Innovating to insure the uninsurable

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The importance of insurance, like many of life’s essentials, is most evident when it is not available. This sigma examines the limits of insurability and their implications. It also uses practical examples to demonstrate how insurers successfully innovate to overcome obstacles to covering new and evolving risks.

The concept of “insurability” is fundamental to the industry. Not every risk can be insured at all times. The concept underlying this observation is called “insurability”. Stated briefly, the essence of this concept is: risks that are insurable are measurable, bounded and well behaved. Premium rates must be acceptable to both insurers and insureds.

Two key challenges: covering new risks and understanding how existing risks evolve. Insurers face two types of insurability challenges: making new risks insurable and understanding how changes in the environment surrounding risks that are already covered affects these risks. As the world continues to change rapidly, new risks arise. The shift in the emphasis of industrialized economies from farming to manufacturing to services has changed the types of risks that businesses face. Intangible hard-to-measure risks loom ever larger. Many have proven difficult to insure. The insurability of a risk can change over time. History offers many examples of risks once deemed uninsurable for which solutions were later found. Conversely, there are risks like asbestos that insurers once covered but now shun.

Traditional tools and new approaches help widen the boundaries of insurability. In response to a changing corporate risk landscape, insurers have developed a variety of tools and techniques that extend the boundaries of insurability. Traditional but still very effective tools include: focusing on rigorous risk selection and product design; adjusting cover conditions, eg, with triggers and self-retention schemes; and developing new types of covers to better serve clients. Transferring risks to reinsurers and the government are also traditional solutions. Risk transfer to capital markets is barely a decade old.

Other innovations in the non-life market that help ensure insurability include captives, integrated programs, run-off solutions and committed capital solutions. Life market innovations include variable annuities, critical illness insurance and run-off solutions.

The limits to insurability can be shifted, but not abolished. Although insurance reduces the risk and uncertainty that clients face for a wide range of hazards, not all risks can be insured. Terrorism risk, for example, is very challenging for private insurers to cover. In some cases, a strong public interest in the provision of insurance might warrant government involvement to help insure a risk that would otherwise be uninsurable.

Securitization holds promise to make peak risks insurable. Despite the uncertainties that change creates, insurers will continue to innovate to meet their clients’ risk transfer needs. Future insurance solutions will further promote efficient risk sharing among insureds, (re-)insurers and capital markets. As the insurance-linked securities market reaps the benefits of scale economies, learning-by-doing and improved liquidity, securitization holds the potential to make coverage more available and affordable.
Our rapidly changing world challenges insurers to keep pace. Technological progress is a double-edged sword, raising new concerns for insurers even as it provides ways to address these concerns. Economic and political shocks are transmitted more rapidly and completely now than in the past.

The world’s growing interconnectedness accelerates the pace of change. From 1998 to 2003, as global population grew by 1% per year and real output rose by 2% a year, the volume of global trade increased by 4% a year; the stock of global foreign direct investment rose by 14% a year; the number of main telephone lines grew 6% a year, international call volume increased 10% per year, and the number of Internet and mobile cellular users rose 29% and 33% per year, respectively.¹

This sigma examines the shifting boundaries of insurance. Insurance provides one way to transfer risk. In exchange for a premium, the insurer indemnifies its client up to a specific limit in the event of a loss. But not every risk can be insured. This sigma examines the shifting boundaries of private (re)insurance and their implications for the insurance industry. It discusses obstacles to insuring certain risks and how insurers have innovated to overcome these obstacles.

Although uninsurability poses a challenge to insurers, it is one that the industry has repeatedly met and overcome. Insurance is a growth industry. Since 1980, life premiums in the industrialized world have increased 3.2% a year faster than GDP and non-life premiums have outpaced GDP by 0.6% a year. In emerging markets, these margins are more striking: 8.9% for life and 1.3% for non-life.²

Many factors, including growing global wealth and a tendency for people to settle in areas where natural catastrophes occur frequently, help explain the growth of insurance premiums.³ But insurers should not take this growth for granted. To sustain its growth, the industry must stay responsive to clients.

The plan of this report.

This sigma first introduces the concept of insurability and what characterizes an insurable risk. This provides a basis to discuss how the nature of risk has changed over time. In particular, physical risks have lost importance relative to intangible risks, many of which are difficult to measure and insure. The report then illustrates how the limits to insurability shift, providing examples of risks once deemed insurable that are no longer, as well as risks once considered uninsurable that insurers now cover. Next the sigma considers how insurers innovate and examines the tools and techniques that they use to address difficult-to-insure and uninsurable risks. The study concludes by discussing the prospects for insurability.

³ Swiss Re, sigma No 1/2004 discusses these trends and how they affect catastrophic losses.
Not every risk can be insured at all times. When insurance coverage for a specific type of risk is unavailable, the risk is said to be “uninsurable”. To understand why this occurs, it is useful to examine the characteristics common to risks for which insurance is available.

Criteria of insurability

Although it is challenging to create a precise formula or checklist to distinguish between what is and is not insurable, industry participants have proposed several guidelines. Table 1, based on Berliner (1982), lists eleven criteria of insurability.

<table>
<thead>
<tr>
<th>Category</th>
<th>Criterion</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuarial</td>
<td>Risk/uncertainty</td>
<td>Measurable</td>
</tr>
<tr>
<td></td>
<td>Loss occurrences</td>
<td>Independent</td>
</tr>
<tr>
<td></td>
<td>Maximum loss</td>
<td>Manageable</td>
</tr>
<tr>
<td></td>
<td>Average loss</td>
<td>Moderate</td>
</tr>
<tr>
<td></td>
<td>Loss frequency</td>
<td>High</td>
</tr>
<tr>
<td>(6)</td>
<td>Moral hazard, adverse selection</td>
<td>Not excessive</td>
</tr>
<tr>
<td>(7)</td>
<td>Insurance premium</td>
<td>Adequate, affordable</td>
</tr>
<tr>
<td>(8)</td>
<td>Insurance cover limits</td>
<td>Acceptable</td>
</tr>
<tr>
<td>(9)</td>
<td>Industry capacity</td>
<td>Sufficient</td>
</tr>
<tr>
<td>(10)</td>
<td>Public policy</td>
<td>Consistent with cover</td>
</tr>
<tr>
<td>(11)</td>
<td>Legal system</td>
<td>Permits the cover</td>
</tr>
</tbody>
</table>

The first six are actuarial. To be insurable, a risk must be measurable in the sense that its likelihood is known (1). An example of a peril whose likelihood is unknown is a new technology whose adoption is uncertain and whose impacts will not be clear for years. There are several other actuarial criteria: The risks in a portfolio should not be overly correlated with one another (2). The total loss potential associated with any single event must be manageable for the insurer (3). The risk profile, moreover, should have events of sufficiently low severity (4) and high frequency (5) for the Law of Large Numbers to apply. This makes performance less variable and more predictable. High frequency/low severity events such as motor accidents are ideally suited for insurance; low frequency/high severity events such as nuclear accidents are not.

...including moral hazard and adverse selection.

A final actuarial criterion concerns asymmetric information, the potential for insureds to know more about their risks than insurers (6). Moral hazard and adverse selection are key examples of asymmetric information. Moral hazard arises when an insured’s behavior changes due to the presence of insurance, such as driving a rented car recklessly after insuring the vehicle in full. Adverse selection occurs when high-risk parties purchase more insurance than low-risk parties. Moral hazard and adverse selection can cause underwriting losses.

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4 In *Limits of Insurability of Risks*, Berliner states nine criteria. We have added criteria 6 and 9 (see above) and have categorized the criteria into three broad groups.

5 The Law of Large Numbers states that if a sample of observations drawn from a given population of independent events is sufficiently large, the average value of the sample will be close to the average value of the overall population. For example, the claims frequency of 10,000 randomly selected motorists will be close to the overall population’s.
### Insurability and its limits

#### Three reflect market conditions...

The next three insurability criteria reflect the state of the insurance market. Premium rates should be affordable to insurance buyers yet sufficient to provide insurers a return on capital commensurate with the risks that they bear (7). Insurers must be able to set acceptable cover limits such as underwriting clauses, regulations and restrictions (8). Finally, industry capacity must suffice to cover the risk in question (9).

#### ...and two societal factors.

The final two insurability criteria concern societal factors. For a risk to be insurable, covering it must be consistent with (or at least not undermine) societal values (10). Covering the risk must also be legal (11).

#### Insurers disagree as to which risks are insurable.

It is not always obvious which risks are and are not insurable. A risk that one insurer deems uninsurable might nonetheless be underwritten by another. This could reflect the latter company’s greater free capacity, different business mix or belief (mistaken or not) that it better understands the risk. Another factor that influences an insurer’s willingness to underwrite a risk is its “risk appetite”, which reflects its view of the risk’s quality and how well the risk fits the insurer’s portfolio objectives with respect to diversification of assets and liabilities. Finally, international differences in legal, judicial, political and social systems and risk landscapes can make a risk insurable in one country but not another.

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### Will Directors and Officers liability remain insurable in the US?

Directors and Officers (D&O) insurance offers protection from liability in the event of negligence, error or omission in the performance of duties. D&O liability is currently insurable. A survey of corporate directors and officers found that 97% of 2,068 US respondents and 92% of 71 Canadian respondents purchased D&O insurance in 2003.⁶ But several factors make US D&O liability a challenge to insure.

#### Challenges to covering D&O risks include moral hazard...

First, providing D&O cover raises moral hazard concerns for insurers. Although recent settlements exhibit a trend toward requiring directors and officers to bear some settlement costs out of pocket, covering punitive damages with an insurance contract arguably weakens their incentive to comply with laws and regulations. This is especially a concern in the face of large bonuses for executives who meet corporate financial targets.

#### ...insureds’ ability to circumvent policy terms...

Second, even when coverage for fraud is explicitly excluded from a D&O contract or forbidden by law, these exclusions require a “final adjudication”. Consequently, these exclusions are hard to enforce and can be thwarted by the insureds’ settlement. This creates uncertainty that makes it difficult to price the coverage properly. If there is a court decision that explicitly determines that fraud has occurred, then the exclusion takes effect and insurers should not be liable to pay for those “guilty” D&Os. However, “severability” provisions permit coverage to those supposedly “innocent” D&Os, who are often targeted by the class plaintiffs’ attorneys.

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⁶ Tillinghast Towers Perrin, “2003 Directors and Officers Liability Survey”.

Third, the rising costs of the US tort system have led to increasing claims and major uncertainty with respect to the insurer’s exposure under D&O liability covers. D&O claims have increased due to:

- the soaring cost of settling class action suits;
- the growing number of such suits;
- a more active Securities and Exchange Commission (Figure 1), whose budget grew from USD 483 million in 2002 to USD 843 million in 2004;⁷
- new trends in securities litigation; and
- the Sarbanes-Oxley Act of 2002, many of whose details will be clarified only after years of costly litigation.

![Figure 1](image-url)  
**Fines and disgorgement imposed by the SEC, 2000–2004**

Finally, loss occurrences are highly correlated. Because they are frequently triggered by bond defaults or sharp stock price declines and changing public sympathies, claims occur in waves. During the recent bear market, many insureds faced securities class action suits brought by a strong US plaintiff bar representing shareholders who lost trillions of dollars in the stock market. In 2003, for example, a manufacturer paid USD 300 million to the domestic shareholders of a company it acquired who felt that the acquiring company’s CEO had made misrepresentations to them about the merger transaction. In April 2004, new class action complaints pertaining to the same allegations were filed, this time on behalf of all foreign investors who were excluded from the initial settlement.⁸

For now, D&O liability insurance will remain available.

Despite these challenges, D&O liability insurance remains a vital part of the US corporate governance system and is therefore likely to remain available. Since few prospective directors or officers would agree to serve on a board without ample D&O liability coverage, strong demand for the coverage persists. New insurers have brought fresh capital to the industry, causing premiums to stabilize despite rising claims settlement expenses.⁹

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⁹ *Tillinghast Towers Perrin*, “2004 Directors and Officers Liability Survey”.
Next we consider two factors restricting the insurability of business risks. First, as services replace manufacturing as the principal creators of economic value, hard-to-insure intangible risks have grown in importance. Second, special features of the insurance market cause rates to fluctuate cyclically.

The declining relative importance of manufacturing

The most valuable assets for many leading firms like Citigroup, Microsoft, and Pfizer are not physical assets, but intangibles such as research and development, brand, reputation and client relationships. Intellectual capital has replaced physical capital as the factor most critical to business success due to two trends. First, service firms have grown much faster than the rest of the economy. In 1955, 16 of the 50 largest US corporations (by revenue) were service businesses; today 33 are.¹⁰ Second, even within the manufacturing sector, many firms derive most of their revenues or income from services. In 2004, General Motors earned USD 2.9 billion from financing home and car purchases and lost USD 0.1 billion on its automotive business; Ford earned USD 5.0 billion on financial services and lost USD 0.2 billion on vehicles.¹¹

This evolution in corporate focus mirrors a broad global shift from farming to manufacturing to services. As societies grow wealthier, they spend a declining share of income on goods and more on services, causing a shift in the labor force. As recently as 1900, 45% of the US workforce was employed in agriculture (Figure 2). Today the 2% of the workforce employed in the sector produces enough to generate a net trade surplus in agricultural products.¹² A similar trend is evident in other industrialized economies, whose manufacturing sector employment shares have also fallen sharply (Table 2).

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¹⁰ Fortune, 5 April 2004.
¹¹ Ford and General Motors 2004 Annual Reports. Ford’s results are pre-tax and GM’s are after-tax.
¹² Although the US imports many foods, it has been a net food exporter for the past few decades.
Table 2
Manufacturing employment shares in industrialized countries, 1960 versus 2002

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>26%</td>
<td>25%</td>
<td>28%</td>
<td>34%</td>
<td>24%</td>
<td>22%</td>
<td>29%</td>
<td>32%</td>
<td>16%</td>
<td>26%</td>
</tr>
<tr>
<td>2002</td>
<td>12%</td>
<td>15%</td>
<td>21%</td>
<td>24%</td>
<td>23%</td>
<td>19%</td>
<td>14%</td>
<td>17%</td>
<td>16%</td>
<td>13%</td>
</tr>
<tr>
<td>Difference, in % points</td>
<td>14%</td>
<td>10%</td>
<td>7%</td>
<td>10%</td>
<td>1%</td>
<td>3%</td>
<td>15%</td>
<td>15%</td>
<td>20%</td>
<td>13%</td>
</tr>
</tbody>
</table>


Intangible assets have eclipsed “bricks and mortar” in importance

The declining role of manufacturing makes physical activities and risks less critical to many firms, reducing their need for “bricks and mortar” coverage. Meanwhile, new, harder-to-quantify risks have emerged for both service and manufacturing companies. Liability risk is one important example. Since 1980, liability claims have grown faster than GDP in many developed economies (Figure 3), though deviations from trend arise from factors such as fluctuations in reserves, interest rates, and medical inflation. US liability claims, for example, spiked in the late 1980s, when Superfund legislation, asbestos claims and high general inflation boosted the level of expected liability claims.

![Figure 3](image)

While small and mid-sized firms continue to insure against physical risks, many large ones self-insure, often through a captive insurer. These companies have the financial resources to withstand the destruction of physical facilities without much hardship, making traditional insurance less of a necessity.

For large firms, a branch, plant or office burning down would likely have far less impact on profits than would other, less tangible risks. Large firms face a panoply of risks in areas such as litigation, product liability, Errors & Omissions, D&O and workers’ compensation. Financial institutions must also contend with interest rate, credit, asset-liability management, accumulation and regulatory risk.
Many of the key risks facing large firms are hard to insure.

Many of the key risks that large corporations face are difficult to insure for several reasons. First, some of these risks relate to activities central to the firm’s business and, as such, cannot efficiently be transferred to insurers. Rather, a firm’s shareholders and bondholders must bear these risks. Second, some of these risks are subject to extreme moral hazard. Finally, some of these risks are difficult to assess or monitor. Although the industry works hard to create client solutions by shaping the perils to conform to the criteria of insurability, general policies exclude or limit exposure to many of these such perils.

Special aspects of the insurance market cause prices to fluctuate

Variable capacity and simultaneous supply and demand shocks cause the availability and price of insurance to fluctuate widely. One special quality of the insurance industry is that its capital is its capacity. When a firm such as Daimler Chrysler or Wal-Mart experiences large financial losses, it might defer capital expenditures, but its capacity will be little affected. By contrast, if insurers suffer large underwriting or investment losses, the industry’s capacity will be depleted. Given the costs of raising new capital quickly and a reluctance to underwrite risks that might weaken their balance sheets, insurers would scale back their underwriting activity. Conversely, several years of strong profitability can create excess industry capacity.

Another special factor that causes insurance shortages and price spikes is simultaneous increases in demand and decreases in supply. For other goods and services, demand shocks occur independent of supply shocks, but insurance is different. When businesses and insurers grow more concerned about a particular peril, demand for coverage can rise as supply declines due to insurers’ increased estimates of potential losses. The joint impact of increased demand for coverage and insurers’ growing reluctance to write policies can cause a sharp jump in insurance prices.

Due to these cyclical forces, the cost of risk as measured by the Risk and Insurance Management Society (RIMS) fell by a cumulative 42% from 1992 to 2000, then rebounded over the next four years (Figure 4).¹³ But insurance costs are not unique in this regard. Other major business expenses also vary widely. Since 1990, oil prices have had an annual standard deviation of 24% versus 19% for insurance. Euro/dollar fluctuations have had a milder 9% standard deviation.

¹³ Each year RIMS surveys North American businesses on their “cost of risk”, defined as the sum of net insurance premiums, retained losses, risk control and loss prevention expenses, and administrative costs per USD 1 000 of revenue.
Figure 4

Insurance prices have fluctuated less than oil prices

Notes: Oil prices are for US domestic West Texas intermediate crude. Before 1999, the European Currency Unit is used instead of the euro.

Sources: Federal Reserve; 2004 RIMS Benchmark Survey; Swiss Re Economic Research & Consulting.
The insurability of risks can change over time. This section first discusses several examples of risks that emerged in the course of economic and social development that the insurance industry found ways to cover. It then discusses a risk that was once insurable but is no longer and an emerging risk that is a potential concern for private insurers.

**Hard-to-insure risks made insurable**

As new risks emerge, insurers respond by innovating. As risks evolve, insurers must adapt. One approach, illustrated by the development of machinery insurance, is to introduce new types of coverage. Another is to work together with government. Private/public partnerships have broadened the limits of insurability in areas including workers’ compensation, atomic and riot risk.

*Machinery insurance*¹⁴

Machinery insurance offers an historical example of how insurers cover new perils. In the early 19th century, the invention of the steam engine launched the Industrial Revolution, an era with new hazards and a need for new insurance covers. A lack of historical data made the risks hard to measure and underwrite.

The Steam Boiler Assurance Company, the first engineering insurance company, was founded in the UK in 1858. Other similar companies were founded soon after. These insurers initially covered only boilers, but gradually extended covers to pressure vessels, protecting equipment that generates or uses power such as steam boilers, turbines, generators and motors. Machinery insurance has been instrumental in promoting the acceptance of new technologies. High output thermal and hydroelectric power plants, for example, could never have been built without adequate insurance protection.

*Workers’ compensation insurance*¹⁵

Workers’ compensation insurance developed in response to social needs. With the spread of industrialization came large-scale production practices that posed new risks to workers. In the UK, injured workers’ only recourse under Common Law was to sue the employer. A similar situation existed in Germany. Barristers, solicitors and other legal practitioners came forward in growing numbers to represent injured workers on a contingency fee basis, although the worker had to bear the burden of proof and some legal expenses. The courts soon grew backlogged with these cases. The general public began to suffer, as crowded dockets delayed other civil actions. Assisted by a growing legal profession, workers were beginning to win their cases and were tying up employers’ machinery, buildings and other property through liens and attachments.

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This increasingly dysfunctional legal system needed reform. But indemnifying employees against workplace hazards posed several challenges. Paying people not to work creates moral hazard; loss occurrences are potentially correlated due to shifting public sentiment; and providing the coverage required new legislation. Germany passed legislation in 1838 to protect railroad employees and passengers in the event of accidents. This led, in 1884, to Bismarck’s Compulsory Insurance Plan for workers, a government-run social insurance program that is a model for many modern workers’ compensation systems. In 1880, the British Parliament passed the Employer’s Liability Act, which created a private, employer-funded system to cover workers involved in accidents due to the negligence of their supervisors. The Act was repealed in 1897 and replaced with a Workmen’s Compensation Act. Today, of the many workers’ compensation systems throughout the world, some are public, others private and still others a hybrid.

Atomic risk

Atomic risk illustrates how governments sometimes provide catastrophe coverage when it is unavailable from private insurers. In 1954, the US Congress revised the Atomic Energy Act to allow private ownership of facilities producing fissionable materials. Firms wishing to build or operate nuclear reactors sought insurance with liability limits of USD 50 to 100 million. Since at the time a USD 10 million limit was deemed extremely large, and the ultimate worldwide limit for any liability risk was an estimated USD 20 million, innovation was needed to cover these new risks. Atomic risks posed several problems for insurers: industry capacity was insufficient; the risk was hard to measure; its low frequency/high severity nature made it hard to insure; and indemnifying private manufacturers in their development of nuclear reactors raised potential moral hazard and public policy concerns.

The Atomic Energy Commission appointed insurance industry leaders to a study group, which visited nuclear facilities and was briefed on the current state of the field. The group concluded that the only solution was to create risk pools. Stock companies formed the Nuclear Energy Liability Insurance Association to write third-party liability coverage and the Nuclear Energy Property Insurance Association to write physical-damage cover. Mutual insurers formed a combined reinsurance pool to write both types of coverage.

These risk pools could provide combined coverage for any one risk of about USD 65 million, but this was not enough. Firms like Westinghouse and General Electric told Congress they could not develop reactors without protection from the threat of a major liability. Congress therefore passed the Price-Anderson Act in 1957, which fixed the maximum liability for any licensed nuclear facility at the amount of private liability insurance available. The government would pay up to USD 500 million beyond that.

Riot insurance

During the 1960s, a wave of riots in the US blighted poor urban neighborhoods. In these riots, more than 200 people were killed, more than 12,500 injured and billions of dollars of property destroyed. As the riots escalated, a presidential commission heard complaints that the high cost and unavailability of property insurance in riot-afflicted areas was delaying the rebuilding of these areas and causing the spread of urban blight.

Insurers told the commission that they were unwilling to write coverage in these neighborhoods for fear that catastrophic reinsurance would be unavailable or prohibitively expensive. Riot insurance posed many challenges: difficulties quantifying the risk, high potential losses, correlation of risks, insufficient capacity, inadequate premiums and moral hazard. To address this challenge the commission took steps leading to the sale of government reinsurance against losses from riots and civil disorder to property insurers covering urban property owners. The coverage, which provided affordable protection against direct loss to real or tangible property from fire and other perils, met with robust demand.

From enigma to insight: insuring natural catastrophes

Underwriting natural catastrophe risk poses serious challenges for insurers. Due to variations in the frequency and severity of catastrophic events, annual results fluctuate widely. As recently as the early 1980s, the precision with which these risks were quantified left much to be desired. The immeasurability, low frequency and high severity of catastrophe risk challenged underwriters and taxed the limits of insurers’ capacity. Many insurers either avoided offering catastrophe covers or severely limited their exposure to them. The resulting supply limitations created an opportunity for enterprising firms that invested in developing models to measure the risks more precisely.

Estimating potential damage requires a solid grasp of the physical catastrophes that can occur, their likelihood, and the economic damage that can be expected to result. This is a multidisciplinary exercise involving expertise in areas including geology, engineering and economics. A steadily growing body of data on catastrophic events and exponentially declining computation costs bolstered the movement to develop catastrophe models.

Eventually, independent catastrophe modeling firms emerged to offer cat modeling capabilities to insurers. Credit rating agencies started using the models to evaluate the riskiness of securities whose payoffs are linked to catastrophic events. These developments have turned natural catastrophe risk from a highly uncertain line of business into a risk for which the quality of objective scientific data is almost unparalleled.

Insurable risks become uninsurable

Some general commercial lines are subject to major uncertainties. A risk implicit in the policy wording but not envisioned by the insurer can create substantial liabilities that severely damage or even bankrupt the insurer. When this occurs, a risk once deemed insurable can become uninsurable.

US asbestos liability¹⁸

Some of the materials introduced in the second half of the 19th century, such as asbestos, posed potential health hazards. Once known as the “miracle mineral” for its power to insulate, asbestos was commonly used in ships, buildings and consumer products. An estimated 27–100 million Americans have been exposed to asbestos. Breathing asbestos fibers may cause a variety of diseases including asbestosis, mesothelioma, and lung cancer.

Asbestos, for example, has entailed over USD 70 billion of liabilities.

Asbestos is a risk run amok: a massive liability of uncertain magnitude that is uninsurable or, at best, difficult and expensive to insure. Asbestos litigation is the longest-running US mass tort in history, entailing higher legal costs than any other personal injury litigation. From 1982 to 2002, as the number of claimants ballooned from 1,000 to 730,000, the nominal amount spent by defendants and insurers increased from USD 1 billion to an estimated USD 70 billion. The ultimate cost of the litigation could range from USD 200 billion to USD 265 billion.¹⁹ Due to asbestos liabilities, several insurers have either failed or are in financial distress and 85 corporations have filed for bankruptcy.

Novel applications of tort law have swelled corporate liabilities.

Asbestos liabilities are extraordinarily high for several reasons. First, whereas previous mass torts had no more than about a dozen defendants, more than 8,000 defendants have been sued for asbestos damage. As defendants go bankrupt, others can be substituted. Moreover, tort law has been applied to asbestos litigation in novel ways:

- In the US tort system, plaintiffs normally must show that a particular product harmed them. Asbestos plaintiffs need only show that a particular product was used in their workplaces; coworkers’ recollections usually suffice.
- Under normal tort law, claimants can collect only if they have suffered impairment. Some US states, by contrast, allow unimpaired claimants to collect for “asbestos exposure” or “fear of cancer”.

Asbestos risk is now nearly uninsurable.

Waves of class action suits and an unstable legal and public policy environment have boosted the scale of and correlation between asbestos risk exposures, creating enough uncertainty to render asbestos risk nearly uninsurable.


Changes in insurability status

Harbinger for future mass torts?
Is asbestos a special case or the beginning of a trend in which waves of aggressive litigation render still other risks uninsurable? Other mass torts such as Agent Orange and breast implants have also involved hundreds of thousands of claimants. Tobacco and fast food cases could involve millions. Still, asbestos remains unique in some ways (Table 3). An absence of regulatory warnings (as existed for tobacco) has increased public and judicial indignation. The large number of defendants also sets asbestos litigation apart.

Table 3
US personal injury mass torts

<table>
<thead>
<tr>
<th>Type of product</th>
<th>Number of defendants</th>
<th>Number/type of plaintiffs</th>
<th>Amount of compensatory fund, USD</th>
<th>Year resolved</th>
<th>Type of restitution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos Insulation and other products</td>
<td>8 400</td>
<td>730,000</td>
<td>70 billion as of 2002</td>
<td>Ongoing</td>
<td>Individual defendant bankruptcies only</td>
</tr>
<tr>
<td>Agent Orange Defoliant used in the Vietnam War</td>
<td>12</td>
<td>250,000</td>
<td>150 million</td>
<td>1984</td>
<td>Class action settlement</td>
</tr>
<tr>
<td>Dalkon Shield Defective intrauterine device (IUD)</td>
<td>1</td>
<td>140,000</td>
<td>2.3 billion</td>
<td>1988</td>
<td>Bankruptcy</td>
</tr>
<tr>
<td>Breast implants Silicon gel breast implants</td>
<td>3</td>
<td>440,000</td>
<td>4.2 billion</td>
<td>1994</td>
<td>Class action settlement (main defendant later filed for bankruptcy)</td>
</tr>
<tr>
<td>Fen-Phen Diet drugs</td>
<td>1</td>
<td>Filing period still open</td>
<td>3.8 billion</td>
<td>2000</td>
<td>Class action settlement (nonmandatory)</td>
</tr>
<tr>
<td>Tobacco Cigarettes</td>
<td>4</td>
<td>50 US states</td>
<td>246 billion</td>
<td>1998</td>
<td>Settlement between 50 states and the tobacco companies (private lawsuits still pending)</td>
</tr>
<tr>
<td>Lead Leaded paint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ongoing Pending</td>
</tr>
<tr>
<td>Firearms Guns</td>
<td></td>
<td>Cities, counties, US government and private plaintiffs</td>
<td></td>
<td></td>
<td>Ongoing Pending</td>
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<td>Fast food Hamburgers, etc.</td>
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Dangerous dynamics of the mass tort business.
But there is still cause for concern. The USD 21 billion that has gone to defendants’ lawyers has attracted more law firms to the mass tort business, who can apply techniques honed in asbestos litigation to future mass torts. Moreover, plaintiff lawyers have reinvested some of their earnings in political contributions to sympathetic candidates, which will make it harder to enact tort reform legislation to rein in costs.

Emerging risks – Nanotechnology as an example
Because they pose potential health hazards that might not be recognized for many years, new technologies are difficult to insure. To assess these risks, insurers must imagine future states of the world and estimate the probability and potential severity of losses in each state. Insurers prefer to cover a technology only after it has begun to mature, scientific controversies have been resolved and its risks have been quantified. Over time, insurers can refine their risk estimates by collecting and assessing additional data. Managing emerging risks is therefore a key challenge for manufacturers, insurers and society.

New technologies may pose unexpected health hazards.
Nanotechnology: an example of a technology with unknown implications.

Nanotechnology is an example of a radical new technology whose possibilities and risks cannot yet accurately be measured.\(^{20}\) The field involves producing and manipulating particles smaller than 100 nanometers (or 1/10,000th of a millimeter). Reducing a material to this size can alter its characteristics because: (1) anything smaller than about 50 nanometers is no longer subject to the laws of classical physics, but of quantum physics; (2) the smaller a body is, the greater its surface area relative to its mass, which makes it more reactive. When substances are broken down to nanoparticles, their colors can change, insulators can become conductors, and insoluble substances can become soluble. Moreover, due to their size, nanoparticles are highly mobile in the body and environment. These special properties facilitate novel applications of great potential use. Products using nanotechnology are already on the market.

Innovative materials, medicines and pharmaceuticals will be among the first nanotechnologically-manufactured products to significantly impact the market. These products could speed the discovery of cures for diseases now thought incurable by providing better diagnostic tools, more effective ways of administering drugs, innovative cancer therapies and treatments for infections and brain diseases. For example, research shows that “buckyballs”\(^{21}\) can block one of the enzymes necessary for the multiplication of the AIDS pathogen by occupying a position in the enzyme’s docking site. The goal is to permanently inhibit the enzyme.

But it raises some difficult questions. A number of commercially available sprays also contain nanoparticles, including disinfectants, air fresheners, dyes, paints, and coatings. Applications like this raise questions, such as:

- Are the invisible particles emitted by air fresheners dangerous to our breathing?
- What happens when products manufactured using nanotechnology are released in the air?
- Can nanoparticles penetrate the skin and harm the body?

Nanotechnology poses underwriting challenges...

Nanotechnology liability risk is difficult to assess because it is new and thus not yet measurable, has an unknown loss potential due to a lack of loss experience, and is vulnerable to a change in public policy.

...that can only be tackled with further research.

Today there is little public awareness of nanotechnology and few studies address long term effects. Prompt and efficient collaboration between the public and private sectors will allow society to reap the benefits of the technology while minimizing its adverse effects. Insurers, as experts on measuring and managing risk, can help frame, steer and accelerate the efforts to clarify what lies ahead.

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\(^{20}\) This discussion is based on the Swiss Re publication “Nanotechnology: Small matter, many unknowns”, available at www.swissre.com.

\(^{21}\) Buckyballs, also known as Buckminster Fullerenes, generally consist of 60 carbon atoms, similar in structure to the pentagons and hexagons on a football. Buckyballs can either be coated or filled with a substance. They function as semiconductors and are soluble in organic solvents.
Insurance prices can send helpful market signals.

Halting an overly risky innovation

Properly-set insurance prices create healthy market incentives, such as discouraging ill-advised innovations. One example is the ultra large crude carriers (ULCCs), whose principal advantage would have been economies of scale due to lower crew costs. Ship owners wanted to construct a new generation of 1 million dead-weight ton (dwt) ships, twice the size of the largest existing tankers. This new generation of ships, however, would pose huge potential risks to the environment, which ship owners did not fully consider in their plans. Once insurers set premiums very high because of the potential liabilities, ship owners cancelled their orders. The diseconomies of risk outweighed the economies of scale. Fairly priced insurance coverage sent a market signal that halted an ill-advised innovation.²²

The insurance industry has developed a range of tools and techniques that extend the limits of insurability by shaping risks to conform to the insurability criteria discussed above. These include:

- **Adjustments to terms and conditions.** Deductibles and co-payments mitigate moral hazard, while cover limits transform unquantifiable underlying risks into known maximum exposures.
- **Risk selection and pricing.** Careful underwriting reduces adverse selection and assures that each risk is adequately priced. Regular prices adjustments enable an insurer to react to loss experience.
- **Innovation.** Insurers innovate to respond to demand for new risk covers. New solutions that better focus on client needs use capacity more efficiently and can reduce the cost of coverage.
- **Reinsurance.** Reinsurance provides additional capacity. By stabilizing underwriting results, reducing its average and maximum loss and providing capital relief, reinsurance makes cover more affordable.
- **Securitization.** By expanding industry capacity, securitization can make coverage for hard-to-insure risks more available. Capital requirements are reduced and risk cover becomes more affordable.
- **Private/public partnerships.** When the free market fails to cover a critical risk, governments can intervene by providing capacity or setting policies that improve the availability of coverage.

This section reviews each of these tools and techniques and illustrates how they have been used to extend the boundaries of insurability. It also discusses whether terrorism risks can be made insurable and reviews recent market and insurability trends.

**Terms and conditions**

Deductibles and co-payments help mitigate moral hazard. A **deductible** is the amount of damages arising from the insured risk that the insured must pay before the insurer makes a payment. A **co-payment**, or coinsurance provision, requires an insurer to pay only some fraction of the total insured loss, leaving the remainder to be paid by the insured. Co-payments often require that this uninsured portion of the exposure be retained to prevent the insured party from covering the coinsured amount under another policy. Deductibles and co-payments help align the interests of the insured and the insurer, mitigate the insured’s incentive to change behavior after buying protection, encourage the policyholder to manage the risk prudently and discourage fraudulent or malicious crime.

**Policy limits reduce insurers’ uncertainty.**

**Policy limits** are included in indemnity contracts to cap the size of payments. It is rare to find an insurance contract without a policy limit of some kind. Policy limits vary based on market conditions and can be per event or aggregate limits per time period. Limits transform ambiguous underlying risks into insured risks with known maximum outcomes. Limiting the maximum loss improves risk consolidation in an insurer’s portfolio and reduces capital requirements.
The long-tail nature of risks is frequently the main challenge in liability insurance. Liability for environmental damage, occupational diseases, consumer losses, or with respect to the victims of historical injustice can span long time periods. No clear principles underlie the many different and contradictory rules on statutory limitation in tort law found in each legal system. The vast majority of liability insurance currently in force or written in recent decades is based on an “occurrence” trigger. Occurrence triggers create ambiguities because they allow claims to be made many years after a policy has expired. For coverage to be activated under a liability policy, the only two conditions are that: (1) the insured must report the claim as required by the policy; and (2) the insured event must have occurred during the policy term.

Claims-made triggers help to better measure liability risks.

The “claims made” trigger favored by liability insurers has grown more common and is becoming the object of regulation under insurance contract law. Under a policy with a claims-made trigger, coverage is activated upon the filing of a claim. There are three requirements: (1) the coverage trigger must be the first notification of a claim to the insurer; (2) the claim must be reported to the insurer within the policy period or the extended reporting period specified in the policy; and (3) the incident must have occurred after a specified retroactive date. These conditions limit the insurer’s long-tail risk. Because claims are paid closer to when the policy is priced, parties to the contract can better measure their risks and insurance needs.

Risk selection and pricing

Insurers have a variety of ways to mitigate adverse selection. For example, since adverse selection can make mortality risk difficult to cover, life insurers place a strong emphasis on risk selection and price differentiation based on criteria including age, gender, medical history and smoker/non-smoker status.

Prices can be adjusted to mitigate a negative claims experience.

Another way to assure that life policies are adequately priced is through regular renewals, at which premiums can be adjusted as needed. Group life premiums are typically adjustable every one or two years. Similarly, if a client wishes to adjust the terms of a policy, the policy is subject to renewal. Annual renewals are also used in non-life business lines. At renewal time, insurers can review premium rates based on claims experience. A negative claims experience will lead to higher premiums in subsequent periods. This experience rating introduces a payback mechanism to the insurance contract.

Innovation in the non-life market

When faced with risks that are difficult to cover, non-life insurers address them by developing new approaches or adapting old ones such as client segmentation, captives, integrated programs, finite risk products, divestment of portfolios in run-off and committed capital.

Focus on market segments
Some insurers have offered improved service and lower rates by focusing on specific market segments. During a depression in 1835, Zachariah Allen sought to lower the insurance premiums on his mill by making safety enhancements to reduce the chance of loss. When his insurer rejected his request for lower rates, he formed the Manufacturers Mutual Fire Insurance Company to cover only highly protected risks. During the next 14 years, policyholders of his company (now called FM Global) enjoyed an average 50% savings on their premiums. Similarly, USAA was founded in 1922 by several military officers who wanted an insurer uniquely suited to the needs of the military and their families. State Farm was founded in 1926 by George Mecherle, a retired farmer who believed that farmers should pay less than city dwellers for motor insurance because they drove more cautiously and for shorter distances. In its early years, State Farm was able to underprice its competitors by as much as 40%.

Captives
When unable to purchase insurance at a reasonable price, many corporations opt to self-insure. But merely setting aside funds against future losses might leave investors suspicious that the money could be spent in some other way. An alternative risk financing structure called a captive, which emerged in the 1970s, reduces this problem. A captive is a (re)insurance vehicle that belongs to a company or group of companies that is not itself active in the insurance industry. The primary business of a captive is to insure the risks of its parent(s) and affiliated companies. Captives are increasingly used to manage hard-to-insure exposures such as product liability, D&O, E&O and medical malpractice risks. Captives address asymmetric information issues in insurance contracts by introducing an element of self-insurance, thereby expanding the limits of insurability.

Because they are incorporated as insurance companies, captives have access to the global reinsurance market. This offers several advantages. First, since large commercial risks end up in the global reinsurance market anyway, using a captive enables an insurance buyer to substitute the lower costs of the captive for the cost layer of a primary insurer. Second, the reinsurance market may be more flexible in structuring risk transfer programs. Third, the better risk diversification of global reinsurers’ risk portfolios usually reduces the capital cost component of the price and offers more capacity.

Multi-parent captives effectively bear industry risks.

Multi-parent captives are similar in design and operation to mutual insurers, risk retention groups, and other cooperative insurers. This form of organization tends to be rediscovered when access to insurance cover for specific, often industry-wide, risks becomes expensive or unavailable. Multi-parent captives are usually established by an industry trade association or by a group of companies operating in the same industry.

ACE Ltd. and XL Capital Ltd each began in the mid-1980s as a multi-parent captive insurer for a consortium of large US corporations seeking to address a lack of insurance market capacity for excess liability and D&O liability coverage.

For a detailed description of captives and Alternative Risk Transfer solutions, see Swiss Re, sigma No 1/2003, “The picture of ART”.

Captives emerged in the 1970s as an alternative risk-financing structure.
AEGIS Ltd. (Associated Electric & Gas Insurance Services), a Bermuda corporation with mutual ownership, was founded in 1975 by members of the American Gas Association that had grown dissatisfied with the commercial insurance market’s ability to provide adequate coverage to electric utilities. Two years later, AEGIS began serving the electric utility industry as well. The OIL Group of Companies is composed of three mutual-like insurance companies — Oil Insurance Ltd. (OIL), Oil Casualty Insurance Ltd. (OCIL) and sEnergy Insurance Ltd. — that are dedicated to serving the needs of the energy industry. OIL, which commenced operations in 1972, provides cost-effective catastrophe insurance to its shareholders. OCIL, a major provider of excess general and D&O liability insurance to energy companies, was formed in 1986, when commercial markets stopped providing needed liability coverage. Formed in 2002, sEnergy provides excess business interruption and excess property insurance to the energy industry.

**Integrated programs**

Integrated programs have gained popularity in recent years. A multi-line product combines different risk categories into one program, typically providing cover for several years. Integrated risk programs can combine casualty exposures with other covers such as D&O, fiduciary and property. In some cases, coverage is subject to per occurrence limits and an aggregate (all lines combined) limit. By taking advantage of diversification effects in combined retentions or shared limits, capacity can be used more efficiently.

In a multi-trigger product, loss payments are made only if a second event occurs. This second condition is frequently linked to an index outside the influence of the policyholder, reducing moral hazard. Because of the additional condition, multi-trigger products can be significantly less expensive than traditional (re)insurance. The policies are mainly used to cover extreme events.

**Finite risk**

Although self-retention, multi-year and multi-line covers have long been used, a new line of business developed in the 1980s that systematically employs a combination of these approaches. Called finite risk (re)insurance, it combines substantial risk transfer with self-insurance. Finite covers are often used when traditional risk transfer solutions are unavailable or too expensive. This occurred during the “liability crisis” as well as other times of capacity shortage.

**Divesting non-life insurance portfolios in run-off**

Putting a book of business into run-off and divesting it is sometimes the best solution for a company that wishes to make a strategic change. In a run-off solution, a discontinued book of business is sold to a (re)insurer, which receives all the (remaining) premiums for that book of business. The claims reserves are transferred from the client to the reinsurer. The acquisition of insurance portfolios in run-off involves a full-scale risk transfer of reserve development risks. The buyer of the portfolio assumes unlimited liability for all business risks within the boundaries of corporate law. By divesting insurance portfolios in run-off, an insurer protects itself from earnings volatility arising from its past activities. These transactions send a strong signal to stakeholders. The largest transactions to date have involved asbestos, environmental and workers compensation liabilities.
Committed capital
Committed capital, often referred to as contingent capital, has been a successful alternative to risk covers that involve huge potential losses. It is based on a contractual commitment to provide capital to a company – in the form of senior debt, surplus notes, preferred shares, sub-prime debt etc – should a substantial pre-specified type of loss event occur. Structured and priced using a combination of insurance and capital market techniques, committed capital products differ from options on corporate securities through their reliance on an a priori defined trigger under which the financing is granted. The trigger, normally an insurance-related event, lowers the likelihood that the client will draw on the facility, which reduces the premium charged. The client gains lower-cost access to capital at times when it is especially needed.

Innovation in the life and health markets
Life and health insurers have also innovated to better serve policyholders. Two examples of these innovations are variable annuities and critical illness coverage. Run-off solutions offer insurers the flexibility to restructure.

Variable annuities
During the 1940s, market and demographic forces raised the possibility that many annuitants would find their pensions inadequate. In just a half century, US life expectancies rose from 48 years to nearly 70 years. Due in part to the war, US inflation in the 1940s exceeded 7% a year, eroding half the spending power of retiree savings. In response, Teachers Insurance and Annuity Association introduced the world’s first variable annuity in July 1952. The annuity allowed policyholders to gain exposure to stocks to hedge inflation risk while also holding fixed-income securities to stabilize returns. This innovation, soon imitated throughout the industry, has enabled many to retire with enhanced financial security.

Critical illness insurance
Critical illness insurance (CI) provides “living benefits”, usually as a lump sum, upon diagnosis of one of a list of well-defined diseases. The concept was originally developed in South Africa to help pay for the treatment of heart disease. CI policies can be stand-alone or can provide accelerated payments of the sums assured on the term, whole life or endowment policies that are now purchased more often as loan protection than to provide funds for treatment. CI policies cover a number of specified critical or life threatening conditions including heart attack, cancer and stroke. Twenty or more diseases may be covered, but this “big three” account for the vast majority of claims.

Since its introduction in South Africa, the United Kingdom has become the biggest market for critical illness plans. Other markets include Ireland, Australia, China, India, Israel, Singapore, Hong Kong, various Eastern European countries, Canada and some US states. In the UK, where CI insurance is often sold when individuals take out a mortgage, the product is structured so that the benefit declines over time along with the mortgage. By paying off the mortgage, the individual effectively swaps the lump sum payment into regular income, because he or she frees up resources that otherwise would have been used for the monthly mortgage repayment.
Consistent with sound risk management practice, insurers regularly review policy definitions and conditions to ensure that the policies continue to meet customer needs cost-effectively. Due to medical advances, an increasing proportion of those who suffer major illnesses survive them, increasing the need for CI protection. Meanwhile, many diseases and procedures that were once life threatening have become routine, with patients making a full recovery, reducing the need for a major payment upon diagnosis.

Run-off solutions in life insurance
In recent years, many life insurers have closed life insurance portfolios to new business and put them into run-off. At year-end 2003, total policyholder liabilities of UK life insurers in run-off amounted to GBP 171 billion, which accounts for approximately 20% of the total policyholder liabilities of UK life insurers.²⁶ In the US and the UK, active markets have evolved in which closed life books are transacted and taken over by an acquiring company. In such a solution, a discontinued book of business is sold to a (re)insurer, which receives all the remaining premiums for that book of business. The policyholder liabilities are transferred from the client to the (re)insurer. This type of risk transfer enhances the insurance market’s capacity.

The strategic move to close and sell a book of business has often been driven by the desire to focus on core business lines or to free up capital and gain access to future cash flows from non-core portfolios. Doing so also increases operational efficiency by removing the need for life insurers to maintain legacy IT systems for non-core business lines. The acquirer of a closed life book usually pays a certain percentage of the embedded value – which represents the net asset value of a portfolio plus the discounted present value of profits which are expected to result from the portfolio in the future.

A (re)insurer often acts as a consolidator by taking over such portfolios. Through its Admin ReSM operations, Swiss Re is today the most important player in this market. Other active companies in the UK include Resolution PLC and Life Company Investor Group. Admin ReSM can include both the acquisition of individual blocks of business and the acquisition of an entire life insurance company.

Using risk transfer to boost insurance capacity

Industry capacity is defined as the financial resources of the insurance market relative to the scale of potential losses. These resources consist of:

- capital and reserves held by primary insurers and reinsurers,
- the capital-raising capacity of these companies, and
- a portion of the short-term cash flows from new business.

Reinsurance, securitization and government backstop protection each expands the scope of the sector’s available insurance cover.

Reinsurance allows primary insurers to cover more risks.

Reinsurance, whether proportional or nonproportional, enables an insurer to reduce its average and maximum probable losses. Ceding risks to reinsurers permits primary insurers to cover additional risks without increasing their capital bases. Thus, reinsurance plays an important role in the insurability of risks characterized by major uncertainty and large potential losses.

Reinsurance is a global business, covering risks from insurers in many geographic locations. Because their risk portfolios are globally diversified, reinsurers are better equipped than primary insurers to assume certain risks.

Insurance risk securitization

Insurance risk securitization involves transforming insurance risks into bonds that are sold to investors.²⁸ Securitization, like reinsurance, provides an additional source of capacity to primary insurers, making coverage more available and affordable. Although the most direct way for insurers to raise funds in the capital markets is by issuing shares, stockholders are exposed to the risks of the entire company. Stock returns depend on the insurance company’s management, investment performance, quality of operations and risk exposures to all perils. Moreover, since returns to an individual stock are positively correlated with overall equity market returns, investors who own insurance company shares are exposed to general equity market risk.

Insurance-linked securities (ILS)

Insurance-linked securities (ILS), by contrast, are primarily exposed to pure insurance risks that have been assessed by one or more independent rating agencies. The investor still faces risk associated with the issuer’s underwriting standards, but not the risks of the insurance (or reinsurance) company’s operations. Moreover, a lack of correlation with the overall stock market makes an ILS more attractive to some investors.

Insurance-linked securities (ILS) represent pure insurance risk.

ILS can potentially benefit from the huge scale of financial markets.

The basic argument for insurance securitization relates to the vast size of the fixed-income securities market, especially the structured finance, asset-backed securities, and mortgage-backed securities sectors, whose issuance volume in recent years has outstripped that of corporate bonds. Were fixed income investors to add ILS to their portfolios, a USD 80 billion catastrophe – larger than any experienced to date – would have little impact on their aggregate return performance. Fluctuations of this magnitude are normal daily occurrences in securities markets.

The ILS market developed in reaction to a series of major natural catastrophes in the early 1990s. In the wake of Hurricane Andrew and the Northridge earthquake, reinsurance was in very short supply, causing premium rates to rise sharply. Industry participants began developing capital market insurance solutions to help insure against property catastrophe risks.

²⁷ For an accessible introduction to reinsurance, see Swiss Re (2004), “Understanding reinsurance: How reinsurers create value and manage risk”.

²⁸ For more on insurance securitization, see Swiss Re (2003), “Insurance-linked securities”.

Swiss Re. sigma No 4/2005
The ILS market includes catastrophe and life bonds.

Since its inception, the ILS market has witnessed worldwide issuance of around USD 19 billion. The two major segments of the market are catastrophe (“cat”) bonds and life insurance bonds. The first non-exchange-traded capital market product that insured against catastrophe losses was an USD 85 million Hannover Re cat bond issued in 1994. Since 1996, more than USD 10 billion of life bonds and USD 10 billion of cat bonds have been issued. At year-end 2004, there were over USD 12 billion of ILS outstanding.

Catastrophe bonds address low frequency/high severity risks.

Many of the catastrophe bonds to date have provided reinsurance coverage for a specific segment: risks with very low annual loss probabilities, typically less than one percent. Cat bonds have had a significant impact on this layer, likely curtailing the rise in the prices in the uppermost segments of traditional catastrophe reinsurance programs.

To date, most life bonds have focused on risk financing.

Life bonds have typically been based on the income flow of premiums from life and savings products. Rather than being held in a special purpose vehicle (SPV), the capital raised is typically transferred to the life insurer. In this sense, life bonds have much in common with the securitization of income flows and asset-backed securities, such as mortgage-backed securities. As with other securitization techniques, “embedded value” deals provide leverage to a life insurer’s equity investors, enabling the insurer to conserve capital and boost return on equity. Life bonds, like cat bonds, can ultimately make insurance more available and affordable.

Transferring mortality risk to the bond market

The first transaction transferring mortality risk to the bond market was an ILS linked to extreme mortality risk issued by Swiss Re in December 2003. The notes, whose value totaled USD 400 million, provide a payout tied to a mortality index. To increase transparency to investors, the index is calculated by an independent firm using publicly available data. To minimize basis risk, it uses weights that reflect the issuer’s book of business. The transaction demonstrates how reinsurers can shift mortality risk to capital markets.

Demand for ILS has broadened.

The investor base for ILS is broadening. Initially, insurance and reinsurance companies were the main investors in catastrophe bonds. Today, according to Swiss Re estimates, hedge funds, dedicated catastrophe funds and money managers purchase almost half of the cat bonds issued, while insurers and reinsurers purchase less than 10%. The broadening of the investor base suggests a potential to expand beyond cat bonds and embedded value life insurance bonds to other hard-to-insure risks.

Government involvement

Many countries have programs to assure the availability of insurance for risks that the private sector has been unable to fully cover, including catastrophic events and terrorism. These programs vary widely in funding structure and
method of operation. The programs complement private insurance and reinsurance with risk-sharing and funding mechanisms involving the government and other public entities.²⁹

Some catastrophe insurance programs require little or no government administration or funding. For example, as part of the country’s catastrophe protection program, Swiss law requires insurers to include coverage for certain catastrophes (excluding earthquake) in fire insurance policies for buildings. A Swiss pool for natural perils (“Elementarschaden-Pool”) founded in 1953 further helps cope with these exposures. In August 2005, heavy flooding in Central and Eastern Europe caused insured property damage of more than CHF 1.3 billion (USD 1.041 billion) in Switzerland alone. Thanks to the pool for natural perils, the proportional payment cutback foreseen by law for events exceeding CHF 250 million was avoided; policyholders were fully compensated for losses.³⁰

In 1978, 18 Canton-owned building insurance companies created the “Swiss earthquake pool” to provide earthquake coverage, too. Part of the building insurance premiums are deposited in this pool. Although membership in the pool is optional, most insurers contribute to it. The Swiss federal government has no involvement in this program nor exposure associated with its operation; nevertheless, the pool would already be able to pay up to CHF 2 billion for an earthquake loss.³¹

Other programs have both pre-funding and post-event assessment features. For example, the California Earthquake Authority (CEA) was established by state statute to insure California residents against losses caused by earthquakes. It was created to ease the residential and earthquake insurance availability crisis caused by fears of an earthquake more damaging than the 1994 Northridge earthquake, which caused USD 12.5 billion in insured losses. The CEA, today the world’s largest residential earthquake insurer, has no claim on government resources. Its funds to pay claims come from premiums, contributions from and assessments on member insurance companies, borrowed funds, reinsurance, and the return on invested funds. Policyholders are covered against losses caused by an earthquake up to CEA’s claims-paying capacity. If an earthquake causes insured damage greater than the CEA’s claims-paying capacity, then policyholders who are victims of that quake are paid a pro rata portion of their covered losses.

Some programs offer catastrophic or terrorism insurance directly through the government, precluding private sector participation. The Israeli government funds and administers two direct insurance programs for losses resulting from terrorist attacks. One is the Property Tax and Compensation Fund, which covers property and casualty insurance. The second is the Law for the Victims of Enemy Action, which covers life and health insurance. Tax revenues, specific and general, fund both.

³¹  Nineteen of the 26 Cantons – the states within the Swiss Confederation – have publicly-owned building insurance companies; in the remaining seven, cover is offered by private insurers.
Other governments have established programs to share catastrophic risks with the private sector by offering reinsurance to individual primary insurers or to an industry pool. The UK’s Pool Reinsurance (Pool Re) program is an example of a shared-risk private/public reinsurance scheme. After a spate of IRA attacks in the UK, insurance against terrorism risk became largely unavailable. Pool Re was established in 1993 to assure the continued availability of insurance cover for damage and loss caused by terrorist actions. Pool Re functions as a reinsurance company for its (voluntary) members, while the government provides reinsurance to Pool Re. Other countries also have private/public terrorism risk pools (see Appendix).

Counterproductive government intervention

Some types of government intervention can make insurance less available. When a government caps premium rates at an artificially low level, insurers exit the market, creating shortages. Public policy can also reduce the supply of insurance when, as in the US, sympathetic juries hand down large, unexpected compensatory and punitive awards. In such an environment, insurers stop writing the liability coverage that businesses need and rates rise sharply, forcing some businesses to close and discouraging others from ever opening.

Can terrorism risks be made insurable?

The devastating attack on the World Trade Center and the Pentagon abruptly forced insurers to confront the issue of international terrorism. Two examples illustrate the effects of September 11 on the insurance market.³² A major North American commercial real estate firm complained of its inability to find enough terrorism insurance to cover its properties. The firm had previously used a blanket property insurance policy providing USD 1 billion of total coverage – including terrorism insurance – that expired in October of 2001. At that time, the firm could find only one insurer that would offer a quote for stand-alone terrorism insurance for a maximum of USD 25 million of coverage. It deemed that limit inadequate because minimal damage to its buildings could easily surpass USD 25 million in claims. The owner of a Midwestern city’s principal airport and several smaller airports reported that its aviation liability premium rose 280 percent in 2002, without including war and terrorism as part of the coverage. Although the owner needed USD 500 million coverage against these risks, it could only obtain USD 50 million for a premium of USD 1 million.

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Terrorism risk does not readily qualify as an insurable risk:

- Because available data reveal little about future probabilities, the risk cannot be properly measured.
- Loss estimations for terrorism scenarios must consider a total loss exposure, ie, the worst case. Many learned on 11 September 2001 that their scenarios were not, in fact, “worst case”.
- Since terrorists often launch a coordinated attack on multiple locations, loss occurrences can be highly correlated.
- A terrorist attack can affect many lines of business.
- The high loss potential of terrorist actions further hampers diversification.

In the absence of terrorist coverage, individuals and companies would bear a major part of the costs of another large scale terrorist event.

Public/private partnerships to cover terrorism risk

A principal terrorist goal is to destabilize a region or country by launching attacks that disrupt normal activities and create fear. Since terrorists will adapt their strategy based on their resources and knowledge of vulnerable targets, the nature of the risk changes over time. This feature of the risk reflects an important difference from natural hazards. Adopting mitigation measures can reduce damage due to a future large-scale Los Angeles earthquake, but it is not possible to influence the occurrence of the earthquake itself. Terrorism risk, on the other hand, will change depending on two complementary strategies of dealing with terrorism. The first consists of government actions to enhance security and reduce the probability that a terrorist attack will occur. The second entails protective measures adopted by those at risk, which might have negative externalities for other potential targets. Bolstering security at one target, for example, may increase the probability of other targets being hit.

Insurers and governments can each help make terrorism risk insurable

Insurers and reinsurers can contain terrorism risk in several ways. First, they can manage their terrorism risk by limiting their exposures. The industry is also well situated to promote dialogue among experts and clients on how to deal with terrorism. Finally, in underwriting the risk, insurers can insist on minimum security standards and educate clients on best practices for protecting individuals and properties from attack.

Government involvement can also help overcome major hurdles to insurability. The government, because of its ability to tax, is in a better position to deal with extreme losses as the insurer of the last resort than are private insurers, whose resources are limited. Moreover, governments can declare terrorism insurance mandatory, eg, by automatically assessing a terrorism premium surcharge on all property policies. Spreading the risk throughout society would greatly expand the risk pool. The economic justification for such a government intervention is that reducing the risks associated with global terrorism to allow the establishment of adequate insurance schemes provides a public good. Security, stability, respect for private property rights and the absence of violence and coercion are among the cornerstones of any society.
Securitization of terrorism-related risks faces hurdles.

Securitization of terrorism risks
Due to the heightened uncertainty in the wake of 11 September 2001, insurers have been reluctant to write terrorist coverage. One alternative is to securitize terrorism risks. However, this approach poses significant challenges:

- Risk models that forecast the frequency and severity of terrorist attacks are difficult to devise and relatively untested.
- Terrorists might plan attacks to roil markets or to profit from market fluctuations.
- Securitization offers only a partial solution because the bond market generally accepts only those risks that insurers have accepted.

To date, two terrorism-related bonds have been issued. Neither is a terrorism bond per se. Rather, they are multi-event cat bonds associated with the risk of terrorist attack and the risk of natural disaster or pandemic. The first was an asset-backed security transaction conducted in August 2003. FIFA, the world governing organization of association football, developed the bond to protect its investment in organizing the 2006 World Cup in Germany. The security, rated investment grade (A3) by Moody’s, covers natural and terrorist catastrophic events that would result in the cancellation of the World Cup game. The second terrorist-related bond is a securitization of catastrophe mortality risk undertaken in December 2003 (see Box above). The earliest transaction to transfer this kind of risk to the capital markets, the bond obtained an investment-grade rating (A3) from Moody’s.

The success of these securitizations reveals a latent appetite among fixed income investors for specialized forms of risk and the rating agencies’ willingness to assess these risks. Multi-event securities may thus become at least a partial long-term solution for privately insuring terrorism risk.

Market and insurability trends

The insurance industry’s ability to absorb difficult-to-insure or uninsurable risks declined in recent years for several reasons. First, global insurance capacity was affected by adverse financial market developments and extraordinary claims, notably those related to 11 September 2001. Between the year-end 2000 and year-end 2002, the reinsurance industry’s capital contracted sharply, hampering the industry’s ability to cover large and difficult-to-insure risks. Thanks to a hard market and recovering securities prices, the industry is once again well capitalized.

One key trend undermining the industry’s ability to cover long-term or extreme risks is the changing relationship between insurers and reinsurers. Reinsurance is generally indemnity-based and tailored to the needs of the ceding company. Traditional reinsurance depends, in part, on well-developed contractual and business relationships between insurers and reinsurers. (Re)insurance contracts are based on an implicit understanding that losses will be shared over the course of a long-term relationship. Lower entry barriers, due in part to the development of offshore markets like Bermuda, have reduced the “payback over the cycle” aspect of (re)insurance contracts. After major losses, higher reinsurance prices rapidly attract newcomers, whose clean balance sheets and solid capital bases enable them to write contracts at prices below those of established reinsurers. This situation suggests a need for new solutions to improve the way traditional reinsurers work with primary companies.
Insurance reduces the risk and uncertainty that clients face. But not all risks can be insured. As this report has noted, for a risk to be insurable, it must be measurable, bounded and reasonably well-behaved. To keep risks insurable in a rapidly-changing world, insurers must pay close attention to wording and policy language. Total exposures must be kept within predefined limits. If contract design and wording cannot clearly define a risk’s limits, insurers will not cover it. Insurers, governments and capital markets all have a role to play in extending the limits of insurability.

**Insurers must continue to innovate**

To keep risks insurable, the industry must continue to innovate in response to the needs of people, businesses and societies. Insurers’ future success will depend on their ability to adapt to meet these needs by developing new products and entering new markets. As this sigma has demonstrated, the industry’s track record is a good one.

One key to insurers’ ability to adapt is the flexibility of traditional insurance contracts. Insurance conditions such as deductibles, co-payments and policy limits help to assure that all parties share risk fairly. These features, though familiar and seemingly mundane, are nonetheless quite powerful. Much has been made – and justifiably so – about how the rapidly growing use of derivatives in recent decades has facilitated more efficient risk sharing. Insurers have long had these tools at their disposal. After all, a deductible is really just another name for a “strike price”, insurance layers are risk tranches and an insurance contract is a type of derivative.

**Governments can help make coverage available**

Governments can intervene to make coverage more widely available in several ways. When the free market fails to adequately insure a peak risk, such as terrorism risk after September 11, governments can make coverage more broadly available either by funding a special vehicle to offer reinsurance or by mandating that policyholders pay a surcharge to facilitate societal risk pooling.

Governments can also promote insurability in other, indirect ways. When the government provides a social benefit such as long-term health care coverage, it familiarizes the public with a type of insurance that it might not otherwise have understood. This education process makes it easier for private insurers to sell complementary covers. Similarly, when a government stops offering a social benefit or scales it back, new demand for private coverage arises from those wishing to replace the lost benefit. Thus, when public pension schemes show signs of financial weakness, the demand for private pensions rises.
Securitization can extend insurability

Insurance securitization complements traditional insurance tools. By expanding industry capacity, large-scale securitization would make coverage for hard-to-insure risks more available and affordable. Attaining a critical mass would drive down Insurance-linked securities (ILS) costs still further through economies of scale, learning-by-doing and enhanced liquidity. A mature ILS market would be especially useful in allowing risks to remain insurable during a hard market. The securitization of mortgage risk over the past three decades has had a similar effect, reducing both the level and volatility of mortgage rates.
### Country Provider Details

**Australia**  
**ARPC**  
The Australian Reinsurance Pool Corporation (ARPC) came into force on 1 July 2003. The scheme covers insurance for loss of or damage to commercial property that is owned by the insured, insurance for business interruption arising from loss of or damage to or inability to use eligible property, and insurance for liability of the insured arising from ownership or occupation of eligible property. Insurers that have issued eligible policies are fully covered by the Australian Reinsurance Pool Corporation (ARPC) for all claims arising out of declared events on policies in force at 1 July 2003 or issued between 1 July and 30 September 2003. For policies issued on or after 1 October 2003 insurers are able to reinsure the terrorism liability with ARPC, subject to the insurer retaining an annual aggregate deductible of 4% of gross property insurance premium or AUD 1 million, whichever is the lesser. Further information is available under: http://arpc.treasury.gov.au

**Austria**  
**Terrorism pool**  
The Austrian terrorism pool started operation 1 January 2003. With effect from 1 January 2004 it gives automatic protection against property damage and business interruption for industrial, commercial and private lines with a sum insured up to € 5 million (per location, insured and calendar year). Risks with a total sum insured exceeding € 5 million must be covered on a facultative basis. Participation is voluntary.

**France**  
**GAREAT**  
With effect from 1 January 2002, the French insurance market in cooperation with the government set up a state-controlled pool for terrorism cover called GAREAT (Gestion de l’Assurance et de la Réassurance des Risques Attentats et Actes de Terrorisme). This pool has insured and co-reinsured risks whose insured value exceeds € 6 million, covering material damage and loss of profits. Eligible policies: Property, ie fire, all risks and multi-peril packages, business interruption (only if linked to property damage) and Engineering, ie machinery breakdown, construction and erection all risks, computer all risks. Participation has been declared obligatory by FFSA and GEMA members and is open to other companies authorized to write direct insurance on French territory or operating under a freedom of services agreement. With effect from 1 January 2005 an additional facility, GAREAT II, provides equivalent terrorism protection for risks not covered by the original pool (now called GAREAT I), however without governmental guarantee.

**Germany**  
**Extremus**  
Following an agreement between the German insurance industry and the Federal government, a special insurer (Extremus Versicherungs-AG) was established to cover buildings and contents as well as business interruption losses arising from acts of terrorism in Germany. License was granted by the Federal Financial Supervisory Authority (BaFin) on 22 October and business was taken up by 1 November 2002. Participation is voluntary.

**Israel**  
**PTCF**  
Terrorism is excluded from standard property policies but the private insurance market grants coverage by separate endorsement. Reinsurance coverage for such endorsements is available.

**Italy**  
**ANIA**  
The Italian Association of Insurers already submitted a proposal to the government to create an insurance/reinsurance pool. Due to the complexity of Italian legislation the proposal has so far not materialized.

**Netherlands**  
**Dutch Reinsurance Pool for Terrorism Claims (NHT)**  
The Dutch terrorism (re-)insurance pool (NHT), established as a dedicated reinsurer, started its operations on 1 July 2003. NHT offers protection for all lines of business (life and non-life) except aviation hull and aircraft liability. Participation is voluntary. However, participating insurers are expected to cede all their terrorism exposure to the pool. Should the annual claims burden exceed € 1 billion all claims will be scaled back proportionally to fit within the limit.

**Spain**  
**Consorcio**  
The Consorcio de Compensación de Seguros (CCS) is a state insurance facility protecting persons, property and business income against “extraordinary risks”, ie natural phenomena such as earthquakes, tsunamis, volcanic eruption, extraordinary floods, atypical cyclonic storms, impact and falling of unmanned aerial bodies, as well as acts with social repercussions (eg terrorism, riots, civil commotion, actions of the Armed Forces or Security Services in peacetime). The cover is integrated into policies issued by private insurance companies who collect premium on behalf of the CCS. Following deregulation in 1990, it became possible to insure these risks privately, whereupon the CCS became a provider of subsidiary coverage only, paying out indemnities when the private insurance company does not cover the risks in question, or when it does cover them but is insolvent. Cover granted by the CCS follows the minimum level of protection defined by law. Policyholders must pay CCS premium in any case, thus maintaining the principle of solidarity for catastrophic risks.
From 1 September 2003, the Swiss Market Solution foresees a terrorism exclusion for all commercial/industrial policies with a TSI above CHF 10 million for contents and all policies covering buildings and BI above that threshold. Up to this limit cover is provided through standard fire policies.

The international reinsurance market withdrew capacity as a consequence of IRA terrorism in the 1990’s, which in turn led to a state supported solution: Limited cover with additional excess cover is available. Pool Re reinsures its members (insurance companies) at rates prescribed in the Pool Re tariff. The English government acts as Pool Re’s “reinsurer of last resort”, in case of insolvency. Coverage is based on a Pool Re specific definition of terrorism. Membership is not compulsory but pool protection is available to members only (currently around 200 insurers).

On 26 November 2002 President Bush signed the Terrorism Risk Insurance Act which obliges all licensed/admitted primary insurers, surplus lines insurers, state workers’ compensation funds and residual market entities to offer coverage for “certified” acts of terrorism. The Treasury Secretary determines what constitutes a “certified” act of terrorism. The federal government will pay up to 90 percent of any insured losses arising from such acts but does not grant any backstop for “non-certified” terrorism. Damages caused by a terrorist attack must be at least USD 5 million to be covered by this three-year program (a prolongation is under review). Losses covered by the program will be capped at USD 100 billion per annum. Over and above this amount Congress has to determine whether excess payments can be made.

Information as of: 12 May 2004.

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France: Gestion de l'Assurance et de la Réassurance des Risques Attentats et Actes de Terrorisme (GAREAT)
Germany: Extremus Versicherungs-AG
Italy: Associazione Nazionale Fra Le Imprese Assicuratrici (ANIA)
Hong Kong: Financial Service Bureau/Office of the Commissioner of Insurance
Netherlands: Verbond Van Verzekeraars; Northern Ireland: Northern Ireland Information Service
Spain: Consorcio de Compensación de Seguros
Switzerland: Schweizerischer Versicherungsverband (SVV)
UK: Association of British Insurers (ABI); HM Treasury/Pool Re
USA: American Insurance Association (AIA)
National Association of Independent Insurers (NAII)

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