsurers, and corporations to investors in the capital market. The CAT bond typically covers the so-called high layers of reinsurance protection, for example, protection against events that have a probability of occurrence of 0.02% or less—that is, a return period of 50 years. CAT bonds provide an effective way for investors to target their investments and for insurers to access underwriting capacity from the larger capital markets.

Figure 4 shows a typical catastrophe bond issuance. The CAT bond transaction begins with the formation of a special-purpose reinsure (SPR)—a reinsurance company incorporated with the specific purpose of entering into a reinsurance agreement between the insurer ("cedent" or "bond sponsor") and the investor. The SPR issues bonds to investors and invests the proceeds in short-term securities, such as government bonds or AAA corporate securities held in a trust account. The insurer pays a premium to the investor, usually LIBOR (London Interbank Offered Rate) plus a risk premium in return for providing capital to the trust. To avoid interest-rate risk, the fixed returns on the securities held in the trust are swapped for floating returns based on LIBOR or some other widely accepted index. The bond pay-off is triggered (structured to pay off) by a defined catastrophic event. On the occurrence of the event, investors are subject to the loss of interest, principal, or both and the trustee for the trust account will release the principal in the SPR to help the insurer pay claims arising from the event. If no contingent event occurs, the trustee returns the principal to the investor upon the expiration of the bonds.

Figure 4. Illustration of Catastrophe Bond



Source: Cummings, J.D. and Barrieu, P., "Innovations in Insurance Markets: Hybrid and Securitized Risk-Transfer Solutions," in Georges Dionne, ed., *Handbook of Insurance*, 2nd ed., Boston: Kluwer Academic Publishers, 2012.

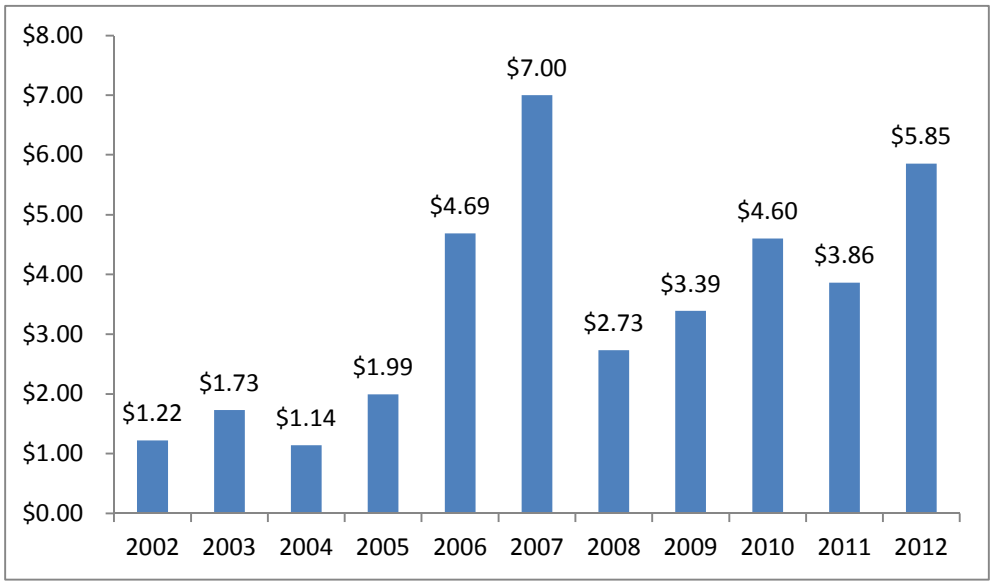
According to Guy Carpenter & Company, a provider of risk and reinsurance intermediation services, institutional asset managers—the custodians of trillions of dollars of investable assets—have largely accepted catastrophe risk as a component of mainstream investment strategy.[31]

Figure 5 and **Figure 6** show catastrophe bond issuance totaled $5.85 billion in 2012, up from $3.86 billion in 2011. Catastrophe bond risk capital outstanding rose from $12.14 billion to $14.83 billion during the same period. In 2013, financial experts expect the market to approach, or exceed, the record for annual issuance of $7.0 billion set in 2007. Total risk capital outstanding increased during the first quarter of 2013, reaching an all-time high of $15.0 billion. This marked the eighth consecutive quarter of growth in risk capital outstanding, up more than 17% since the end of the first quarter of 2012. Although most disaster insurance risk experts see the expansion of the use of CAT bonds as an encouraging development in managing disaster risk, they also note that taxation, accounting, and regulatory barriers limit the likelihood of a rapid expansion of the insurance-linked securitization market.

[31] Guy Carpenter & Company, LLC, "Catastrophe Bond Update: First Quarter 2013," May 2013, located at http://www.guycarp.com/portal/extranet/insights/briefingsPDF/2013/Catastrophe%20Bond%20Update%20First%20Quarter%202013.pdf;JSESSIONIDGCPORTALWCPORTALAPP=pjRQR2ZMLy5n2ppDpPxyl9lj5L5TdLYz4KTzdryXCkHpjs2bZg1p!-2116277995?vid=5.

Figure 5. Catastrophe Bonds, Annual Risk Capital Issued, 2002-2012

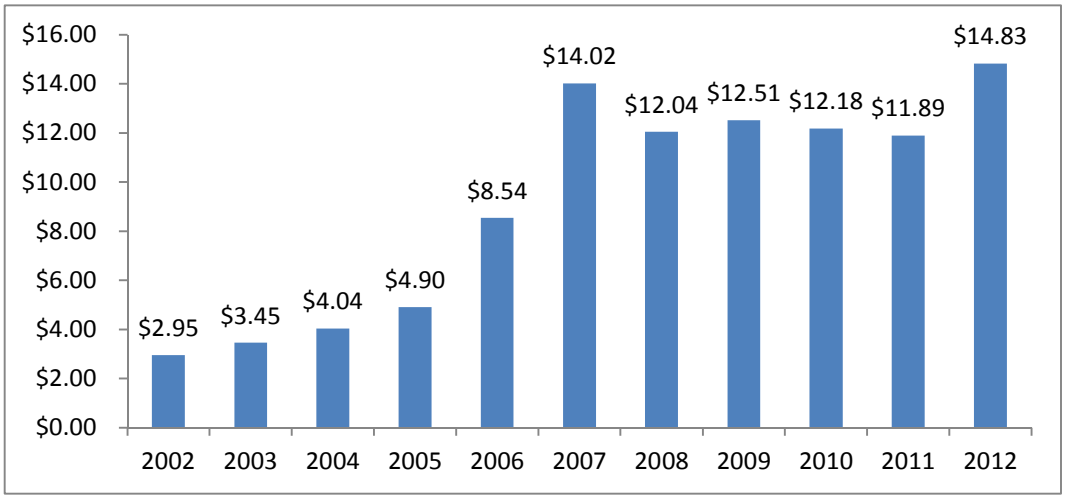
($ billions)



Source: Guy Carpenter & Company and Insurance Information Institute.

Figure 6. Catastrophe Bonds, Risk Capital Outstanding, 2002-2012

($ billions)



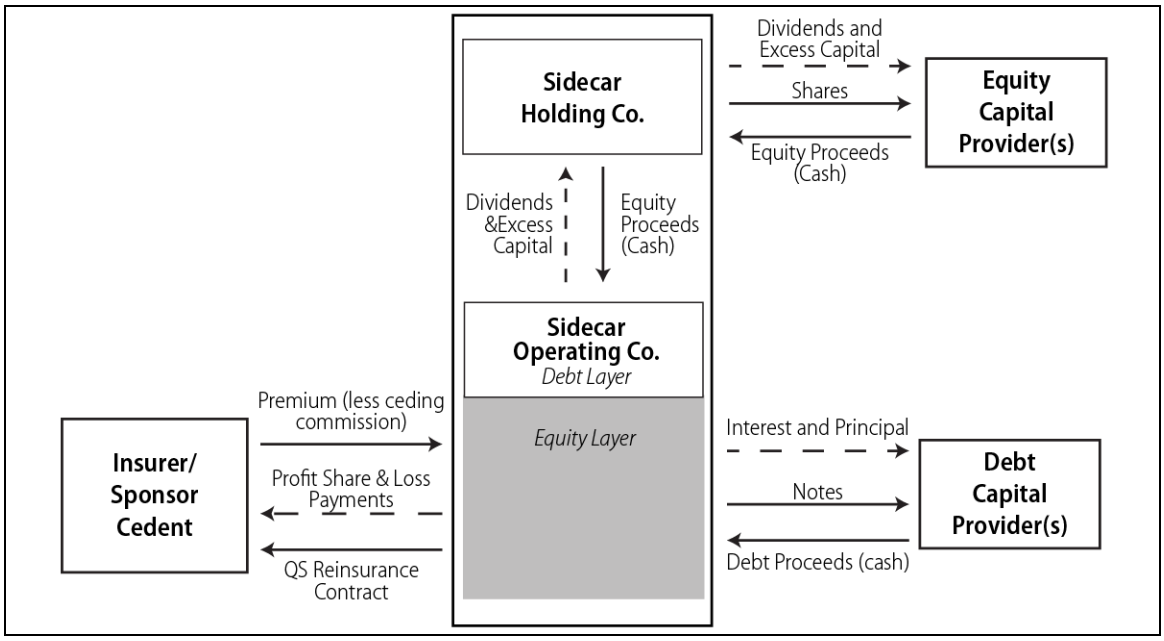
Source: Guy Carpenter & Company and Insurance Information Institute.

Sidecars

Figure 7 shows a sidecar transition, which is an innovative financial vehicle established as a special-purpose vehicle (SPV) formed by an insurance or reinsurance company to provide additional capacity to write reinsurance. Reinsurers favor the sidecar because they provide additional capacity without diluting shareholders' equity. The SPV operates as a side vehicle—referred to as a "sidecar" company—to a larger established reinsurer's operation. The sidecar (1) diversifies or spreads an individual reinsurer's risk among the reinsurance community by issuing

fully collateralized debt to its investors and (2) acts as a stop loss by partitioning reinsurers' risks to improve their financial strength ratings by reducing the volatility of their earnings.

Figure 7. Illustration of Sidecar Transaction



Source: Cummings, J.D. and Barrieu, P., "Innovations in Insurance Markets: Hybrid and Securitized Risk-Transfer Solutions," in Georges Dionne, ed., *Handbook of Insurance*, 2nd ed., Boston: Kluwer Academic Publishers, 2012.

Operationally, an insurer or reinsurer will establish a sidecar by transferring policies and premiums to an SPR that uses the funds as collateral for bonds, loans, and equity. Hedge funds and private equity investors have provided the bulk of the funds to capitalize these unusual insurance investment vehicles. Investors would agree, for example, to invest the funds for two to three years and typically earned 20% to 30% return or more on their investments. The reinsurer creating the sidecar receives a commission. Investors typically obtain a relatively high investment return through interest payments and dividends from the trust when the sidecar expires, assuming that all of the capital has not been used to meet claims payouts.

Industry Loss Warrants

An industry loss warrant (ILW) is a contract between two insurers and is not pre-funded. Unlike traditional reinsurance, where the reinsurer pays a portion of the primary insurer's losses according to an agreed-upon formula, the ILW is triggered by a predetermined level of industry loss. However, the ILW has a second trigger based on indemnity losses. The contract "warrants" that the reinsurer will pay up to a specific amount toward the buyer's losses if the industry suffers a predetermined loss amount after the industry loss is triggered.

Industry loss trigger(s) are structured to provide prompt payment when, or if, aggregate industry losses for covered risks exceed a certain threshold for a single occurrence or sequential occurrences over the contract term. Importantly, since ILWs are priced and underwritten based on expectations of industry loss, underwriting information about the (re)insurance company is not needed, and the process and cost associated with these risk transfers is generally less significant

than other options. The largest risk to the buyer of protection with these vehicles is basis risk. It is very possible that a (re)insurer could incur substantial losses, while the industry's losses do not exceed the payout trigger. Therefore, these contracts are typically very attractive to larger insurers that have exposures mimicking the broader industry.

Catastrophe Equity Puts

Catastrophe equity puts (Cat-E-Puts) are a form of contingent financing transaction in which the buyer has the option to issue preferred stock at a pre-agreed price on the occurrence of a contingent event. Insurers typically use Cat-E-Puts to raise equity capital at a favorable price after a catastrophe, when its stock price is likely to be depressed.

Cat-E-Puts are not asset-backed securities but options. A catastrophe equity put provides contingent capital on a post-loss basis, similar to a standby credit facility. A put option provides the option holder the right, but not the obligation to sell a security at a certain price at a future time. In this case, a reinsurer grants the option holder the right to sell its equity to the reinsurer at a set price in the event of a catastrophic loss.

The Cat-E-Put option buyer pays an option premium to the provider—option writer—of contingent capital. The option gives the buyer the right to obtain capital at pre-negotiated rates following the occurrence of a catastrophic event that exposes the company's capital beyond the insurance or reinsurance program in place at the time of the event. Catastrophe equity puts provide off-balance sheet risk capital at a lower cost than conventional reinsurance.

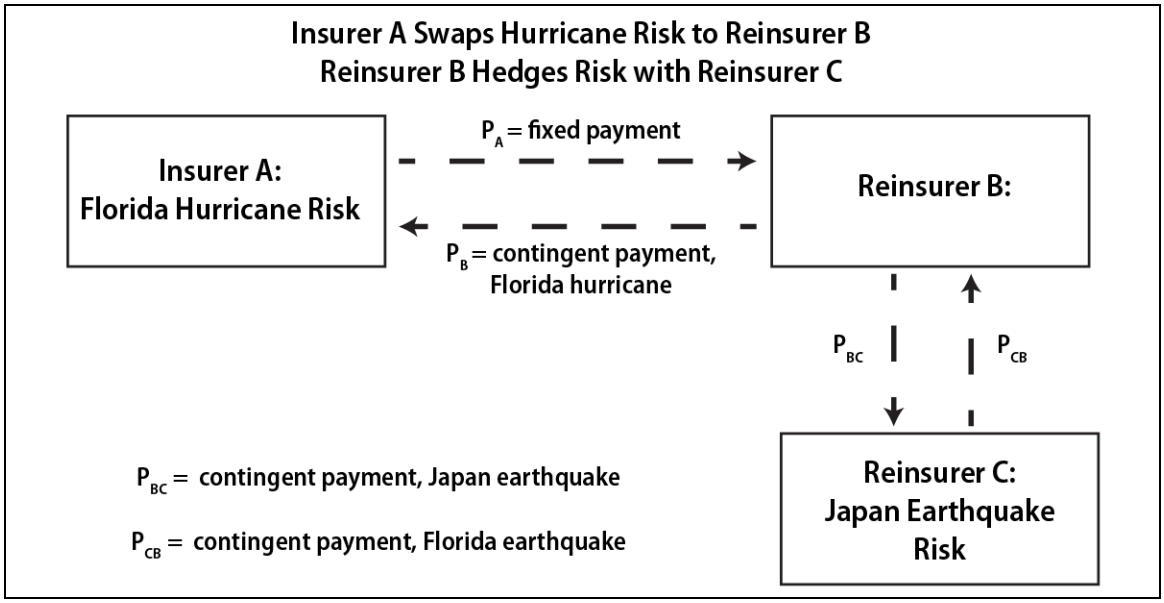
Catastrophe Risk Swaps

Figure 8 provides an illustration of how catastrophe risk swaps are executed between two counterparties, which have agreed to exchange streams of cash flows, based on movements in the value of an asset, yield, or index, according to predetermined rules. The swaps are traded in the over-the-counter market. The swap is executed on a zero premium basis, provided the difference in riskiness can be agreed upon.

In a catastrophe insurance swap, insurers may exchange policies from one region of the country for policies in another region. Each swap is a reciprocal agreement between the two insuring entities. These transactions allow insurers to diversify their portfolios. For example, an insurer in Florida with a heavy concentration of hurricane-exposed risk can swap a portion of that business for a book of business in Illinois, where it is less exposed to the same risk.

A different kind of swap could involve an insurer exchanging a series of fixed predefined payments for a series of floating payments whose values depend on the occurrence of an insured catastrophic event. If the catastrophic event occurs, the insurer receives a higher cash flow from the floating payment stream, which can be used to offset claim payments. Catastrophe swaps make existing capital more efficient and provide an advantage to both parties because they result in reduced risk and improved diversification at no cost.

Figure 8. Illustration of Catastrophe Swap



Source: Cummings, J.D. and Barrieu, P., "Innovations in Insurance Markets: Hybrid and Securitized Risk-Transfer Solutions," in Georges Dionne, ed., *Handbook of Insurance*, 2nd ed., Boston: Kluwer Academic Publishers, 2012.

Key Challenges Facing Insurance Risk Securitization

Although catastrophe bonds trade with a somewhat higher spread over traditional debt, lack of standardized contracts, relatively limited trading volume due to a lack of liquidity, high cost, and uncertainty surrounding accounting, regulatory, and rating-agency treatment inhibit ILS market growth.

In general, the insurance-linked securitization market faces several challenges:

1. Uncertainty concerning the probability of catastrophic loss stemming from climate change, sea level rise, and storm surge;
2. Lack of uniform standards (e.g., language), institutional infrastructure, and methodology to evaluate the costs and benefits of risk transfer instruments that would facilitate comparison to conventional reinsurance;
3. Lack of standardized contracts for future delivery on organized exchanges (futures), and rights, but not guarantees for future delivery (options markets);
4. Unfavorable tax treatment of onshore securitization inhibits their utilization (regulatory recognition of offshore securitizations could encourage insurers to use this approach to manage their catastrophe risk);
5. Lack of tradable market indices (or granular data) for parametric transactions based on an index or a formula for payment; and
6. Limited secondary market makes insurance risk transfer instruments relatively illiquid.

Government Intervention in Risk-Transfer Markets

Since the mid-1990s, most policymakers and insurance industry participants have agreed that a catastrophic natural disaster could cause an unexpected and sudden large loss of insurers' capital reserves, leading to a rise in the price of insurance and a fall in supply. Given this risk scenario, some have called for an expanded role for the federal government in catastrophe insurance markets, arguing that such intervention is necessary to address market failure. Intervention could take any of several forms designed to expand the private sector's ability to provide catastrophe insurance, such as adding a high-end federal reinsurance backstop, providing short-term government liquidity loans, or offering federal multiple-peril homeowners insurance policies covering both wind and flood damages.

Arguments for Intervention

Proponents of federal intervention argue that the government is the *de facto* insurer of last resort for mega-catastrophes, largely because the government is presumed to be better positioned to bear catastrophe risk because of its broad resource base and borrowing capacity.[32] The federal government, however, currently lacks a comprehensive approach to manage the effects of catastrophic natural disasters, relying instead on ad-hoc disaster relief spending to facilitate recovery and rebuilding following a major disaster.

Federal financial intervention in the catastrophe reinsurance market, some contend, could reduce the burdens for future disaster relief expenditures, promote efficient risk management by property owners, and encourage individuals and states to take steps to reduce loss exposure, ultimately resulting, in theory, in overall lower social and federal costs. Some argue that an explicit *ex ante* federal government catastrophic risk financing approach would arguably be the best way to assess, budget, and plan for the future cost of catastrophe risks before such events occur.[33]

Arguments against Intervention

Opponents of federal intervention in catastrophe insurance markets insist that there is sufficient private insurance and reinsurance capacity to adequately cover catastrophic risks. They insist the federal government's role in disaster risk financing should be to ensure a framework that allows private market mechanisms to work without local regulatory interference (i.e., regulatory price constraints that seek to keep premium rates below actuarial rates).[34] In their view, federal intervention in catastrophe insurance markets is likely to have negative unexpected side effects, such as moral hazard, and reduces the economic disincentives for homeowners and businesses to locate in disaster-prone areas or neglect risk prevention. They argue that private insurers, state residual markets, and state catastrophe funds already protect coastal properties, and federal

[32] National Association of Insurance Commissioners, "Natural Catastrophe Risk: Creating a Comprehensive National Plan," June 15, 2009, located at http://www.naic.org/documents/committees_c_natural_catastrophe_plan_final.pdf.

[33] Ibid.

[34] See Mark A. Hofmann, "Insurers, Reinsurers Oppose National Catastrophe Fund for Homeowners," March 24, 2013, located at http://www.businessinsurance.com/article/20130324/NEWS04/303249981#; and Personal Letter from Chris Hackett, Director, Policy Development and Research, Property Casualty Insurers Association of America to Matthew A. McKenney, Federal Insurance Office, U.S. Department of the Treasury, June 24, 2013, located at http://www.pciaa.net/web/sitehome.nsf/lcpublic/379/$file/PCI_Comments_FIO_Nat_Cat_062413.pdf.

government intervention would only distort the insurance market by regulating the availability of coverage and level of premiums, displacing private capital deployed in insurance and reinsurance, and stifling innovative private sector solutions for managing and financing catastrophic risks.[35] Government insurance schemes, they say, would not reflect the risk level of the activity being insured, thereby eliminating a potentially powerful economic deterrent to risky behavior. Moreover, government intervention could force the public at large to cross-subsidize the risky behavior of residents in high-risk areas.

Potential Points of Agreement

Some consensus is that the federal government could use its regulatory authority to create incentives for private capital to flow into the property insurance market, such as establishing strong building codes, encouraging effective land planning techniques, and requiring a state insurance regulatory environment that fosters competition and risk-based pricing. In addition, there is some consensus that the federal government could help decrease barriers in the nascent markets for insurance-linked securities (ILS) and provide liquidity through temporary loans designed to stabilize the market after a mega-catastrophe. Other "common ground" topics include clarifying accounting rules for special-purpose reinsurers and changing the rules to require foreign and domestic reinsurers to meet the same collateral requirements.

Legislative Options

Several catastrophic risk-financing legislative options are before the 113th Congress. For example, H.R. 737, the Homeowners' Defense Act of 2013, would establish a National Catastrophe Risk Consortium to facilitate both multistate pooling of catastrophic risks (covering a variety of event probabilities and types) and natural disaster-linked securitization, thereby strengthening the financial capacity of these programs.

H.R. 737 is designed to facilitate catastrophic risk transfer to capital markets and increase transparency (liquidity) in the market for catastrophic risk. The bill would establish the National Catastrophe Risk Consortium, a voluntary organization that states can choose to join that would be charged with facilitating financial innovation to allow participating states to transfer catastrophic risk to the capital market. The aim of the consortium would be to ensure the availability and affordability of homeowner's insurance coverage for catastrophic events. To facilitate catastrophe risk securitization, the consortium would use an integrated risk valuation method that identifies, tracks, and publicizes the risks embedded in financial transactions. The insurance risk securitization, serialization, bundling, and re-bundling of risk-adjusted assets within a single transaction process will be transferred to the capital market through a catastrophe risk interactive exchange platform.

In theory, the consortium would standardize natural catastrophe peril bond terms, tranches, and pay out formulae, which, in turn, would enhance the marketability/liquidity of risk-linked securities, such as catastrophe bonds structured to attract more capital. Credit rating agencies would rate the various tranches according to their expected loss. The consortium would issue catastrophe bonds, and other innovative financial instruments, using an electronic platform with a

[35] Ibid.

common legal structure and documentation. Securities would be issued by the consortium in an SEC 144A private placement to investors who are Qualified Institutional Buyers or similar classes of investors, and who sign an Investor Awareness Letter. Reinsurance credit would be granted by the insurance regulator based on the full collateralization of the reinsurance contract within a Regulation 112 trust, with suitable investment restrictions.

The consortium would transfer the catastrophe risk directly to international catastrophe reinsurance and capital markets on competitive terms. States would presumably grant reinsurance credit based on the full collateralization of the reinsurance contract within a Regulation 112 trust, with suitable investment restrictions. The consortium is structured to overcome regulatory and tax constraints to catastrophe risk transfer through securitization. Removal of regulatory and tax constraints associated with catastrophe bonds and other alternative financial instruments issued by the National Catastrophe Risk Consortium could, in theory, increase the capacity of the private capital market to assume more catastrophe risk.

H.R. 240, the Homeowners Insurance Protection Act of 2013, would create the National Commission on Catastrophe Preparation and Protection with the authority to establish a federal reinsurance program to make reinsurance coverage available to eligible state natural catastrophe insurance programs to improve the availability and affordability of coverage for homes, and the solvency and capacity of homeowners' insurance markets.

Congress could choose to provide tax incentives designed to expand the supply of capital reserves that stand behind private insurance. H.R. 549, the Homeowner Catastrophe Protection Act of 2013, would allow property and casualty insurance companies to make tax-deductible contributions to a tax-exempt policyholder disaster protection fund established for the payment of policyholders' claims arising from certain catastrophic events, such as windstorms, earthquakes, fires, or floods.[36] This tax law change would encourage the use of reinsurance by assessing the reserve amounts on net premiums.

Current tax provisions do not encourage insurers to reserve funds for unknown losses. Reserves for such contingencies can only be accumulated out of after-tax income. In contrast, reserves set aside for reported losses, or losses incurred but which have not been reported at the end of a given accounting period, are not taxed by the federal government. Allowing insurers to accumulate tax-deferred reserves for catastrophe perils would reduce federal tax revenue, and may involve tax benefits that favor one type of activity over another, raising issues of efficiency. Economists have raised the question of whether tax incentives for homeowners would be sufficient to get people to buy disaster insurance. Congress might decide to assess the cost-benefit of the provision for tax deductibility of catastrophe reserves against possible savings in ad hoc disaster relief outlays.

Congress might also choose to consider several other legislative options to address the financial consequences of catastrophic natural disaster losses. These include

- **Bipartisan Study Commissions.** Congress could choose to establish a bipartisan study commission to examine various proposals to improve capabilities of the insurance marketplace to provide sufficient capacity to facilitate the pooling and spreading of risk from catastrophic financial losses from natural disasters.

[36] See CRS Report RL33060, *Tax Deductions for Catastrophic Risk Insurance Reserves: Explanation and Economic Analysis*, by Rawle O. King.

- **Implement a Federal Multiple Peril Insurance Program.** In the aftermath of the devastation caused by Hurricane Sandy, one policy option that Congress might consider would be to authorize the creation of multi-peril property insurance policies that cover wind perils under the National Flood Insurance Program (NFIP). Multiple peril insurance could eliminate the problem of uninsured property owners, but it could also create new uncertain liabilities for federal taxpayers.
- **Federal Catastrophe Liquidity Loan and Debt Guarantee Program.** Congress might decide to authorize the U.S. Treasury to guarantee municipal obligations of state sponsored and quasi-state sponsored municipal bonds and provide liquidity loans to state "qualified reinsurance programs" for natural disasters. The loan program could dampen swings in insurance rates and address availability deficiencies caused by inefficient capital markets. The federal guarantees of debt issuance would complement existing state-sponsored measures that pre-fund insured property catastrophe exposures through insurance premiums and assessments on insurers.

Concluding Remarks

In recent decades, the financial volatility of large-scale natural catastrophes and the cost of financing recovery have emerged as important policy issues for Congress. However, besides the Terrorism Risk Insurance Act of 2002,[37] Congress has not approved an explicit federal disaster insurance law, since the creation of the NFIP in 1968, because of a lack of consensus that a catastrophe risk-financing problem exists. Concerns expressed have included disagreements about what constitutes adequate provisions for mitigation, a desire to avoid unnecessary government intrusion into markets served by the private sector (crowding out), moral hazards associated with government guarantees or economic subsidies that distort market incentives and increase social costs, and the potential for expanded financial liabilities and burden on federal taxpayers.[38]

With this in mind, a key policy challenge for Congress is determining whether private insurers and their reinsurance partners have the financial capacity to absorb losses from a future mega-catastrophe and, if necessary, what reforms would improve insurers' access to capital to ensure adequate capacity. Is there a need to improve the nation's ability to finance catastrophe risk and, if so, how? Congress, for example, might choose to consider the appropriate roles and policies of the public and private sectors in addressing disaster risks.

Three key points of view usually emerge when debating catastrophe-funding issues. One view is that natural catastrophes are "uninsurable" in the private sector and the federal government should intervene to either directly underwrite catastrophe risks or provide a federal reinsurance backstop to private insurers, reinsurers, or state pools. This view has not been widely supported in the past because it was believed that the private sector had access to sufficient capital to enable it to finance the cost of providing catastrophic insurance.

[37] P.L. 107-297; 116 Stat. 2322. For more information on the TRIA, see CRS Report R42716, *Terrorism Risk Insurance: Issue Analysis and Overview of Current Program*, by Baird Webel.

[38] U.S. Government Accountability Office, *Natural Disasters: Public Policy Option for Changing the Federal Role in Natural Catastrophe Insurance*, GAO-08-07 (Washington: November 26, 2007), located at http://www.gao.gov/new.items/d087.pdf.

A second point of view argues that catastrophe risk is insurable up to a point but federal involvement in the catastrophe insurance market would be required for a mega-catastrophic disaster. Many disaster insurance experts agree with this point of view; namely, for the very highest layers of catastrophe risk, the government (and consequently the taxpayer) is now, by default, the insurer of last resort. They support the idea of a public-private partnership in financing a mega-catastrophe. Such a public-private catastrophe insurance partnership would presumably leave the private sector responsible for underwriting property insurance and the federal government responsible for providing capital only when consumers and the private insurance and capital markets are unable to do so.

Under this arrangement, as envisioned by some disaster insurance experts, the government could facilitate a more effective risk spreading that achieves more effective pooling of losses over time and broader pooling of losses among risks through a borrowing mechanism (debt financing) and tax deferral of loss reserves for natural disasters. Broader pooling of losses among risks requires government-imposed mandatory purchase requirements. Economists note, however, that any scheme that imposes a mandatory insurance requirement for all property owners could create economic distortions, such as cross subsidization of risks, where low-risk individuals subsidize high-risk individuals.

A third point of view presupposes that financial resources in the private sector are sufficient to make federal intervention not necessary in catastrophe insurance markets. For risks to be insurable, however, they must be actuarially determined and risk-based, albeit potentially prohibitively high for the average household. However, if insurance rates are priced outside of the household budget of the average individual, the insurance product becomes essentially unmarketable—even with a government purchase mandate, as evidenced by the relatively low participation (purchase) rates in high-risk flood zones where a federal mandatory flood insurance purchase requirement exists.

In conclusion, several policy options for expanding the federal role in financing natural disaster losses are currently under consideration, but enactment into law will likely be based on whether it can be shown that potential catastrophe losses, in the absence of federal intervention, are beyond the capacity of private markets to diversify catastrophe risks.

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