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Abstract

This paper examines the recent emergence of initiatives involving the reinsurance industry and the capital markets to develop mechanisms to finance the losses arising from catastrophic events. These initiatives are discussed from two perspectives. One perspective explores these financing mechanisms from the contention that catastrophic events are becoming increasingly non-insurable within contemporary risk society. In this regard the paper addresses issues relating to the coherence and sustainability of the risk networks underpinning efforts to maintain the insurability of catastrophic events. These catastrophe-financing initiatives are also discussed from a second, although related perspective. This refers to the very emergence of these different financing mechanisms. In this regard the moving potential of liberal government or the inventive mechanics driving the development of different ways to manage catastrophic risk become significant. The paper argues that the emergence of these different catastrophe-financing mechanisms is occurring at the intersection of concerns over the non-insurability of the catastrophic and the extremes of capitalist ingenuity, suggesting both perspectives might offer insights into some of the possible future trajectories of risk society.

Keywords: catastrophe risk; catastrophe financing; risk society; risk networks; securitization; 'insuratization'.

This paper is concerned with catastrophic risk (both from natural catastrophic events, such as earthquakes, hurricanes and floods, and from 'man-made' ones, such as environmental disasters, satellite crashes and terrorist attacks). More specifically, the paper addresses issues relating to mechanisms available to finance the costs associated with such catastrophic events.

The focus of the paper is on the recent emergence of innovative financial instruments developed by reinsurers in conjunction with the capital markets

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designed to spread the costs of catastrophes across a wider financing base. This process, termed the securitization of catastrophic risk, involves packaging the risks associated with a particular catastrophic event and transferring them to the capital markets, which assumes the obligation for financing the costs of catastrophes in return for some form of payment from the reinsurer. Securitized catastrophic risk first appeared in the capital markets in 1995 and 1996 and remains as yet very much in its infancy. While initial attempts to raise an interest in these products were considered somewhat disappointing, the annual USA market size is now estimated to be greater than US$1 billion, with a projected annual market of perhaps US$60 billion (McDonald 1999: 75).

The emergence of securitized catastrophic risk and its relative infancy provide the empirical terrain of the paper, one which connects the paper to risk theories. From one perspective, a defining element of Beck's (1992) argument that society has moved from being an industrial to a risk society hinges around the incalculability and non-insurability of an ever-increasing number of catastrophes, accelerating the risk society towards a situation where actuarial techniques are rendered inapplicable. Within such a risk theory framework, the extent to which the convergence of the institutions of reinsurance with the capital markets can generate alternative risk transfer mechanisms and facilitate the reinsurability of catastrophic risk assumes some salience. The occurrence of recent transfers from reinsurers to the capital markets of the risk of earthquakes in Japan and California, windstorms in Europe, hurricanes in Florida and typhoons in Japan (*ART Deal Directory*) might suggest that, if the more traditional reinsurance institutions are perhaps becoming increasingly cautious in their underwriting practices, this does not necessarily mean that catastrophic risk cannot become insurable in different ways. Thinking along these lines, the development of securitized catastrophic risk becomes connectable to other perspectives on risk theory.

To researchers of liberal government the very emergence of securitized catastrophic risk takes on some significance. The tentative steps taken by reinsurers to discover different approaches to catastrophe financing might be considered as an illustration of the continuously shifting techniques, mechanics and dimensions integral to the practical functioning of liberal government. In the context of insurance, Ewald (1991: 198) describes this process as '[i]nsurantial imaginary' and the ongoing movement of what are thought of as '[p]rofitable, useful and necessary uses' for insurance technology. More broadly, the risk networks established to support securitized catastrophic risk resemble Rose's assemblages of government constituted by:

> diverse components – persons, forms of knowledge, technical procedures and modes of judgement and sanction. . . . [f]ull of parts that come from elsewhere, strange couplings, chance relations. Cogs and levers that don't work – and yet which 'work' in the sense that they produce effects that have meaning and consequence for us.
>
> (Rose 1996: 38)

From such a perspective, the type of components brought together and how they are intended to function – don't work and yet 'work' – also becomes of interest.

The notion of catastrophic risk networks not working yet 'working' is of considerable importance for the paper. As suggested, the development of securitized catastrophic risk and its associated risk networks has involved the connecting of a heterogeneous assortment of people, rationales, techniques and knowledges. The paper seeks to stress the disagreements surrounding these emerging risk networks. In particular, the paper explores whether these risk networks might or might not maintain the necessary degrees of coherence between institutions and technologies so as to incorporate the minimum level of articulation necessary for the practical functioning of catastrophe financing. From a risk society perspective, which presupposes the incalculability of catastrophic risk, considerable emphasis would be placed on exploring how and to what extent the incalculable catastrophic might have become, in a sense, calculable. In this regard, some assessment of the technical viability and sustainability of this new method of financing catastrophic risk becomes significant. The paper adopts the position that, even for active participants in the field, the immaturity of the market for securitized catastrophic risk suggests that its viability remains massively underdetermined and as such an empirical issue. Arguments such as '[w]e'll need a year in which there are several large catastrophe events to really judge their market potential' (Hann 1998: 32) adds purchase to the observation that the risk assemblage might 'work' in the sense of generating effects and consequences which themselves could be undesirable.

Risk networks not working yet 'working' assumes a different significance for researchers in liberal government. Actual rather than possible failures of catastrophic risk networks and hence of liberal government would in an important way be treated as internal to the practice of liberal government,[1] with the evaluation of failure itself a constitutive component of government. The actual failure of catastrophic risk networks is not within the empirical scope of the paper. The paper does, however, consider some of the linkages already being explored in the USA between politicians, political agencies and efforts to establish the market for securitized catastrophic risk. One purpose in this regard is to give some sense of the uncertainties and dilemmas as politicians in a very creative and liberal fashion grapple with their responsibilities to address catastrophe financing and how these might become inventively connected to the development of capital market initiatives.

The 'crossbreeding of insurance and the capital markets

In reviewing Ericson and Haggerty's 1997 study of the transformation of the role of the police into that of risk managers, O'Malley (1999) speculated as to whether the increasing realignment of police with other risk management agencies was suggestive of other emergent connections between risk institutions,

philosophies and projects. O'Malley then raised the issue of how such dynamic ranges of potential relationships might unfold in the future in unanticipated ways and with unanticipated consequences: 'What happens when such divergent models of risk are brought together? What unforeseen hybridizations appear, and how far will such emergent innovations change the shape and course of what we take now to be risk society and what we imagine to be its future trajectory?' (1999: 146). The securitizaton of catastrophic risk has been one such recent innovation, which, in combining in different ways elements from both reinsurance and the capital markets, has created a '[c]rossbreeding between two diverse disciplines, insurance and capital market finance', one which '[w]ill no doubt create interesting applications' (Clark 2000: 5).

Although, at this early stage of the gestation period, it is difficult as yet to determine what mutant offspring might ultimately emerge from this cross-breeding, in trying to imagine possible future risk trajectories, one might consider some 'interesting applications' already being made available by the securitization of catastrophic risk. One glimpse, and an arguably benign interpretation of the risk opportunities available, proceeds along the following lines. As reinsurers seeking to spread the costs associated with the occurrence of a hurricane intersect with capital market participants seeking to diversify the risk of their asset portfolio by investing in the likelihood of a hurricane not occurring, the intriguing scenario emerges of reinsurers and investors assessing their relative financial exposures to a particular hurricane with an '[u]p to date, fine-tuned stochastic envelope of likely losses, all in real-time . . . even as the locals board up their windows and flee to higher ground' (Buff 1999: 68). As the projected path of the hurricane is tracked and investments in the occurrence of a hurricane are traded, an asset evaluation process emerges unparalleled in more conventional capital market situations. Anticipating quarterly corporate earnings and stock price changes pales in comparison to the vagaries of nature, whereby a slight last-minute change in the direction of Hurricane Andrew (already at US$15.5 billion the most expensive catastrophe in USA history) causing it to strike Miami rather than rural Florida 20 miles south would have more than tripled the costs of damages (Cutler and Zeckhauser 1997: 5). Nevertheless, the opportunity to have taken '[t]he plunge into one of the most nerve-jangling securities ever designed, with a name to match: Catastrophic Bonds' (Securitization 2000a) constitutes one possible future trajectory of risk management. From such a perspective, the emergent mutation maintains a degree of economic coherence as the costs of catastrophes are spread across a wider financing base.

Conceptual and analytical distinctions between capital market behavior as investing, as speculating and as gambling (if indeed such distinctions exist) continue to prove contentious (Chancellor 1999; Soros 1995). From the very practical perspective of the functioning of catastrophe financing, however, a less benign interpretation of the above scenario offers a different glimpse of another possible trajectory of risk management. As reinsurers wishing to transfer the unacceptable financial losses associated with a catastrophe now intersect with

financial speculators for whom no gamble is too great, the bizarre scenario emerges of a fund manager tracking the path of a hurricane worrying: 'Either the hurricane doesn't hit and they look like a hero. Or it does and they get fired' (Securitization 2000a). The locals as insureds boarding up their windows might also have cause to worry should they discover that their anticipated future compensation for damages might depend upon the speculative capital of a party of unknown name and solvency. From such a perspective, the responsibility and care insureds took to protect themselves from catastrophic danger might ultimately prove to be of no avail, as divergent philosophic and economic perspectives on the roles of insurance catastrophically collide, producing the most unwelcome of offspring. In the wake of a major catastrophe politicians might also worry as they conduct hearings into the failure of the functioning of the market for catastrophe financing, evaluate their past decisions and their legitimate future responses as disgruntled constituents complain about the non-performance of their insurance contracts.

The above two perspectives on the possible future trajectories of catastrophe financing and risk management generated by the crossbreeding of insurance and the capital markets suggest some of the tensions and divisions surrounding the intersection of a seemingly insatiable appetite for financial protection from danger with a seemingly equally insatiable appetite for the investment potential of risk. O'Malley's observation that the blurring of various risk management institutions might develop to levels '[t]hat risk technologies will soon have no recognizable base in any existing institutional setting' (1999: 146) assumes considerable significance when the emergent risk technologies encompass aspirations to reduce risk together with those that seek to intensify or magnify risk's profit potential.

Reinsurance

As Ericson *et al*. (2000: 533) observe, while risk management and insurance have attracted substantial attention from researchers interested in risk theory, relatively little attention has been paid to the actual functioning of the market for insurance. In terms of Ewald's (1991: 197–8) delineation of the various components which constitute the insurance industry, the institutions of insurance have taken second stage to insurance as technologies and forms of government. The reinsurance industry for its part has been largely ignored. Reinsurers insure insurers from the full financial costs of catastrophic events. Operating in the shadow of the more publicly visible and recognizable insurance industry, few holders of insurance are aware that their coverage might well have been ceded by their familiar insurer to a reinsurer. However, reinsurance has an immense if largely unnoticed presence for the practical mechanics of the insurance market and, in particular, for the financing of catastrophic events.

'*Catastrophic risk*'

> Just how the catastrophe underwriter arrives at key decisions has proved a source of fascination for many years, yet literature on the topic is particularly scarce. . . . The implication is either that catastrophe underwriters have a carefully guarded secret to be protected at all costs or that the methods they employ defy description or communication to interested parties.
>
> (Ayling 1984: xvii)

Ayling's observation on the lack of transparency surrounding the mechanics of the reinsurance industry echoes Ewald's description of the industry's calculative methods involving a 'special kind of alchemy' (1991: 200) as the sudden forces of the catastrophic are transformed into business opportunities. Although it is not the purpose of this paper to provide a detailed analysis of the operating protocols of the reinsurance industry, a number of general observations are necessary in order to establish some broad appreciation of the considerable complexities which surround the industry.

As reinsurers concede, the industry in dealing with low probability events has a particularly fragile connection to statistical technologies. As regards natural catastrophes, reinsurers operate in a calculative space invested by inescapable uncertainty: '[i]t is still not possible to assess when, where and how often these events will occur' (Swiss Re 1999: 401). In an industry in which the watchword is 'disaster may strike at any time' (Hauck 1998: 220), such caution is apt. Moving away from natural catastrophes to man-made disasters, these too pose prediction problems. For example, reinsurers contemplating exposures in technology are involved in a process of 'thinking the unthinkable and quantifying the unquantifiable. *It is a near-impossible task*, both because of the speed with which technological progress is accelerating and because the insurance industry is increasingly confronted with *risks* which are not clear-cut' (Swiss Re Corporate Annual Report 1998: 40, emphasis added).

Drawing the distinction between risk as a statistically assessable state of danger and uncertainty as what O'Malley (2000: 461) terms as a 'foreseeable' exposure to danger without knowledge of its probability, 'unthinkable' and 'unquantifiable' risks like the notion of 'catastrophic risk' seem to possess a certain incongruity. Yet a process involving the practical reconciliation of uncertainty and risk, often to an extent to which their distinction becomes blurred, lies at the heart of reinsurance practice (Reinsurance Association of America).

At a general level, reinsurers operate as investment houses, investing payments received from insurers in various forms of assets in order to generate sufficient funds to reimburse insurers and subsequently insureds in the event of some specified catastrophic event (Cutler and Zeckhauser 1997: 26). As the notions of 'alchemy' and 'secretive and description defying methods' imply, detailed explanations of what combination of reinsured catastrophes can be

appropriately included in a portfolio of business are rare. However, recurring themes stress the emphasis the industry places on disciplined underwriting and geographical and product diversification to encourage the cautious assumption of catastrophe-financing obligations (Leonard 1998: 9). In addition, more formal safeguards exist to supplement institutionalized industry practices. Both the insurance and reinsurance industries are regulated at the state and federal levels, with various codes governing capital requirements, policy writing, dividend payments, risk exposure and loss-reporting procedures (Davidson 1998; Insurance Information Institute 1989).

Irrespective of safeguards, in the wake of a major catastrophe or a series of catastrophes the industry is characterized by consolidations, mergers and restructurings. This decline in capacity or the supply of reinsurance, often coinciding with an increase in demand, introduces a cyclical dimension into the industry as the premiums reinsurers charge rise, facilitating the recovery of past losses and the accumulation of financial reserves (*The Economist* 1999). From such a perspective catastrophe financing constitutes a form of contingency funding, one premised however upon the development of long-term relationships between reinsurers and their clients and a long-term commitment from reinsurers to the market for catastrophe financing (Lonkevich 1999a: 4).

Thinking at this point just within these broad paradigmatic parameters of reinsurance protocol raises a number of issues as regards the proposed alignment of the capital markets with catastrophe financing. As regards the premise of the uninsurability of catastrophic risk, it is reinsurers as the financiers 'of last resort' who have historically decided on its calculability and insurability and have done so, as the above discussion suggests, within a very distinct institutional framework and with highly idiosyncratic methods. In slightly different terms, catastrophic risk already becomes calculable and reinsurable only under highly specific circumstances. The securitization of catastrophic risk in the capital market will involve for the most part participants with a mentality of investing over the shortest of time horizons, worrying if a single catastrophe (itself a phenomenon outside their normal range of expertise) might occur. Nevertheless, securitized catastrophic risk is becoming an increasingly discussed and employed method of catastrophe financing.

The securitization of catastrophic risk

> [C]atastrophe losses will continue to become more frequent and severe in the future. . . . The complexity and loss potential of these risks, however, is so great that cover and risk spread is only possible on a global scale and only with the specialised know-how of a professional reinsurer. Some extreme catastrophe scenarios, for which available traditional reinsurance capacity is insufficient, can only be covered using additional alternative forms of reinsurance,

> such as the transfer of the risk to the capital markets through securitization. . . . [C]hanges in global environmental conditions will also have an increasing – though as yet still indeterminable – effect. This category of risk includes global warming, depletion of the ozone layer, air pollution and radiation. Against this backdrop, *the challenge to the insurance industry remains to provide innovative solutions*.
>
> (Swiss Re, Corporate Annual Report 1998: 41, emphasis added)

The increasing frequency and severity of catastrophes, their escalating costs and new categories of extreme catastrophe with as yet indeterminable effects, all resonate in part with Beck's thesis of risk society and its acceleration towards non-insurability. In the 1990s USA catastrophe costs amounted to US$98 billion or twice the inflation-adjusted amount for the previous thirty-nine years (Marcon 1999: 61). Economic and residential development in the USA in areas prone to earthquakes and hurricanes means that the reinsurance industry now considers that the potential costs from a single future catastrophe could amount to US$100 billion, eliminating 40 per cent of the total capital of the USA property liability insurance industry (Doherty 1997: 716). While from the practical perspective of catastrophe financing additional funding is required to meet the costs of different and more expensive catastrophes, the source of such funding is still very much in doubt. To some reinsurers catastrophes can either remain or become reinsurable only if innovative solutions or more imaginatively assembled risk networks for catastrophe financing can be discovered.

As suggested, the capacity of securitized catastrophic risk to assume this role as an alternative risk transfer mechanism is still in doubt. However, the successful securitization of catastrophic risk has occurred with substantial discussions taking place as to its wider applicability. While for the most part securitization has so far involved natural catastrophes, other placements include aerospace liabilities (Souter 1999) and satellite failure (Hunter 1999), with securitization also being explored for agricultural losses, labour strikes, environmental pollution (Securitization 2000b), automobile insurance and workers compensation (Hunter 1999). Under such circumstances, discussions as to the viability of securitization assume some significance.

Clashing risk philosophies

> Our experience continues to demonstrate that a market for innovative instruments to manage insurance risk does exist, and that investors have an appetite for that risk.
>
> (Evidence presented by a capital market spokesperson before the Committee on Banking and Financial Services, US House of Representatives, Serial 105–56, 1998: 66)

> If they [securitized catastrophic risk products] made more sense, more people

> would be buying them, just as people are buying nearly everything else that Wall Street is offering these days.
>
> (Evidence presented by a reinsurance spokesperson before the Committee on Banking and Financial Services, US House of Representatives, Serial 105–56 1998: 71)

The idea of capital market participants with an appetite for the investment potential of catastrophic risk intersecting with a nagging doubt over whether securitized catastrophic risk makes sense continues to a considerable extent to shape the ongoing articulation of catastrophe financing with the capital markets. From the former standpoint, an almost inevitable and productive relationship is forged between catastrophes and the greater funding and liquidity capacity of the capital markets (Heise 2000). It has been argued (Marcon 1999: 60) that, with US$26 trillion under management in the USA capital markets, US$14 trillion is held by institutional investors who would evaluate the investment implications of catastrophic risk. Simultaneously, however, the same relationship has been viewed as a further illustration of speculative excess with the capital markets being littered '[w]ith high-yielding securities that history has proved were not yielding enough to compensate for the risk' (Securitization 2000a). Or, at the same time as the capital markets are being attracted to the profit potential of catastrophic risk, insurance companies in hurricane-prone Florida are prevented from withdrawing from the State only by a legal moratorium on market exit; and in California (fires and earthquakes), Texas and Hawaii (hurricanes) catastrophe insurance is largely made available only by some form of subsidy from state authorities (Jaffe and Russell 1997).

The broad concept of securitized financial products obtained its first general capital market acceptance in the 1980s, with early market offerings being primarily designed as mechanisms to transform illiquid assets held by financial institutions (for example, anticipated streams of mortgage or credit-card payments) into tradable securities by selling the anticipated principal and interest receipts separately in the capital markets. Even in terms of its own scheme of rationality, however, securitization has proved a highly erratic form of investment. The 1994 collapse in the USA of the market for securitized mortgage-backed investments was attributed to a combination of product complexity such that '[e]ven sophisticated investors are unable to assess them' and to modeling methods which are '[f]ar from reliable' (Steinherr 2000: 81). It is perhaps not without a touch of irony in the context of the proposed securitization of environmental liabilities that the mortgage repayments with the highest likelihood of default became known as ' [t]oxic waste" by the traders who handled them' (Mayer 1993: 153).

Deficiencies in modeling methods also plagued early attempts to securitize catastrophic risk. The initial lukewarm capital market response was attributed to information deficiencies with '[t]he biggest impediment to investors buying these bonds seem[ing] to be that they did not know how to model and price the risk' (Canter and Cole 2000). This should come as no surprise given the

reinsurance industry's own acknowledgments of its particularly idiosyncratic relationship to calculative technologies. However, the enticement of securitized catastrophic risk being '[t]he equivalent to a free lunch for investors (Froot *et al*. 1995: 6) was hardly likely to go unnoticed. Employing prevailing financial economic theory as a conduit to connect catastrophes to the capital markets, the lack of any statistical correlation between the occurrence of catastrophes and either general stock market movements or economic conditions suggested the attractiveness of such assets for a diversified investment portfolio (Marcon 1999: 62). As Riggin (2000) frames the issue, '[a]ssuming these securities are fairly priced, investors and hedgers can supplement their portfolios without adding to their overall risk'. Furthermore, whereas projected losses of US$100 billion associated with a 'mega-catastrophe' would constitute a daunting amount for reinsurers, with an estimated average US$133 billion daily standard deviation or fluctuation in the financial market's capitalization value, the magnitude of such losses is argued to fall within an experiential 'comfort zone' for capital market investors (Froot *et al*. 1995: 3–4).

In terms of the coherence of emerging risk networks, however, the above arguments should be treated with caution even within their own theoretical co-ordinates. First, while the manageability of possible catastrophe losses relative to the size of routine capital market fluctuations is strictly accurate in terms of the dollar amounts of risk involved, it fails to draw a distinction between the impact of a US$133 billion fluctuation in asset values spread across all possible market participants and the impact of sizeable catastrophe losses upon a limited number of capital market catastrophe investors. Second, the case for securitized catastrophic risk on the basis of its articulation within a wider diversified asset portfolio is highly contingent upon the availability and credibility of underlying catastrophe-related data with which potential investors can identify, measure and price the risk of the investments (Steinherr 2000). In this regard, the calculability of catastrophic risk and its relationship to catastrophe information systems came to be considered critical for the success of securitization (Lewis and Davis 1998).

Catastrophe information systems

With the availability of catastrophe-related information coming to be seen as pivotal for the effective securitization of catastrophic risk, the risk networks which have emerged to facilitate securitization in one sense illustrate the remarkable capacity of assemblages of government to combine different elements in diverse and productive ways. Reinsurers, capital market participants, catastrophe information systems, catastrophe-modeling agencies, investment-rating agencies, financial underwriters and existing financial products have all become imaginatively assembled. From a liberal government perspective, the very emergence of such risk networks capable of supporting securitization as an alternative method of catastrophe financing can itself be considered as

illustrative of the moving and creative possibilities of government. The addendum that it remains to be discovered during the practical operation of securitized catastrophic risk if and how these connections might or might not work in the future clearly leaves unfinished issues as to their sustainable viability. The inherent potential for a high degree of instability, which, it will be argued, such networks already display can, however, be viewed from a different perspective. While securitization is contributing to catastrophe financing at the current time, it is also pertinent to consider whether in some imminent risk society these risk networks, in not working yet 'working', might inch society a little closer towards some of Beck's darker premonitions of an increasing lack of insurance protection.

Once in 100 years

> In the traditional reinsurance market, insurers and reinsurers undoubtedly had a comparative advantage over insureds and investors in *estimating catastrophe losses* . . . The new modeling companies have leveled this field by providing loss estimation services not only to insurers and reinsurers but to banks, consulting companies, brokers, and investors. That *all parties can be equally informed* has been a factor in arousing the interest of investors in new instruments.
>
> (Doherty 1997: 715, emphasis added)

> What securitization really means is that a bunch of people in the investment world are going to become insurance underwriters, and I don t think on balance they are going to do very well. . . . Securitization is going out and making deals with people who don t know a lot about reinsurance and are probably taking some professional s opinion who *sets the probabilities* of a bunch of tornadoes in Omaha or something and he will give you *an answer that pleases you*, that I can promise you.
>
> (Warren Buffet, quoted in Ostermiller 1999, emphasis added)

As 'equally informed' parties and 'an answer that pleases you' became connected, the risk networks to support catastrophe financing were made contingent upon the co-possibilities of the scientific claims of catastrophe-modeling systems and the recurring theme of alchemy. The increasingly blurred distinction between parties equally informed of the losses a particular catastrophe might generate, with nobody still any wiser of when it might strike, while perhaps an appropriate description of how securitized risk will function, nevertheless constituted a fragile calculative foundation. To make securitization viable in the capital markets and enhance its acceptability to investors required that the calculability of catastrophic risk undergo some modification.

Equally informed parties were offered the opportunity to assess their loss '[e]xposures by ZIP code' (Major 1996: 2) as recently established catastrophe information companies connected to emergent risk networks and sold access to

their catastrophe-pricing models. Risk Management Solutions offered models which '[e]ncompass algorithms and expert systems that allow clients to quantify potential damage and financial losses from specific perils. The models are built upon detailed databases describing highly localized variations in hazard characteristics, as well as databases capturing property inventory, building stock, and insurance exposures' (Risk Management Solutions 2000). While some questioned the allegiance of modeling agencies on the basis that '[t]hey are employed by the ceding insurers rather than investors' (Efrat quoted in Hunter 1999), these estimates were nevertheless '[p]rominently displayed in [catastrophe] bond prospectuses and are used as a basis for pricing' (Canter *et al*. 2000). Risk 'rating agencies, [which] because of their diligence, are an important source of information for investors' (Whitney 1999: 78) used these data and also connected to emergent risk networks by translating the risk profile of catastrophes into the standardized risk assessments of more conventional investments. The oversubscribed 1997 issue by the United Services Automobile Association (USAA) of US$477 million of hurricane bonds was premised largely on '[t]he involvement of rating agencies. Once the note was given a rating, it became easier for investors to assess whether they were being compensated for the risk they were being asked to assume' (Canter *et al*. 2000). As a catastrophic risk underwriter also now a component of catastrophe-financing risk networks explained, the rating agencies '[h]ave helped make the whole enterprise look rational. "They've given everybody ground cover"' (Securitization 2000a).

The modification of the calculability of catastrophic risk or the 'ground cover' 'to make the whole enterprise look rational' established a link between catastrophic risk, its calculability and existing capital market risk protocols and products:

> The bankers selling these bonds say that you do not need to be a meteorologist to quantify the risk, they have hired Ph. Ds to churn through decades of data. [I]n the USAA deal, the answer from the computers was that the likelihood that USA would be hit with a hurricane costing the company more than $1billion was less than once in 100 years . . . [t]he agencies took the '*once in100 years*' calculation and converted that into their way of talking about the likelihood of default. By their reckoning, the *riskiest bets* in the USAA's deal were equivalent to those offered by junk bonds.
>
> (Securitization 2000a, emphasis added)

As parties 'equally informed' of estimated losses intersected with a once-in-100 years 'answer that pleases you' and connected to PhDs churning through decades of data for risk-rating agencies and underwriters, the investment potential of securitized catastrophic risk became translated into 'the riskiest bets' offered by junk bonds. Nevertheless, the calculability of catastrophic risk while increasingly contingent on complex and unstable risk networks became informationally and technically feasible.

If the rise of new risk professions is necessary to link the calculable catastrophe to a voracious appetite for catastrophe knowledge and to its profit

potential, the functioning of an imminent risk society might perhaps witness the most imaginative claims to expertise. Eqecat (voted Professional Service Provider of the year 2000 by *The Review-Worldwide Reinsurance*) conducted research '[t]o meet the capital market's demand for high quality reinsurance data' and facilitated the successful issue of a US$200 million securitization of US and Japanese earthquake and European windstorm risk. The research 'provided overall loss probabilities and peril/regional contributions to the risk and performed analysis of all known historical events for the last 300, 1300, and 50 years in the US, Japan, and Europe respectively' (EQECAT 2000). Securitization endeavors based upon eighteenth-century US and eighth-century Japanese data not only leave unfinished questions as to the viable functioning of the implied risk networks but, in not working yet perhaps 'working', also leave unfinished what future consequences might ensue for the owners of insurance in distant locations.

Proliferation

If an essential feature of government assemblages is their capacity to add, delete, reorder and reassemble constitutive components, catastrophe financing has proved a fertile area of application. In a process of proliferating risk connections, risk networks are developing to create ever more imaginative risk relationships. What are considered reinsurable catastrophes, who are qualified to assume the risks and the technologies and practices employed in risk assessment are all being reconfigured with ever more unpredictable consequences.

Reinsurers might become deleted from the catastrophic risk network as corporations can now bypass reinsurers and themselves take advantage of the opportunities offered by the capital markets for securitized catastrophe risk. In 1999 Tokyo Disney securitized US$200 million of earthquake property damage and business interruption losses directly in the capital markets (*National Underwriter* 1999). The 1995 Kobe earthquake in Japan caused US$100 billion of economic losses through business interruptions of which only US$3billion were insured due to a reluctance by many reinsurers to become extensively involved in either the business interruption or the Tokyo property insurance market: 'Tokyo Disney was looking for both, so it designed its own custom coverage and placed it in the capital markets . . . [t]he company was also seeking long-term protection and placed 5 year bonds. Historically they could not have bought that cover' (Miller 1999). Reinsurers themselves struggle to delineate the emergent risk network 'There's no insurance company involved. It's not insurance. It's totally outside the insurance world' (Lonkevitch 1999b: 3). As the capital market ventures where reinsurers fear to tread, whether outside, inside or alongside the insurance world, in the case of a Tokyo earthquake occurrence, the possible interactions among the constituent components of the risk network are simply not known. An earthquake of the magnitude of that of 1923 in Tokyo, which it is estimated might now cause losses of up to US$1.4 trillion (Bantwel and

Kunreuther 2000: 76), would prompt unpredictable and dramatic shifts in the closely linked global capital markets rendering catastrophe financing contingent upon flows of highly uncertain funding.

In a further process of proliferation, capital market investment houses are now establishing their own reinsurance subsidiaries to explore the securitization possibilities of emerging forms of catastrophes. Referred to as 'event-risk' bonds, so as to encourage investors to think '[i]n a broader context than simply monetizing Mother Nature's potential for destruction (Buff 1999: 66), 'boutique catastrophe houses' will now evaluate the profit potential of a range of catastrophes. Reinsurers again struggle to trace recognizable components of the underlying risk network: the '[c]atastrophe risk area is at the boundary of what is statistically measurable. How can you measure the probability of a labor dispute? It involves personalities and relationships and politics' (Securitization 2000b).

Dual-trigger catastrophe derivatives are also now being offered by the capital markets to protect reinsurers from specified catastrophe losses and a stock market crash which would expose a reinsurer to substantial reductions in its investment income. The assumption behind the instrument is that '[h]edging two independently varying risks can be achieved more efficiently in combination than separately' (*Reactions* 1999: 11). As regards the underlying risk network, unfortunately '[t]here is absolutely no data on the correlation between asset and liability markets though such a correlation may exist should a large catastrophe occur' (Winston 1999: 29). Reinsurers, the capital markets and insureds might all want to keep their fingers crossed in the event of a satellite loss and a subsequent decline in telecommunication- and technology-related stock prices (Broad 1999).

Insuratization

As the above discussion implies, securitized catastrophic risk has involved the emergence of creatively assembled risk networks of disparate components from a variety of sources. Catastrophe financing, once considered as an essentially conservative risk-spreading exercise undertaken by reinsurers, in becoming implicated with capital market participants seeking to intensify the profit potential of catastrophic risk, has experienced a transformation of both its traditional philosophy and its potential participants. It would, however, be inaccurate to see this transformation as either linear or a one-directional flow of influence with capital market practices and practitioners remaining otherwise unaltered except in the immediate vicinity of their intersection with catastrophic risk. Suggestive perhaps of how both elements of government assemblages and their anticipated purposes can become reconfigured during their operation in ways which deviate from any initial intention, capital market risk networks have also become reassembled, as reinsurers for their part now seek to reposition their relationships with all manner of capital market imperatives, further promoting the proliferation of financial risk networks.

While some reinsurers question the coherence of securitized catastrophic risk and the incongruence of a capital market involvement, other reinsurers in a concurrent and reciprocal process of adaptation actively seek to portray themselves as polymorphous financial risk management entities offering a variety of seamless risk products and services eroding any traditional boundary between reinsurance and the capital markets:

> Ask our customers who we are and you will get answers varying from: an *insurer* providing insurance policies . . . [a] *reinsurer* providing significant capital support . . . [a] *guarantor* of capital asset values . . . [a] *counterparty* for swops, options and other financial instruments . . . [a]nd an *investor* supplying direct capital investment.
>
> (*Center Group Corporate Annual Report* 1998: 11, emphasis in original)

Even as reinsurers caution that changing financial market structures, products and services are '[s]peeding up to a point where competitive demands often exceed the ability to fully evaluate the risks associated with these opportunities' (*Zurich Re Corporate Annual Report* 1998: 2–3), the quest for 'holistic' risk management approaches continues to accelerate. On the basis that reinsurance can develop coverage for more conventional capital market risks, a process labeled 'insuratization', or the simultaneous hedging of catastrophic and capital market risks '[w]ithin one overall risk management program' (Riggin 2000) has emerged. Premised, at least in part, upon the principle that reinsurers for their part should engage in broader and more entrepreneurial ways of examining risk, capital market concerns such as credit risk, foreign exchange and '[b]alance sheet issues' (Souter 1999: 1) have all been targeted as areas where a reinsurer can '[p]rotect a company from an insurance and a financial loss occurring at the same time (CNA Risk Management 1998).

Reinsurers now construct the most imaginative portfolio of insured risks: 'Mead Corp, Dayton, has purchased a single insurance policy from AIG that covers property and casualty, foreign exchange risk translation, interest rates, and various commodity prices including pulp, old corrugated cardboard, natural gas, fuel oil and coal (Hague 1998: 4). As ' Insuratization takes on Securitization [these] tools . . . should be used not simply to manage risk, but to maximize shareholder value' with '[t]he biggest obstacle [being] the reluctance to break from the stranglehold of traditional ways of doing things' (*National Underwriter* 1999: 2). As the capital markets and reinsurers compete for an array of financial risk opportunities, insurance is conceptualized and operationalized as a mechanism no longer to 'manage risk' but simultaneously 'to maximize shareholder value'. It would appear that, as the stranglehold of traditional ways of doing things is broken, in an imminent risk society all manner of financial risk networks might become an amalgam of both risk management and more overt entrepreneurial risk projects. The inclusion of catastrophe financing endeavours within this collection of programmes, practices, knowledges and agents while no doubt an imaginative governmental development also perhaps renders unimaginable some future trajectories of financial risk networks.

Political linkages

In April 1998 the US House of Representatives Committee on Banking and Financial Services convened to consider '[t]he fundamental question of whether there is an appropriate federal role . . . to ensure the availability and affordability of home-owners insurance in disaster-prone areas . . . that avoid the creation of imprudential [sic] Federal contingent liabilities' (Committee on Banking and Financial Services, US House of Representatives, Serial 105–56, 1998: 2). The Committee Chairman opened proceedings by acknowledging '[a] growing problem in some States where homeowners insurance has become difficult, if not impossible, to obtain at affordable rates' (Committee on Banking and Financial Services, US House of Representatives, Serial 105–56, 1998: 1). Along similar lines to Beck s position on the increasing non-insurability of catastrophes, the committee noted a lack of availability of homeowner insurance after the Northridge earthquake in California, Hurricane Andrew in Florida and ongoing shortages in a number of other states vulnerable to natural catastrophes. In a very liberal fashion, politicians wrestled with the problem of whether catastrophe financing was a legitimate and necessary focus of their attention and, if so, what interventions might be appropriate.

Illustrative of the uncertainty both about whether any political involvement was warranted and about the complexity of unravelling the coherence of even existing catastrophe-financing risk networks, one politician argued that any political participation in catastrophe financing '[i]s grossly interfering with the free marketplace', recalling how previous government financial initiatives had served to increase rather than reduce the risk from catastrophic events: '[w]e made that mistake with the nuclear power industry. This government provided secondary insurance that limited the risk and as a result we have power stations built in this country on earthquake faults' (US House of Representatives, Committee on Banking and Financial Services, US House of Representatives, Serial 105–56, 1998: 104).

A deputy secretary of the US Department of Treasury, in outlining the underlying principles of the administration's approach to the issue, displayed an appropriate broad liberal regard for the parameters and rationale of political intervention. In advocating a Federal role in catastrophe financing as 'a Government backdrop', he claimed that this could legitimately be achieved only if:

> [t]hat role be [a] limited role . . . [t]hat we be hardheaded, that we assure the Federal Government is fairly compensated for any value that it provides, that we recognize the fast-changing and maturing state of the capital markets, and that we do not allow a Federal role to preempt a more appropriate role for the private markets.
>
> (US House of Representatives, Committee on Banking and Financial Services, US House of Representatives, Serial 105–56, 1998: 19)

In recommending that Federal authorities should offer to provide states with some form of catastrophe funding, politicians were confronted by the problem

of discovering their limited, hardheaded, capital- and private market-friendly solution.

The potential of the capital markets to support catastrophe-funding initiatives proved a contentious issue. Politicians were advised by a reinsurance representative that securitized catastrophic risk '[w]ill not be cost effective in the future because high cost infrequent natural disasters cannot be efficiently priced in the private market. This is not an indictment of capitalism. This is simply the truth' (Committee on Banking and Financial Services, US House of Representatives, Serial 105–56, 1998: 71). In response to politicians' questions as to whether the development of capital market catastrophe financing initiatives might mitigate or even eliminate the need for political intervention, an administration official advised that:

> I think it is difficult to sort out, in terms of the growth of involvement in reinsurance in the capital markets, how much of it is a desirable innovation that will be permanent and how much of it is in response to the fact that after rather difficult years in the 1990's from the point of view of catastrophes, the world has been somewhat more fortunate.
>
> (Committee on Banking and Financial Services, US House of Representatives Serial 105–56, 1998: 33)

It was proposed that a system of Federally funded catastrophe bonds should be made available to states which provide, in the event of a catastrophe, a specified amount of funds to cover associated losses. Since the maximum funding would be capped at some predetermined level and would require specified contributions into a Federal Disaster Fund by participating states, the requirement that Federal involvement should be 'limited' and ' hardheaded' would, at least in principle, seem to have been addressed.

More interestingly, however, state agencies would be required to 'auction' this acquired catastrophe funding to interested parties, with both private insurers and capital market participants entitled to bid for this contingent funding. To the direct political inquiry as to whether there '[w]ould be an ability to have a private marketplace for the sale of – a secondary market for the sale of those bonds', politicians were informed they '[w]ould in all likelihood be quite conducive to the future development of what is already a rapidly growing private capital market in these kinds of instruments' (Committee on Banking and Financial Services, US House of Representatives Serial 105–56, 1998: 22). From the standpoint of a liberal concern not to overstep the boundaries of private capital market endeavors, it is perhaps understandable that political initiatives to address problems of catastrophe financing should become woven within emergent risk networks. Such risk networks now raise the possibility of reinsurers, capital market participants *and* Federal catastrophe representatives tracking the direction of an hurricane in real time, trading Federally financed catastrophe bonds even as the locals board up their windows and flee to higher ground. If such a scenario is suggestive of other emergent risk networks in other financial risk management areas, then the question is raised whether in some

imminent risk society the insurance which citizens believe they have acquired might ultimately prove to be more imaginary than real. So too might the financial backdrop that political agencies believe they have provided in the event of a catastrophe.

A closing scenario

The greater involvement of the capital markets with catastrophe financing might seem already to have tested the boundaries of both the calculability of catastrophic events and the creative capabilities of liberal government to assemble financial risk networks. The observation has been made that 'Market psychology . . . [i]s arguably now a function of radically different factors, actors and loops than in any earlier period. The big question remains: Does anybody *need* to know what is going on' (Kwinter and Fabricius 2000: 619, emphasis added). This question is perhaps also central to the securitization of catastrophic risk. If capital market processes do indeed consist of nobody needing to know what is going on, even the presumed significance of the applicability of calculative actuarial techniques to catastrophe financing might also require some revision. In slightly different terms, if perhaps the traditional boundaries of catastrophe financing, in becoming progressively redrawn, have been replaced by different risk imperatives, rules and procedures, then the characteristics of these unfamiliar risk protocols and their respective boundaries might connect securitized catastrophic risk to risk theories in quite unusual ways.

In October 2001 the US House of Representatives Subcommittee on Capital Markets, Insurance and Government Sponsored Enterprises convened in the wake of the September 11 attacks in New York. The Ranking Member of the Subcommittee in his opening statement declared that '[m]any reinsurers have decided to curtail their coverage for future terrorism events' (Kanjorski 2001). A reinsurer testified:

> It is crucial that everyone recognize that we are dealing with a peril this [sic] is not quantifiable and therefore not insurable within the finite resources of the private insurance industry. Quite simply, the financial capacity of our industry is limited. Unfortunately, the potential harm that terrorists can inflict is unpredictable in frequency and unlimited in severity . . . [t]errorism has become uninsurable in the private marketplace.
>
> (Mathis 2001: 3)

The US General Accounting Office confirmed '[c]overage for terrorist attacks is not now amenable to normal insurance underwriting, risk management, and actuarial techniques' (Hillman 2001: 15). As a reinsurer emphasized, 'The problem with what happened on September 11 is that it presented a risk no one had could concede would happen . . . [t]he idea of two, fully fueled 767 s hitting both towers was unimaginable' (Sinnott 2001). These descriptions of terrorism as uninsurable due to a combination of unimaginable risk of unlimited severity,

rendering all standard actuarial calculations and techniques inapplicable, while not of Chernobyl dimensions (Beck 1996: 31) share some similarities with Beck's accounts of the risk society being increasingly located outside the limits of private insurance. Indeed, there was widespread support from both politicians and industry representatives for the provision of Federal funds to meet the costs related to the attack. From such a perspective, the incalculability of the catastrophic indeed constituted an insurmountable impediment to its private insurability.

At the same time, however, there was an explicit recognition within the subcommittee that any such funding should not be allowed to encourage terrorism to remain permanently outside the private insurance market. The Secretary of the Treasury in his plenary address emphasized that any direct Federal involvement in compensating for the costs of terrorism '[r]etains all those elements of our private insurance system that continue to work well, and provides a transition period to allow the private sector to establish market mechanisms to deal with this insidious new risk' (O'Neill 2001). There was no elaboration on the likely properties of these 'market mechanisms . The belief that terrorism should in the future be returned to the private insurance market might be considered as a political conviction of the productive potential of liberal government to reassemble viable risk networks to allow terrorism to become reinsurable. In the context of other discussions at the hearing, however, the future private insurability of terrorism might become dependent upon risk networks premised less upon the recalculability of terrorist risk but rather upon the concept of nobody needing to know what is going on.

Expert testimony had been sought from a proponent of securitized catastrophic risk who was introduced by the Ranking Member of the Subcommittee as a witness whose testimony he 'especially' anticipated, since '[i]n recent weeks I have found his advice informative and insightful' (Kanjorski 2001: 2). Evidence was presented that:

> Securitized CAT(astrophe) instruments are likely to be the most efficient way to cover catastrophic events, including terrorism. *One risk of federal involvement in the terrorism insurance market is that it would potentially discourage the development of these private market initiatives. . . . .[T]herefore, any Federal involvement should be done in such a way as not to discourage private industry from returning to this market.*
>
> (Cummins 2001: 2, emphasis in original)

The Ranking Member of the Subcommittee, in proposing that some temporary financial assistance from the administration was necessary, recommended that any legislation must adhere to the principle '[t]hat we must sunset the program. The reinsurance industry is dynamic and we must not disrupt the development of new products' and recognize that 'Other solutions include . . . [f]acilitating the issuance of catastrophe bonds' (Kanjorski 2001: 2).

As emphasized throughout, securitized catastrophic risk is very much in its infancy and its sustainable viability remains an empirical issue. The position

that securitization illustrates the capacity of liberal government to assemble elements in creative ways in order to transfer different and more costly catastrophic risks is clearly tenable. Perhaps unimaginable risks require unimaginable solutions. The position can also be adopted that the instability of the risk networks underpinning securitization suggests that any such risk transfers might be more imaginary than real, and in not working yet 'working' the possible future consequences of these risk networks are simply not known. Such positions need not be necessarily mutually exclusive and perhaps, like the risk networks involved, remain unresolved and unfinished.

Note

1 I am grateful to a reviewer for highlighting the importance of this observation in the context of this paper.

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