

PART III A

Chapter 12

Comparative Analysis of Large Scale Catastrophe Compensation Schemes

by

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This chapter first compares the large-scale compensation scheme of sixteen OECD countries. The role of the private market and governments in coping with the catastrophe losses is then described. Three groupings of the varied government programs are made based on whether the government primarily acts as insurer, reinsurer or underwriter of catastrophe risk. A comparison between the three groups focusing on the tradeoffs between moral hazard, adverse selection, loss potential, subsidy, and cost of insurance is made for the programs. OECD country experiences are used to identify characteristics of desirable programs and are extended to the recent experiences of Turkey. Finally, an analysis of the possible lessons for developing countries interested in establishing catastrophe compensation schemes from the experience of the OECD studied countries is undertaken.

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Introduction

This chapter examines several aspects of government sponsored catastrophe insurance programs. The covariant nature of catastrophe risk makes it difficult for the private insurance market to create cost efficient insurance products. The capital required to support catastrophe insurance is much greater than the capital needed for insurance products directed at independent, non-correlated risks. This makes market based catastrophe insurance products expensive. One tool to reduce the cost of catastrophe insurance is to use government capital. Several insurance programs have been developed in the OECD countries that link government capital to insurance for catastrophe risk. This paper explores several issues related to government sponsored catastrophe insurance programs.

Part 1 is a comparative analysis of some government supported catastrophe insurance programs in several OECD countries. The analysis begins with a general description of the role of the government and the market in providing financial protection from catastrophe losses. Once the theoretical framework for the problem is described, it is used to compare the surveyed countries. A brief discussion on the social/political framework in various countries and the level of catastrophe risk is also discussed to reveal how these factors might influence the types of programs adopted in each country.

Since the Second World War, a nearly universal consensus has developed by governments in OECD countries that they are responsible to protect their citizens from losses caused by catastrophes, whether man-made or natural. The widespread involvement of governments in managing catastrophe risk is a reflection of the inability of the insurance market to efficiently finance catastrophe risk. Insurance works best when it deals with independent, non-correlated risk. Catastrophes, particularly natural hazard catastrophes, are typified by their co-variant nature: an event like an earthquake or flood will damage large numbers of similarly situated properties at the same time. The capital required by insurance companies to cope with co-variant risk is much higher than the capital needed to deal with independent, non-correlated risks. This increase cost of capital is reflected in expensive premiums.

The high cost of private insurance has led to government sponsored catastrophe programs. In part, these programs reflect the ability of governments to access financial resources at costs below those of the private insurance industry. Governments have a deep credit capacity: they can borrow by issuing debt and can raise resources rapidly through its ability to

tax (Cutler and Zeckhauser 1999). As a result, the government is a logical entity to provide reasonable cost catastrophe protection.

The reliance on governments as risk managers is problematic. Almost all government risk management and insurance programs are plagued by problems of moral hazard (Priest 1996). Moral hazard is the phenomenon that behavior changes if someone perceives that a third party bears the cost of their actions. If the government bears the costs of catastrophes, their citizens are unlikely to reduce the risk of their behavior. They rely on the government to “bail them out”. As a result, government intervention in the risk management process increases overall societal risk. This increase in risk is reflected in the costs of government managed catastrophe programs. As the costs increase, they bump against the budgetary limitations of how much governments are willing to pay for catastrophe losses.

One of the most important features of the private insurance market is its ability to control moral hazard. Through the use of insurance pricing based on actuarial risk, the use of coinsurance and deductibles, and placement of limits on the amount of insurance provided, the private market has created a series of policy tools to reduce the risk of moral hazard. These tools primarily rely on the capacity of the private market to segregate risks. By matching insurance protection and its cost to the risk parameters of each insured, the private market controls moral hazard. Governments are less capable of using the tools of private market place to control moral hazard. Government programs tend to treat all citizens the same. The need to provide “equitable” treatment overrides the need to reduce moral hazard by “efficiently” segregating its citizens into diverse risk pools.

This creates a natural tension for policy makers. Governments are best able to spread the cost of risk but increase overall societal risk by not containing moral hazard. The market is able to control moral hazard thus reducing overall societal risk, but lacks the financial capacity to efficiently spread catastrophe risks. Policy makers are interested in strategies that blend the strengths of the private and public sector: reducing moral hazard while providing needed financial capacity. The sampling of catastrophe programs surveyed by the OECD provides a platform for comparing how different governments blend government and private solutions to financing catastrophe risk. The tradeoffs between the different government programs are explored in Part 1.

Part 2 presents for policy makers a framework to analyze alternative approaches for coping with catastrophe risk. Based on the tradeoffs discussed in Part 1, what is the best model for integrating governmental action in a catastrophe financing program? This part notes that the answer to this question is largely dependant on the objective for government

participation. If the government role is to facilitate the private market with needed credit resources, the level of government involvement may be minimal. The program designed by the government should make its treasury available for a fee from the private market. In general, the government should support a voluntary insurance program with actuarially set rates that is supported by the government as a reinsurer. If the objective of the government is create an insurance program that substitutes for government post disaster aid, then the structure of the program may be much different. In this case, the interest in the government is reducing its commitment to provide financial aid after a disaster. This objective is met by a mandatory insurance program that has something paid by citizens who expect to receive post disaster financial support. In this case, the mandatory program may need subsidized rates to encourage participation. In essence, the “right” program is determined by the objective of the governmental participation in a sponsored insurance program. The theoretical analysis is linked to evaluate the recently established Turkey Catastrophe Insurance Program to see how its features match up to the objectives articulated for establishing the program.

Part 3 of the chapter explores what the lessons from the OECD catastrophe insurance programs are applicable to the needs of poorer countries coping with catastrophe risk. To begin with, the nature of catastrophe risk to the developing countries is described. On the whole, the catastrophe risk is much greater on both an absolute and relative basis in developing countries. At the same time, the interest of governments in allocating scarce resources to cope with catastrophe risk is minimal. The reason for this diminished interest is explored. For developing countries that are beginning to cope with issues of economic development and labor protection, risk management initiatives related to catastrophe risk may be viewed by policy makers as premature.

1. OECD Survey

1.1. Scope of the Problem

The concern with catastrophe risk in the OECD countries is well founded. Natural and man-made disasters have increased dramatically in both their frequency and severity over the last decades. As Table 12.1 indicates, in the last 10 years, there has been more than double the number of great natural disasters as compared to the 1960s. Those impacted by the increase in natural catastrophes have also increased. According to the Red Cross' *World Disasters Report 2002*, “those affected - whether left injured, homeless or hungry - tripled to 2 billion during the past decade. Direct economic losses multiplied five times over the same period, to US\$ 629

billion in the 1990s” (IFRC 2002). Furthermore, the future does not bode well: Munich Re has projected losses from great natural catastrophes to rise to US \$300 billion annually by 2050.

Table 12.1

| Decade | 1950–1959 | 1960–1969 | 1970–1979 | 1980–1989 | 1990–1999 | Last 10 years |
|------------------|-----------|-----------|-----------|-----------|-----------|---------------|
| Number of events | 20 | 27 | 47 | 63 | 91 | 60 |
| Economic losses | 42.7 | 76.7 | 140.6 | 217.3 | 670.4 | 514.5 |
| Insured losses | - | 6.2 | 13.1 | 27.4 | 126.0 | 83.6 |

Losses in US\$ bn (2003 values)

Last 10:60s

| |
|------|
| 2.2 |
| 6.7 |
| 13.5 |

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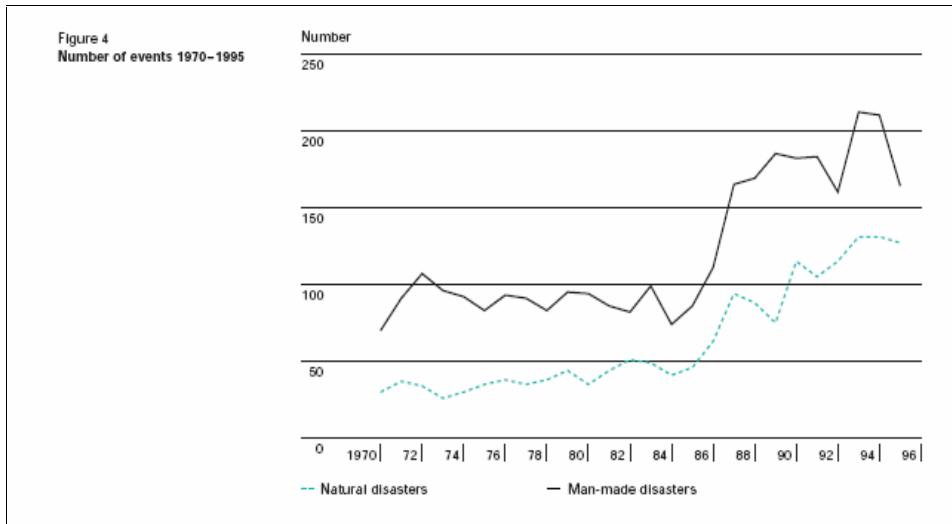
The comparison of the last ten years with the 1960s shows a dramatic increase.

Source: Munich Re (2004). *Topics Geo*, 2003.

As for man-made disasters, there has been a similar rise. Swiss Re reported 238 major man-made disasters in 2003, compared to 65 in 1970 (Swiss Re 2004). The intensity of man-made disasters has also escalated. Catastrophes such as chemical spills, explosions, fires and collisions caused \$12 billion dollars in total economic losses in 2003. Most of this sum covers the damages from two major disasters, the Columbia shuttle explosion and the 3-day power outage in New York State. This increasing trend in man-made disasters has been underway for some time. As early as 1996, Swiss Re has noted the increasing number and costs of man-made disasters. Graph 12.1 shows the trend from 1970 through 1995.

The substantial increase in catastrophe risk has focused the attention of governments on appropriate strategies to cope with these losses. The natural tendency is for any government to rely on the private insurance industry to provide needed protection against losses from catastrophes.

Graph 12.1



Source: Swiss Re. *Sigma*, No. 1, 1996.

1.2. How Insurance Reduces Risk¹

Over the past few years, the academic community has developed a clear understanding of how private insurance operates. There is a substantial theoretical and empirical body of work describing the private insurance market. More recently, the specific role of the private insurance market and the problem of catastrophe risk have received considerable academic attention.² The intervention of the government in financing catastrophe risk arises from a perceived inability of the private market to adequately cope with catastrophe risk. To frame the proper role that governments take to finance catastrophes, it is important to understand how the private insurance market operates.

As an economic tool, insurance has distinct advantages. Its primary advantage is the ability to reduce the overall level of risk to society. This reduction of risk occurs through three principal features of insurance: the aggregation of risks, the segregation of risks into separate pools, and the control of moral hazard.

Aggregation of Risk

Insurance operates where losses have a probabilistic character. Losses that are certain to occur in a particular period cannot be insured against. Rather, one must either accumulate savings in advance to pay for the loss or shift savings (generally through borrowing) after the loss occurs to restore the prior economic condition. Insurance works when losses are probabilistic, either as to whether or not the loss will occur or to when the losses certain to occur will occur (like life insurance).

Insurance reduces the risk level to society by aggregating uncorrelated risks. The risk-reducing function occurs from the operation of the law of large numbers—the empirical phenomena according to which the probability density function of a loss tends to become concentrated around the mean as the sample number increases (Priest 1996). For statistically independent risks, the sum of the aggregated risks is less than the sum of the risks taken individually. This reduction of the mean of independent risks is at the heart of insurance. For each individual participating in an insurance program, they receive the relative benefit of their risk being valued like all other similarly situated persons. For each individual, their risk is lower when pooled.

As relates to catastrophes, the benefit of aggregating uncorrelated risks is lost. The law of large numbers will not apply if members of a risk pool are not statistically independent to some degree. Aggregating statistically dependent or correlated risks increases the variability of the risk pool. This means that the pool would have to maintain reserves greater than the reserves that each individual would have to maintain if uninsured. This is what happens with catastrophes. Since natural catastrophes are events that occur to large percentage of the population at the same time, they are highly correlated risks. As such, they cannot be reduced by aggregating the risks into a common pool. In fact, the reserves required by an insurance company to protect against the risk must be more than the reserves that each insured would individually need to keep to provide financial protection. The natural advantage of insurance is lost. Private insurance has difficulty efficiently coping with highly correlated events that can cause substantial economic damage.

The insurance industry has adapted several techniques to make co-variant risk insurable. The most common technique is enlarging the risk collective by bundling together several types of perils. Bundling occurs when separate risks like fire, flood, earthquake, and hurricane are combined or bundled into a single policy. Since each of the perils is uncorrelated to the others, the bundling of the insurance reduces the accumulated risk of any one hazard in the policy. Since the insureds know that they are not exposed

to all the risks in the bundle and may be reluctant to pay for risk that will not impact them, the purchase of bundled catastrophe risk often needs to be made mandatory. A similar result is obtained by bundling catastrophe risk with other insurance. The requirement that catastrophe insurance be purchased in combination with fire insurance is a tool to bundle two risks that are not correlated, thereby reducing the covariant nature of the entire bundled risk pool.

Catastrophe risk provides a distinctive problem for private insurance. The covariant nature of the risk removes the natural advantage of insurance to reduce risk by aggregating independent risks. For insurance to successfully cope with covariant risk, it must devise strategies to bundle correlated and uncorrelated risks. In so doing, it needs to introduce other characteristics into the insurance arrangement.

Risk segregation

Insurance works best when insurance companies can segregate risk. Insurers distinguish relatively high-risk from low-risk insureds and then assign them to narrowly defined risk pools through their underwriting process. Through risk segregation, insurers reduce expected losses. This reduction occurs through two processes. The first is primarily mathematical. If there are both high-risk and low-risk populations among insureds, the summed variance of segregated pools will be less than the variance of a single undifferentiated pool. Because segregation reduces variance, it reduces risk.

The second risk-reducing function of segregation is to set an insurance premium that most accurately reflects the risk that an insured brings to a pool. Charging insureds a premium related to underlying risk informs insureds about the cost of engaging in activities that generate the risk. For example, a higher insurance premium for living in a flood plain is a market rationing device. Some homeowners are prevented from living in a flood prone region because of the higher premium charged. As a result, the overall cost of floods will be lower for society as a whole.

As well, risk segregation charges lower premiums to low-risk activities. As a result, the low-risk activity is properly encouraged. The ability of insurance to perform this function is a result of the ability to segregate risks into proper risk pools. By so doing, it reduces the risk of adverse selection: the phenomena that only those with risks higher than indicated by a pooled insurance premium will actually purchase the insurance.

Control of Moral Hazard

Insurance also reduces risk by controlling moral hazard. Moral hazard is the phenomenon that one changes their behavior because their risk of loss is borne by someone else. As relates to insurance, the issue of moral hazard is whether an insured's behavior changes in a way to increase risk because they purchased insurance. A simple example is whether a driver is more reckless because his automobile is insured. Since the cost of his reckless behavior is paid for by the insurance company, does he change his behavior? If so, then a moral hazard problem exists.

As may be expected, the insurance industry has adopted a number of measures to reduce the impact of moral hazard. Among the tools commonly employed are the use of deductibles and coinsurance as part of the insurance contract. A deductible is set at a level that still provides incentive for the insured to act as they did prior to purchasing insurance because they must cover a significant portion of the loss themselves. Co-insurance operates like a deductible. Coinsurance is when the insurer and the insured share the loss together. For example, an 80% coinsurance clause means that the insured pays 20% of his losses while the insurance company pays 80%. In this way, the insured has an incentive to operate safely to avoid paying his portion of the loss. A final tool is to exclude some events from insurance coverage. The exclusion in life insurance policies against payment for death by suicide is a common example of the use of an exclusion directed at moral hazard.

By way of summary, insurance has the capacity to reduce societal levels of risk through risk aggregation and risk segregation. It can preserve the lower risk through the use of tools that address the problem of moral hazard.

1.3. Private Market for Catastrophe Insurance

The limitations associated with the private market coping with covariant risk do not mean that the private insurance industry is incapable of coping with catastrophe risk. The private market is the main means of coping with man-made catastrophes. In addition, the private insurance industry does provide significant insurance protection for natural catastrophes as well. As noted in Table 12.1, private insurance funds approximately 20% of all losses from natural catastrophes now.

In 2003, the OECD completed a study on flood insurance in their member countries. The study noted that nine OECD countries have voluntary, stand alone flood insurance policies available. Those countries include Australia, Austria, Belgium, Canada, Germany, Italy, Mexico, the Netherlands, and Slovakia (OECD 2003). An additional eight countries provide flood insurance bundled with other risks like fire insurance. Those

countries include Czech Republic, Israel, Japan, Mexico (it offers more than one type of policy), Portugal, Spain, Switzerland, Turkey and the United Kingdom. The report noted that of the 18.5 billion Euro of losses from the severe floods in Central Europe in 2002, only 20% of the losses were paid by private insurance. The low recovery from the insurance industry is a reflection of both the low limits on policies purchased as well as the low numbers of potential insureds that purchased policies. It is possible for the private market to provide substantial protection against floods. In the United Kingdom, 95% of all households have flood insurance that is bundled with their homeowners' policies.

Although catastrophes can be handled by the private market, the cost of private insurance is expensive. This cost is the result of two factors. The first is the problem of adverse selection. Adverse selection occurs when only the high risk group purchases insurance. This group is generally subject to repeated losses. To compensate, the insurers will insist on very high premiums for this group (Swiss Re 1998a). The second problem relates to the capital that needs to be reserved by the insurance companies to cope with catastrophe risk. Because of the covariant nature of the risk as discussed earlier, the insurance companies need additional capital to hedge catastrophe risk (Lewis and Murdock 1999). To pay for the increased capital, they need to increase the premiums for the catastrophe insurance they offer. For the same reasons, reinsurance companies also must increase their capital for catastrophe reinsurance and the prices they charge. By some estimates, reinsurance rates (reinsurance is the insurance purchased by insurance companies to spread their risk) in the United States for catastrophe protection have increased by as much as 150% during the mid-1990's (Cummins 1997). As the cost of natural catastrophes increase worldwide and the private cost of protecting against those catastrophes increases to address the covariant nature of the risk, the difficulty of providing affordable insurance becomes apparent.

The high cost of private catastrophe insurance has created a policy role for governments to address the financial needs of their citizens to cope with catastrophes. The range of governmental action is described in the next section.

1.4. Government Role in Catastrophe Risk Management

The proper role of governments in financing catastrophe losses is part of a much larger debate on the role of governments as risk managers. The central theme of the argument is that the state or government is the most effective mechanism for spreading risk and losses. Governments are presumed to be the best economic agents to absorb risk. "It is profitable for all concerned that risks should be shifted to the agency best able to bear

them through wealth and its ability to pool risks. The government, above all other economic agencies, fits this description” (Arrow 1992). The capacity of governments to absorb the cost of catastrophes at a lower cost than the private market is the compelling justification for their involvement in managing catastrophe risk. As the costs of private insurance increases, the willingness to draw on the financial resources of governments increases. Naturally, there are constraints on the ability of governments to act as catastrophe risk managers.

The most obvious is budgetary constraints. The capacity of government to spread risks places considerable demand on tax resources. A variety of risks are given to the government to spread: retirement benefits, health, and defense are just a few of the risks that governments are asked to absorb. Catastrophes are just one of a number of demands made on the risk spreading ability of governments. For all governments, there is a limit to their capacity to raise taxes.

Even with budgetary constraints, all governments in the OECD countries provide post catastrophe aid. The provision of post-disaster aid is a transfer of risk from the population to the government. The fact that the transfer occurs automatically through the payment of taxes does not diminish its risk transfer attributes. The level of post-disaster aid can be substantial. The United States spends about \$7 billion a year in post disaster assistance (Moss 1999). In the broadest sense, the government is the insurer of risk since it pays all claims, even if it does not receive premiums for accepting the risk.

For many governments, there is an interest in limiting the role of direct post disaster aid. These governments have explored alternative strategies that have the government sponsor a catastrophe insurance program. The primary motivation is to have those receiving benefits from the government pay something for the benefit other than tax payments. The task is to design programs that efficiently use the financial strength of the government while limiting the impact of moral hazard. This generally involves creating a partnership between the government and the insurance industry to harness the comparative strengths of each party. The risk management literature extensively discusses the types of partnerships that may be developed between governments and private market to cope with catastrophe risk. Generally, these may be categorized in three broad areas: government as insurer using the administrative capacity of the private market to assist in programs that are fundamentally directed and paid for by governments; government as reinsurer providing secondary support to the primary role of the private insurance industry; and government as underwriter setting rules and regulations that enable the private market to operate without direct governmental financial support.

1.5. Government as Insurer

One approach is creating governmental sponsored insurance programs. These programs take on the characteristics of a private insurance but are neither guided by insurance principles nor financed principally by an identifiable fund of insurance reserves (Kane 1996). In essence, these programs are used primarily to redistribute losses without the risk reduction functions of insurance discussed earlier (Priest 1996). By and large, these types of programs would be characterized by centralized decision making with mandatory and uniform charges for insurance. They would be further characterized by claim payments of set amounts regardless of the level of loss. The main difference between these types of programs and pure aid is that something is generally collected from the public as a condition of their participation in the program. The amount collected and the payments made are generally uniform. Being uniform, they do not have the characteristic of an insurance premium: a charge related to the risk being assumed.

While governments are effective instruments to spread risk, they are notoriously ineffective in limiting moral hazard. Virtually every study of government insurance activities shows moral hazard problems to be severe (Priest 1996). The government as insurer seldom makes proper efforts to control moral hazard. Government programs can incorporate the tools used in the private market to control moral hazard, but they rarely do so to the extent of the private market. The techniques used by the private sector are best characterized as constraints on benefits to control moral hazard. Deductibles, co-insurance, and policy limits are all tools that reduce benefits to control moral hazard. Voter interest in benefits is unlikely to permit the government to control moral hazard to the same extent as the private market.

The dividing line between the government as insurer or as reinsurer is not clear. The primary distinction is whether the government requires the private insurance market to retain some portion of the risk. If there is no risk retained by the private insurance market, the program is a government insurance program. If some level of risk is retained, the program is characterized as a reinsurance program. On this basis, the programs in Spain, the National Flood Insurance Program in the United States, and the Turkey Catastrophe Insurance Pool all would qualify as government sponsored insurance programs.

1.6. Government as Reinsurer

This approach has been discussed in the literature as the *market enhancing view* of government policy (Lewis and Murdock 1999). This view looks for the government to facilitate more efficient private-sector insurance. This is done by the establishment of a government reinsurance

program that has the ability to directly access the government's treasury after other resources have been consumed (Cutler and Zeckhauser 1999). Generally, the government requires the private market to assume and pay for some level of risk. Generally, the government assumes the most expensive risk. The government relies on the administrative capacity of the private insurance market to perform needed services like marketing, premium collection, policy issuance and claims handling. The private market is paid a fee for these services. This approach blends the risk spreading capacity of the government with the ability of the private market to efficiently apply insurance principles. Formal government reinsurance programs for different catastrophe risks exist in New Zealand, Japan, South Africa, Norway, France, the United Kingdom, the United States and the Netherlands. These programs are directed at diverse catastrophe risks like earthquakes (Japan), terrorism (the United Kingdom), flooding (France), and political riots (South Africa).

1.7. Government as Underwriter

The third area of government involvement relates to governmental setting of rules and policies that assist the private market to insure catastrophe risks. For many man-made risks, the role of the government is to set the terms of liability so that the risks are insurable. There are two broad issues related to insurability or risks: the ability to identify the risk and the ability to set premiums for each potential class of customer (Freeman and Kunreuther 1997). Often, governments play a key role in setting the conditions related to a risk that make it insurable: it sets "underwriting standards" that permit the private sector to develop insurance products. In coping with man-made disasters, the primary issue is setting liability limits (Munich Re 2002). With proper government rule-making, most man-made disasters are insured in the private market. Generally, man-made disasters do not have the central problem of natural catastrophes: covariant risk. These disasters tend to be independent, non-correlated events. The main insurability issue relates to the potential size of the catastrophe. They are the type of risks that private insurance is designed to handle.

Governmental setting of standards of behavior is not only done to impact the insurability of risk. This is a general function performed by governments in all OECD countries. In the context of the relationship between the public and private sector in financing catastrophes, the government can play a distinctive role by more narrowly defining appropriate behavior and limiting liability. By so doing, it directly enhances the capacity of the private market to manage risk.

With these basic strategies defined, it is appropriate to examine some catastrophe insurance programs and understand how they fit the broad theoretical model.

1.8. Government Catastrophe Funded Programs in the OECD

For purposes of this paper, catastrophe programs in Australia, Belgium, Denmark, France, Iceland, Japan, Mexico, the Netherlands, New Zealand, Norway, Poland, the Slovak Republic, Spain, Switzerland, Turkey, and the United States were analyzed. The programs in these countries can be grouped into the three main categories defined in the earlier section: government as insurer, government as reinsurer, and government as underwriter.

In many OECD countries, the government creates “funds” to pay for catastrophe losses. These funds are generally created from tax revenue. It is a means to reserve against future obligations of the government to pay for disaster losses. This type of funding is the most common programs in the surveyed countries. In this group are Australia, Denmark, Mexico, the Netherlands, Norway and Poland. The permanent fund in Australia is the Natural Disaster Relief Arrangements (NDRA). Under this program, the Commonwealth provides funding assistance to States and Territories aimed at alleviating the financial burden of rebuilding infrastructure and making disaster relief payments. On a sliding scale basis, the Commonwealth reimburses States and Territories from one-half to three-fourths of the expenses incurred to cope with natural catastrophes. In addition to the NDRA, Australia will provide special funding for particular disasters. For example, the government provided AS\$151.7 million in funding for flood assistance in New South Wales and Southern Queensland for the 2000-2001 floods. There is a very limited market for residential flood insurance³.

Mexico has a National Fund for Natural Disasters (FONDEN) that was established in 1996. FONDEN is a budgetary allocation for disaster relief and reconstruction. FONDEN’s budget is currently set at \$350 million a year. The Netherlands has the Calamities Compensation Act that was established in 1998. It only applies to floods and earthquakes. The maximum to be paid each year is 450 million Euro. Poland and Norway have similar schemes. In Poland, the National Program for Restoration and Modernization pays for flood damages to individual, commercial and local government property. The Program is funded by the national and local governments. Norway has the National Fund for Natural Disaster Assistance that pays for natural disaster losses to roads, bridges, battlements, farmland, crops and forest areas. The maximum compensation per loss is NOK 405,000. The fund is publicly financed.

In each of these countries, there is some private insurance available for flooding risk. It should be noted that Australia has private insurance against floods, particularly for commercial properties. For flash floods, nearly 60% of all commercial properties are insured. There is much less penetration of the insurance market for non-flash floods, perhaps as low as 5%. There is flood insurance in both Mexico and the Netherlands. The Netherlands's Calamities Compensation Act only pays for damages that cannot be commercially insured.

These programs are *ex post* assistance programs. The conditions for benefits are set and funded by the government. Generally, the funds are meant to supplement the private insurance market.

Examples of Government as Insurer

A number of countries have created government sponsored insurance programs. In these programs, the government collects a fee or premium for providing insurance coverage. Often the private insurance industry is used to provide needed administrative services. An example of this type of program is the Spanish program. The Spanish government plays a unique role in the publicly administered disaster financing program, Consorcio de Compensacion de Seguros (CCS). Founded in 1954, CCS is a public corporation providing 'extraordinary risks' insurance: coverage against natural disasters and risks with 'social repercussions' (terrorism, riots, etc.): in short, a broad range of natural and man-made disaster scenarios. Consorcio indemnifies claims resulting from extraordinary events and extends to both natural phenomena (earthquakes, tsunamis, tidal waters, extraordinary floods, volcanic eruptions, atypical cyclonic storms, falling astral bodies and aerolites) and political and social events (terrorism, riots and civil commotion). The CCS payments are subsidiary to payments made by the private insurance industry. CCS pays only if the risk was not covered by private insurance (for the poor if they did not buy insurance) or if the insurance company fails to pay because it is insolvent. The "extraordinary risk" protection is a mandatory additional coverage added to fire and natural perils, motor and railway vehicles and other property damage policies. The CCS surcharge is automatically included in the base policy's premium and credited to CCS every month. Deductibles for property loss amount to a maximum of 1% of the insured total and a minimum of 150.25 Euros. The private insurance companies set the base policy premium. The surcharge varies by the type of policy offered, but is a reflection of the base rate charged on the primary policy. The program collects a premium and CCS pays for catastrophe losses that are not otherwise handled in the private market. It is a government sponsored insurance program.

Examples of Government as Reinsurer

The second broad category of program is those that employ some type of state guaranty to support the private insurance industry. The most common approach is for the state to provide reinsurance to the private insurance industry. In this scenario, the private market sells catastrophe insurance. The risk from the policies is resold to a government managed or funded reinsurance company. Generally, the catastrophe insurance must be purchased by businesses or homeowners that purchase first party insurance: fire, homeowners', automobile, or property policies. The mandatory coverage extends to catastrophes as defined by the government and can include man-made catastrophes (the recent terrorism insurance programs), natural catastrophes generally (France) or specific natural hazards like earthquakes (Japan) or hurricanes (Florida). The cost of the catastrophe coverage is added to the premium for the standard insurance policy. Generally, the additional catastrophe premium is computed as a percentage of the premium for the property policy. In each instance, some sharing arrangement between the private market and the government is made concerning the catastrophe premium collected and the risk to be borne by the government. In some instances, all of the risk and the catastrophe payment may be shifted to the government (France) or there may be a mandatory sharing arrangement between the government and the private insurance industry (Japan). As a rule, the government guaranties payment of all eligible claims even if the premiums collected are not adequate to pay all claims. It is this additional guaranty of the government that provides the needed capital for the insurance to work. Two of the most well-known of these programs are the public reinsurance programs in France and Japan.

The Japanese government administers the Japan Earthquake Reinsurance Company (JER), which, as the name suggests, provides financing in the event of earthquakes, volcanic eruptions and tsunamis. Homeowner's earthquake insurance is supplementary to fire insurance, reinsured solely through JER. All earthquake risks written by private insurers in Japan are wholly reinsured with the Japan Earthquake Reinsurance Company. The Japan Earthquake Reinsurance Company cedes a certain portion of the portfolio back to the original direct insurers and to another Japanese reinsurance company in accordance with a sharing arrangement established by the government. The remainder of the reinsurance liability is assumed on the basis of excess of loss insurance coverage concluded between the government and the Japan Earthquake Reinsurance Company. Based on the ceding of risk between the private sector and the government, losses would be shared on the following terms: payment up to 75 billion yen is to be borne 100% by the private insurance companies. Losses over 75 billion yen and up to 1.0774 trillion yen, are

shared equally between the government and the insurance industry. Losses up to 4,500 billion yen are borne 95% by the government and 5% by the insurance industry. Premiums are actuarially determined for each insured property.

The French Government sponsors two insurance programmes: the National Disaster Compensation Scheme (CAT NAT), and *Fonds National de Garantie des Calamités Agricoles*. CAT NAT is backed by a state-guaranteed public reinsurance program, *Caisse Centrale de Réassurance* (CCR). Insurance companies have the option of reinsuring unusually large disaster risks through CCR, which are then backed by the government as reinsurer of last resort. CCR offers two types of reinsurance protection: quota-sharing and stop-loss coverage. The quota-share insurance has CCR participating in losses in proportion to the sharing arrangement of the premium collected for catastrophe coverage. “Stop loss” reinsurance is a “non-proportional” mechanism by which CCR assumes risk after a certain disaster damage level has been attained. Because of CCR’s unlimited government guarantee, it has no capacity limit.

The catastrophe insurance is sold by the private insurance companies. Any non-life insurance policy taken out in France contains an additional mandatory surcharge (6% on automobile policies and 12% on all other non-life policies) that covers losses in the event of a natural disaster. The French government fixes the insurance premiums.

CAT NAT covers earthquakes, floods, landslides, hailstorms, avalanches, tsunamis and droughts. Payment requires a government declaration of a disaster, determined by a set of criteria pertaining to the disaster’s scope and magnitude. The program covers both personal and commercial losses on insured property above the amount reimbursed by private insurance companies.

The use of the government as reinsurer for the private insurance industry is also the tool used to cover terrorist risk. Since September 11, 2001, France, Germany, and the United States have created government guaranteed reinsurance like programs to provide protection against terrorism. Spain has had terrorism included in its catastrophe program since inception. The United Kingdom established a government guaranteed terrorism insurance program in the 1990’s.

Examples of Government as Underwriter

As relates to natural catastrophes, there have been a number of proposals that maintain that with more governmental policy involvement, the private market for insurance would be enhanced. In the area of man-made environmental risks, there has been considerable attention focused on the

proper role of government in setting standards of behavior and establishing limits of liability to permit the private market to develop insurance for these risks. In the United States, private insurance for asbestos risk, underground storage tanks, and environmental contamination have been created based on explicit governmental regulations addressed to these risks. The regulations provided the “underwriting standards” for the private market (Freeman and Kunreuther 1997). In the realm of natural catastrophes, there have been suggestions that more effective private insurance markets could be created with governmental requirements for mandatory private insurance and stricter guidelines on land use planning and building construction (Kunreuther 1996). The governmental function required is not to provide financial support for well defined risks, but to clarify liability so as to permit the creation of private insurance.

1.9. Comparisons between the approaches

A description of the various existing programs does not detail the types of tradeoffs imbedded in the different programs. As noted earlier, both governmentally sponsored and private insurance markets must deal with a series of issues to effectively operate. Principal among these are the problems of adverse selection and moral hazard. Intuitively, different approaches involve different tradeoffs. It is important for policy makers to understand the nature of those tradeoffs.

Some research exists that reflect on the nature of the tradeoffs inherent in different approaches to insuring catastrophe risk. In a survey that Swiss Re completed in 1998 of flood insurance programs worldwide, they identified three characteristics that distinguished the different programs: risk of anti-selection, loss potential, and the cost of risk assessment (Swiss Re 1998). The survey then compared six types of flood insurance programs to determine if the risk characteristics were low, medium and high for each risk category. The table is included here as Table 12.2. The term “anti-selection” by Swiss Re is commonly called “adverse selection”. In the private insurance market, a main concern is that only high risk persons will purchase insurance. If the insurance is priced on the basis of a mix of high and low risk policyholders, the premium charged are inadequate for the risk pool if only the high risk buy the insurance. The problem of adverse selection is particularly troublesome for natural catastrophe insurance programs. Generally, catastrophes occur in well defined geographic regions. Earthquakes occur along seismic fault lines, floods occur in low-lying areas, and windstorms are directed at coastlines. If only the highly exposed purchase insurance, the cost of the insurance would be prohibitively expensive. For the private insurance programs to work, they require that low risk populations be included in the programs. This is generally accomplished

by making the programs mandatory or subsidizing the rates. Purely voluntary natural catastrophe risk programs generally suffer from lack of participation. Only populations with very high risk are willing to participate.

On the y axis, Swiss Re defines a variety of flood insurance programs. There is a blend of both private and public programs. They define six different types of programs. The facultative individual cover is private insurance purchased for one property to protect against flood risk. This is the most common approach taken by large commercial customers. The Facultative Package is private insurance against floods that is bundled with other types of catastrophe protection. Compulsory Package with fire cover is mandatory privately provided insurance coverage that is bundled with fire insurance. Compulsory state solution is the French model: compulsory insurance for all catastrophe risk at a set premium. Facultative cover with low limits is private flood insurance with very low levels of protection. The final program is Compulsory cover with graduated premiums and deductibles. While Swiss Re does not identify any flood insurance program, based on this model, the Turkish Catastrophe Insurance Pool does duplicate this model for earthquake insurance.

The analysis by Swiss Re indicates voluntary (facultative) insurance programs carry a high risk of adverse selection: only those with a high level of risk are willing to pay for the insurance. The Facultative individual cover and the facultative cover with low limit both have high risk of adverse selection. If the insurance is coupled with other types of catastrophe risk (Germany), the likelihood of adverse selection is moderate. Mandatory programs (United Kingdom and France) have a low risk of adverse selection. On the other hand, the compulsory programs have a high risk of loss potential. This makes sense. If everyone has insurance against a covariant catastrophe risk, the aggregate losses to the insurance program will be very high. In addition, a mandatory program has a high level of moral hazard risk. There is little incentive for insureds to reduce their risk if they must purchase insurance and the rates they pay for the insurance are set regardless of the level of risk. It should be noted that the loss potential is reduced to medium if the premium is graduated to reflect risk. This reduction in the loss potential is a reflection of the reduction in moral hazard.

The third variable used by Swiss Re is the cost of risk assessment. This is the cost of evaluating the exposure of each insureds. As may be expected, the cost of risk assessment is high for voluntary programs while the cost is low for compulsory programs.

Broadly speaking, the following tradeoffs are reflected in the Swiss Re analysis. Compulsory programs have a much higher level of loss potential

reflecting a higher level of moral hazard. These programs are balanced by lower levels of adverse selection and the cost of risk assessment. Voluntary or facultative programs correspondingly have a high risk of adverse selection and cost of risk assessment, but lower levels of loss potential. The loss potential of compulsory programs can be reduced if graduated premiums or deductibles are used. As noted earlier, variable premiums and deductibles are tools used to reduce moral hazard.

The approach used by Swiss Re can be modified to help understand the tradeoffs inherent in the government natural hazard programs in the OECD countries. On the horizontal axis, five policy concerns related to different types of insurance programs are identified: moral hazard, adverse selection, loss potential, subsidy, and the cost of insurance. Table 12.3 varies from the Swiss Re table in that it accounts for moral hazard and subsidy. Subsidy is an indicator of the extent to which low risk policy holders subsidize high risk policy holders.

Table 12.2. Comparison of Insurance Solutions and Specific Risk in Flood Insurance

| Insurance solution | Risk of antiselection | Loss potential | Cost of risk assessment |
|--|-----------------------|----------------|-------------------------|
| Facultative individual cover (eg industrial property, Italy) | high | medium | high |
| Facultative package solutions (eg residential property, Germany) | medium | medium | medium |
| Compulsory package with fire cover (eg UK) | low | high | low |
| Compulsory state solutions (eg France) | low | high | low |
| Facultative cover with low limit (eg Austria) | high | low | medium |
| Compulsory cover with graduated premiums and deductible | low | medium | low |

Source: Swiss Re 1998a.

Table 12.3 shows the tradeoffs from different types of programs. For example, the government as insurer has a high risk of moral hazard, a high loss potential (which is related to the moral hazard risk), but a low cost of the insurance for the insureds. The low cost is reflected in the high level of subsidy. The same profile exists for a compulsory state reinsurance program. The academic literature maintains that these types of programs are not insurance. They are not governed by insurance principles (primarily that rates for insurance should reflect risk) or are paid by an identifiable fund of insurance reserves (actuarially determined) (Kane 1996). Rather, these programs are tax-transfer programs disguised as insurance (Priest 1996). In operation, these programs have the same risk profile as programs where the government is the insurer.

Table 12.3 Insurance Solutions for Catastrophe Risk

| Insurance Solution | Moral Hazard | Adverse Selection | Loss Potential | Subsidy | Cost of Insurance |
|--|--------------|-------------------|----------------|---------|-------------------|
| Government as Insurer | high | low | high | high | low |
| Compulsory Private Insurance (UK) | high | low | high | medium | medium |
| Compulsory State Reinsurance Solution (France) | high | low | high | high | low |
| Compulsory State Reinsurance Program with Graduated Premiums (Spain) | medium | low | medium | medium | medium |
| Voluntary State Program with Graduated Premiums | low | high | medium | low | high |

As one moves to programs with more insurance like characteristics, the risk profile of the programs change. The moral hazard, the loss potential and the subsidy characteristics all decrease. On the other hand, the adverse selection risk and the cost of insurance to each policyholder increase.

Different approaches tradeoff identifiable characteristics. The government as insurer has high moral hazard risk but provides lower cost protection to a wider range of insureds. The government as reinsurer with actuarially set rates reduces moral hazard but at a higher cost of insurance. The acceptability of the tradeoffs for each country is a function of political values.

The comparative benefit of each approach is a function of the political values of each country. For example, countries with a strong sense of solidarity

are willing to have the government assume a high loss potential, moral hazard and a high subsidy between low risk to high risk taxpayers in exchange for low costs of insurance and the comfort that everyone is provided protection. This would typify the French system. By contrast, the government may make voluntary insurance available to its citizens with a relatively low level of moral hazard, low subsidy and high cost of insurance for policy holders. This approach provides accommodation to its taxpayers by making a program available, but minimal government cost. This typifies two of the programs in the United States: the NFIP and the California Earthquake Authority. It is not surprising that these two countries develop programs with substantially different approaches to the role of government in coping with risk.

An interesting phenomenon of the different catastrophe risk programs in the OECD is that some countries apply their programs to a wide range of risks while others limit the program to specified risks. The next section will explore this phenomenon from the perspective of the relative risks faced by each country from natural hazards.

1.10. Natural Disaster Exposure and National Programs

Besides political culture, another reason for the differences in approach between OECD countries is the level of natural disaster exposure. In one of its recent publications, Munich Re completed a study of a number of countries. The study focused on the level of exposure of a country to different natural hazards and the geographic spread of the hazard risk. The results for Japan are shown on Table 12.4.

Japan has a very high earthquake risk that impacts a substantial portion of the country. The most striking characteristic is the very high level of exposure of Japan to earthquakes over a large region.

By contrast, Table 12.5 shows the same table for France.

The contrast with Japan is significant, as France has only one very high risk hazard, flooding. At that risk is for a very small region. The catastrophe insurance program in each country reflects these disaster risks. Japan focuses their government catastrophe insurance programs on their high risk exposures with broad geographic exposure. In France, there are no very high risk exposures with any geographic reach, merely a handful of low to medium risk hazards. It is not surprising that the French catastrophe insurance program covers a wide range of hazards. Like the political culture in different countries, catastrophe insurance programs are also a reflection of hazard exposure. Low risk countries are more inclined to provide protection for more hazards while countries with a high risk to one hazard are more likely to devote their resources to the high risk exposures.

Table 12.4 Natural Hazard Exposure for Japan (Munich Re 2000)

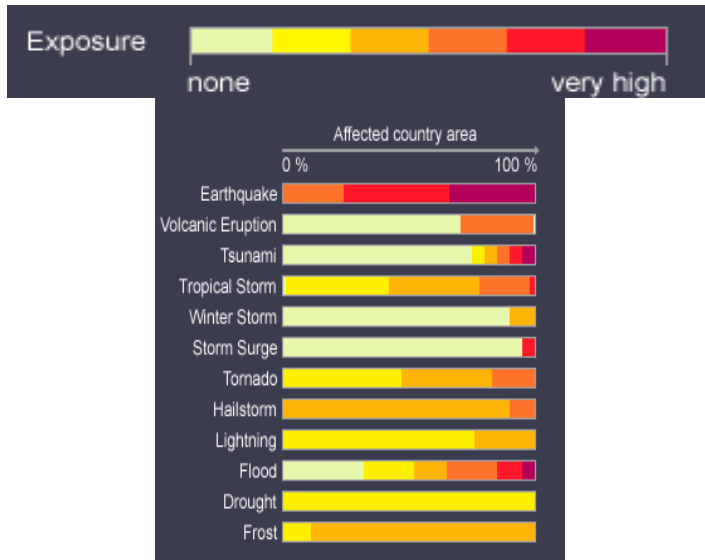
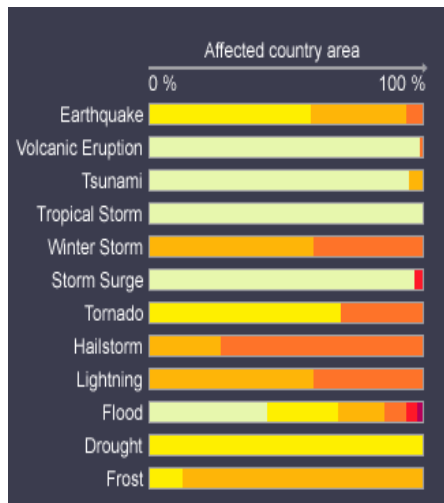


Table 12.5 Natural Hazard Exposure for France

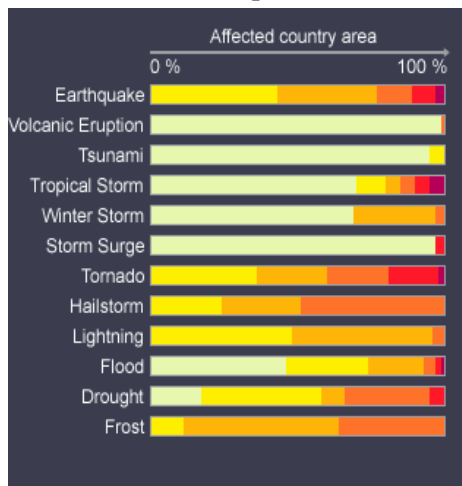


The United States provides an interesting contrast. As noted in Table 12.6, the United States has very high exposure to four hazards: flooding, tornadoes, tropical storms (hurricanes) and earthquake. Each of these risks is geographically limited. The United States has created three

separate programs to deal with flooding, tropical storms, and earthquake. The flooding program is the only program sponsored by the national government. The earthquake risk is handled by California and the hurricane risk is handled by Florida. There is no specific government program for tornado risk.

The relationship between hazard risk and program formation is important. Just like political preferences, the level of risk is related to potential solutions. For countries with very high levels of risk, they tend to develop programs that focus on that risk. Large countries with geographically diverse risks have insurance programs that are regionally centered. Countries with low levels of hazard risk make their programs more broadly based.

Table 12.6 United States Exposure to Natural Hazards



The prior sections have focused on the tradeoffs between different governmental programs to cope with catastrophes. In its survey of flood insurance programs, Swiss Re noted:

“The wide variety of flood insurance solutions available in the different countries is quite astonishing. State and private insurers provide cover in a variety of casts, and the involvement of the reinsurance community can be anything from “zero” to “substantial”. Insurance penetration levels lie between 0% and 100% and the scope of cover-provided that insurance is available at all-ranges from “very restricted” to “unrestricted”. None of this comes as a surprise, however. Hazard risk and loss potential differ widely from one market to another, just as the economic

development levels and the structures of the national insurance industries do. This constellation is joined by specific issues associated with flood insurance. Clearly these circumstances do not allow for any ideal and universally valid or applicable solution for insurance against floods” (Swiss Re 1998a).

Clearly, the same can be said for all catastrophes. The wide variety of exposure risk, political preferences, and the status of the domestic insurance market will heavily influence the national programs adopted by different countries. There is no clear best solution. Rather, the varied solutions are a mix of alternatives based on widely varying circumstances.

After surveying and comparing different government supported catastrophe risk programs in selected OECD countries, a natural extension of the analysis is defining the “best” characteristics of the programs. From a policy maker’s perspective, what are the features of existing programs that make them desirable to assist governments in managing catastrophe risk? With ever increasing losses from catastrophes, the demand for government assistance to cope with catastrophe losses will only increase. The recent increase in government sponsored programs to cope with terrorist risk is one recent example of new demands being placed on governments. What guidance can the existing programs provide to policy makers? The next section will provide a framework for analyzing this question.

2. Extending the Analysis to the experience of Turkey

As noted in the prior section, there is a constellation of programs developed to cope with catastrophe risk. From a policy-makers perspective, it would be helpful to identify the best characteristics of a national catastrophe program. This section will extend the lessons learned from examining different natural hazard programs to pull out possible “best practices” and extend those practices to the recent experience of Turkey in developing a national program directed at residential losses from earthquakes.

2.1. Framing the Discussion of Best Program

Understanding the “best” system is primarily a matter of framing. An economist interested in a “(Pareto-)optimal response” might reply that none of the existing systems meets this objective. Rather, a more efficient alternative is to avoid public sector involvement and source needed resources from alternative capital market instruments (Cochrane 1999). An economist trained in social economics might frame the problem much differently (Lutz 1999). In this instance, a focus on the “common good”

rather than economic efficiency would create the proper measuring stick. The wide variation of current involvement in providing post catastrophe assistance, governmental resources available to support catastrophe risk programs, the level of catastrophe risk, and the viability of the private insurance market all influence the extent and nature of government involvement in financing catastrophe risk. Different governmental objectives will influence the role the government is willing to play in supporting new programs. It is precisely because of these variables that such a wide variety of programs have been tried by different governments. These alternative approaches limit any discussion of the most desirable system.

If the objectives of the government are well defined, one could develop an optimization program to evaluate different alternatives to meet varied objectives. In analyzing financial alternatives for developing countries to cope with catastrophe risk, there are a series of optimization programs being developed that compare the desirability of different tools to finance risk⁴. The programs objective is to define for policy makers the best tool to optimize the ability of governments to sustain consistent economic growth while accounting for natural hazard catastrophe risk.

In examining the catastrophe risk programs supported by governments in OECD countries, two primary objectives might exist. One approach is governmental concern that the cost of its post disaster aid is too high and being inefficiently provided. The government seeks an option to post disaster aid by changing its role as the provider of aid to supporting a market alternative to finance catastrophe risk. This concern is the primary driver of the recently (2000) created Turkish Catastrophe Insurance Pool (TCIP) (Guerenko 2004). Prior to the creation of the pool, homeowners relied on the government to provide replacement housing after an earthquake. In fact, the government was required by law to provide replacement housing. The purpose of the TCIP was to transform the role of the government from the “insurer” of the risk to a role as a financial guarantor or “reinsurer” for a market based homeowners’ insurance program. In measuring the success of the TCIP, the criteria for measurement must be to compare TCIP with the historical practice: is the TCIP more efficient in providing assistance to homeowners than the former practice of providing post disaster aid? Since the TCIP replaces an existing strategy, it is possible to measure its success against the historical practice.

A number of other catastrophe programs have arisen from an entirely different need. The recent government supported terrorist risk programs in the United States and European programs for Germany, France and Austria for example were created because the private market was unable to provide adequate protection against terrorism risk. The primary problems were the cost and/or availability of capital to the private market to make risk

financing available. For these programs, the financial strength of the government was required to make the programs available and affordable.

The purpose of describing these two alternative objectives is to make the obvious point that the “best” system for providing government support for catastrophe risk is linked to the objective of the program. The “best” program is the one that most efficiently meets the governmental goals taking into account a series of constraints. Those constraints include the status of the domestic insurance market, available government resources to implement new programs, the magnitude of the risk being addressed by the program, and current governmental expenditures on catastrophes. Since these characteristics vary country to country, it is not surprising that so many different programs have emerged.

That being said, the prior analysis provides some guidance on financing catastrophe risk. The fact that OECD countries provide government support for financing catastrophe risk indicates a consensus exists on a collective obligation to provide governmental resources for catastrophes: the risk of catastrophe loss should not fall only on the shoulders of those injured. An effective government supported catastrophe insurance program needs to: (1) meet a defined government objective and (2) reduce the consequences of adverse selection and moral hazard. As noted earlier, adverse selection occurs when those with the highest risk disproportionately participate in an insurance program. Insurance works because it pools risk. The pricing of the risk in the pool is based on average risk. This is a mixture of high and low risk populations. If only those with high risk are in the pool, then the premiums collected will be inadequate to pay for claims. Participation in the risk pool has been “adversely selected” by only those with high risk.

Moral hazard is the phenomenon where behavior is changed because another party assumes the risk of one’s behavior. As relates to catastrophe risk, the problem is most commonly seen in those who live in high risk areas. They are generally unwilling to change their behavior by moving from the high risk area or pay for risk mitigation measures if the government reimburses them for potential losses. As noted earlier, moral hazard risk also exists in the private insurance market. In the private market, sophisticated techniques have been developed to limit the moral hazard risk. The most common tools make the insured still responsible for a portion of his losses. This is done through deductibles and co-pay arrangements. The intent is to provide incentive for the insured to engage in risk reducing activity.

The purpose of the program will influence its structure. If the purpose is to provide a market because the private market is restrained by the cost of capital, it is likely that the government will limit its involvement to providing financial support to the private market. The California Earthquake

Authority and the United States' terrorism insurance program typify this arrangement. The government provided financial backing to the private insurance industry to permit them to provide insurance coverage that might not otherwise be available. The private insurance companies were primarily responsible for designing and selling the insurance. These programs have low insurance penetration: less than 30% of potential insureds have purchased insurance.

If the purpose of the program is primarily to substitute government post disaster aid with an insurance program, then the structure of the program tends to be much different. Generally, this type of program uses mandatory insurance. The most common tool used is to bundle the catastrophe insurance with other insurance. A primary objective is for the government to collect some money for obligations they will need to eventually pay anyway. The collection of funds in advance is preferable to waiting until an event occurs and spreading the cost *ex post*.

Governments have acted as either the primary insurer or as a reinsurer. The main advantage of acting as a reinsurer is the reduced administrative load on the government. The government can rely on the ability of the private market to sell and issue policies, collect premiums, and manage claims. This reduces the need for the government to duplicate an administrative services network already created by the private market.

This provides several approaches to determine the "best" structure for a program. If the government is neutral as to whether insurance is purchased, the best program would be a voluntary reinsurance program priced at actuarially fair rates. This would ordinarily be the case where the government is providing financial support to supplement the private market. This limits the risk to the government to a call on its Treasury for a contingent future payment. If the rates are actuarially fair, then the government is being adequately paid for providing the needed credit support. By providing reinsurance, the government can rely on the insurance industry to handle all administrative needs. As well, the insurance industry can structure the program to cope with the issues of adverse selection and moral hazard.

If the government is concerned that the catastrophe insurance be purchased, a mandatory program provided by the private sector at actuarially fair rates with reinsurance from the government is the best option. If the insurance is too expensive at actuarially fair rates, then the government probably needs to subsidize the rates to make the program politically palatable. This is especially the case if the insurance program substitutes for post catastrophe government aid. Generally, the program is made mandatory by bundling the insurance with some other type of

insurance commonly purchased, like homeowners or automobile insurance. The mandatory component of the program should address the problem of adverse selection. The problem of moral hazard still looms. Moral hazard can be reduced by making the catastrophe risk premiums vary with the level of risk. As well, some type of deductible and co-payment should be included in the insurance. The moral hazard risk in a mandatory insurance program is probably less than the moral hazard imbedded in a pure government post disaster aid program.

To get compliance with a mandatory program, the government must make clear that those exposed to the program's catastrophe risk can only look to the insurance to pay for their losses. If there is a perception that substantial post-disaster government assistance will be available, there will develop considerable resistance to purchasing the mandatory insurance. A mandatory program has the benefit of setting the terms of government financial support for catastrophe losses in advance. With an effective program in place, it should reduce the pressure to provide *ad hoc* post disaster support.

With these broad principles in mind, it may be helpful to apply them to a recent catastrophe risk insurance program. By so doing, it is possible to see the constraints in applying these principles.

2.2. Evaluation of the Program Principles to the Turkish Catastrophe Insurance Pool

One of the most recent comprehensive insurance programs instituted in an OECD country is the Turkish Catastrophe Insurance Pool (TCIP). Earthquakes in August and November 1999 devastated north-western Turkey. The extensive physical damage, which was re-estimated at US \$ 10.2 billion, was largely absorbed by the public sector which re-built physical infrastructure, government buildings and private houses. The total budget for the Government of Turkey (GoT) between August 1999 and December 2002 amounted to US \$6.4 billion, or 3 per cent of GDP (OECD 2004).

To mitigate the contingent financial costs arising from the probability of other seismic shocks and to provide an adequate level of earthquake coverage at affordable rates, a compulsory earthquake insurance scheme, the TCIP, was established in 2000. The World Bank played a major role in providing technical advice and financing for the TCIP. The TCIP is a compulsory government sponsored insurance program for earthquake risk. The expected annual losses to Turkey from earthquakes are US\$ 1 billion. A major earthquake in Istanbul could have direct losses in excess of US \$25 billion. Historically, private earthquake insurance existed in Turkey. The

penetration for the private insurance was very low: 2% outside Istanbul and 15% within Istanbul. There was little incentive to purchase insurance since the National Disaster Law required that the government fund replacement housing for those destroyed in an earthquake nearly free of charge. The TCIP was created to provide affordable earthquake insurance for domestic dwellings while reducing the GoT's fiscal exposure to earthquake losses.

The TCIP mandated that all registered residential building owners purchase a separate earthquake insurance policy. To provide incentives for the insurance to be purchased, the government mandated that deed offices only register transactions affected on insured buildings and required municipalities to check for insurance policies when opening a new account for water or gas services to dwellings. Currently, this requirement is only required in five provinces. Depending on the results in these provinces, the requirement may be extended to the rest of the country. The policy covered up to US\$50,000 in losses per dwellings with no coverage for contents. The Disaster Law was amended by governmental decree so to properties that could be covered by the TCIP would not be eligible for government aid. The TCIP is the sole source of earthquake insurance for the first US\$50,000 of losses: private insurance is available for higher limits. While the Disaster Law was modified, a new Earthquake Insurance Law was proposed. There were 15 rating categories created based on hazard zone area and type of dwelling. The insurance is sold through 32 authorized insurance companies who perform the underwriting, collect premiums, issue policies and settle claims. A deductible of 2% exists on each policy. The insurance companies are paid a commission for their services. The claim paying objective for the TCIP in 2004 is to create claims paying ability for up to US\$ 1 billion in losses. A reinsurance program was created with a consortium of 60 international reinsurance companies, the World Bank, and the Government of Turkey as the reinsurer of last resort.

To date, the program has had limited success. On a countrywide basis, approximately 16% of total insurable dwellings (approximately 13 million) now have coverage. In Istanbul, the penetration rate is now 27.3%; it had been as high as 32%. For a "mandatory program", these are relatively modest levels of penetration.

From 2000 through November 2004, eighty-five earthquakes occurred in Turkey and the scheme paid total damages of US \$5.72 million to 4,919 homeowners. For the two most serious earthquakes (Afyon in 2002 and Bingol in 2003), the GoT waived the provisions of the Disaster Law requiring the purchase of insurance and declared all citizens eligible for government support, insured or not. The costs of non-insured victims in the 2002 and 2003 earthquakes cost the Treasury an additional US \$200 million.

Based on the earlier discussion, the TCIP was designed as a substitute for mandated post disaster government assistance for homeowners. The earlier discussion suggests that the government support a mandatory insurance program with government reinsurance. The mandatory nature of the program eliminates the risk of adverse selection. The premium payments received by the government can be used to offset future government payments for housing reconstruction. The program should have graduated premium rates. To reduce the administrative burden, the program should rely on the existing private insurance companies to provide needed technical support. The insurance should be bundled with some other needed financial product. The GoT should limit its role to the reinsurer for the program. The program should try to limit moral hazard by using deductibles and correlating premiums to risk. The insurance is intended as a substitute for government aid.

The characteristics of the TCIP closely follow the model. It is a mandatory program with actuarially set rates. It relies on the private sector to perform most administrative duties. It uses deductibles to limit moral hazard. It bundled the purchase of insurance to the receipt of public utilities and the recording of property transactions. In these respects, it is very well designed. The major flaw is the unwillingness of the GoT to make the insurance the sole source of paying earthquakes claims. If Turkish homeowners perceive they will receive government aid regardless of their purchase of insurance, the resistance to purchasing the insurance will increase.

How does the Turkish experience stake up with the discussion on desirable characteristics of government supported catastrophe programs discussed earlier? The program meets most the criteria for a long-term sustainable approach to the problem. It charges premium on actuarial rates that should reduce moral hazard. By making the program mandatory, it reduced the risk of adverse selection. By engaging the private sector in the process of administration, it reduced the bureaucratic burdens often associated with government directed programs. By bundling the insurance with access to public utilities, it provides a means to enforce the mandatory nature of its program. In terms of program design, the approach taken by the GoT is solid. The low level of market penetration is likely related to the GoT's willingness to provide post disaster aid to homeowners.

2.3. Conclusions Based on Turkey's Experience

Providing guidance to policy makers on the most desirable form of government catastrophe insurance programs is difficult. Generally speaking, there are two basic objectives for these programs. One objective is to provide credit support to the private market to make catastrophe insurance

available. For this type of program, the government should limit its involvement to reinsuring a voluntary market based private insurance program with actuarially fair rates. The government should be paid an amount that compensates it for providing credit support. A second type of program is one that substitutes an insurance program for post disaster aid from the government for catastrophe losses. This type of program should be mandatory. To the extent possible, the government should rely on the private market to provide needed administrative services. Rates for the insurance should be actuarially determined. If the rates are too high, the government may need to subsidize the premium for the insurance. To succeed, the government needs to make the insurance program the primary source of paying for losses from catastrophes. If it is perceived that the government is still willing to provide substantial post-disaster aid, it will destroy the incentive to participate in the program.

While theory and experience provides some valuable lessons on the desirability of alternative programs for financing catastrophe risk, this is a problem that could benefit from empirical research combined with proper economic modelling. In truth, the best approach to evaluate the best way for governments to support catastrophe insurance programs is still a matter largely of political choice, not empirical evidence. As this topic receives more attention, it is likely that further empirical research will help illuminate the policy options.

3. Lessons for Emerging and Developing Countries

A main focus of this report is the application of the experiences of the OECD countries to the needs of the developing world for strategies to cope with the financial risk of catastrophes. As noted in the introduction, there is a fundamental difference between the experiences of the OECD countries and the developing world. The OECD programs are all *ex ante* measures: they were put in place before catastrophes occur. They were designed to set the terms for governmental assistance following a catastrophe. Most developing countries react to disasters rather than plan for their consequences. Before much can be learned from the OECD experiences, developing countries must first decide that planning for catastrophes is important to them.

While the benefit of planning for catastrophes is clear, planning has an associated cost: it requires budgetary allotments to finance *ex ante* risk management measures. For countries with severely constrained financial resources, the case for justifying the allocation of those resources to finance losses from catastrophes is not clear-cut. Two arguments hold sway that

militates against the allocation of poorer countries' resources to finance losses from catastrophes. First, it is an inefficient allocation of resources. In the OECD countries, governmental concern about the economic security of its citizens from catastrophe losses occurred after governments had resolved risk issues associated with economic development and workers rights. As noted in the discussion on Turkey in the prior section, Turkey developed an insurance scheme as a substitute for substantial governmental assistance to homeowners after earthquakes. For many poorer countries, governments are focused on economic development. They provide minimal funds from their budgets now for catastrophe assistance. It may be that security for catastrophe losses is still of secondary concern.

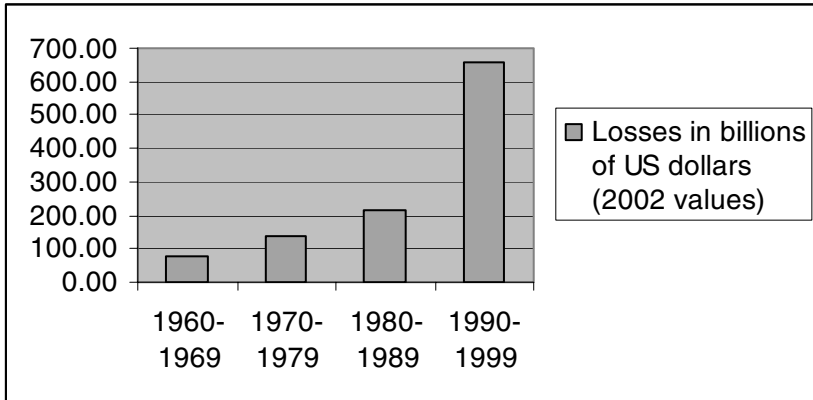
The second obstacle is the realization that the developed world is willing to provide resources needed to cope with catastrophes on an *ad hoc* basis after a catastrophe occurs. Aid, grants and loans provided after a disaster are much less expensive than allocating funds from limited budgets. In fact, depending on the amount and the terms of funding available for catastrophe assistance, it may be much more efficient to allocate budgetary funds for activities that the international community is less willing to fund.

Part 3 focuses on the potential application of the experiences of the surveyed countries in coping with losses from catastrophes to the needs of developing and emerging countries. The first section will review the increasing costs of catastrophes in the third world. Once the problem has been identified, a discussion of the willingness of poorer countries to allocate scarce resources to cope with catastrophes will be undertaken. Next, the current means by which governments in poorer countries cope with catastrophes is reviewed. Finally, the potential lessons from the experience of the surveyed countries for poorer countries are explored.

3.1. Catastrophe Exposure in the Developing World⁵

Earlier in this paper, the general statistical information on the costs of natural and man-made disasters was reviewed. The problem is even more severe in developing countries. For those interested in the topic of natural hazard risk and economic development, one fact is central: the losses from natural catastrophes continue to escalate at an alarming rate. The economic cost of disasters has been increasing over decades.

Figure 12.5 Economic Losses due to Natural Disasters from 1960 to 2000.

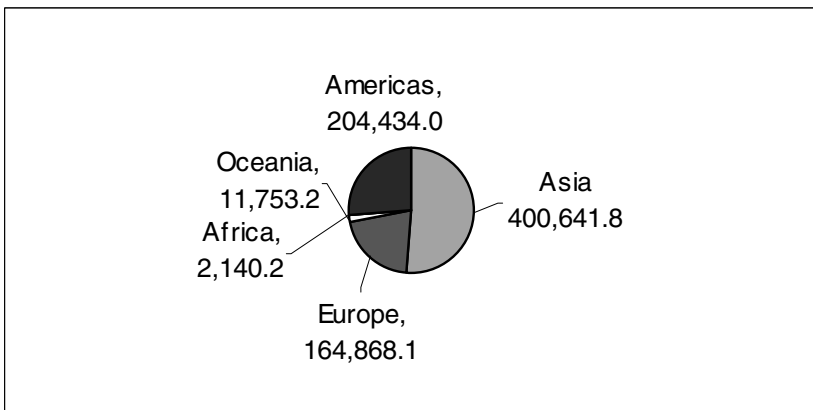


Source: Munich Re.

According to Munich Re, real annual economic losses averaged US\$75.5 billion in the 1960’s, US\$ 138.4 billion in 1970’s, US\$ 213.9 billion in the 1980’s, and US\$ 659.9 billion in the 1990’s. Munich Re estimates that global economic losses for the most recent 10 years (1992-2002) were 7.3 times greater than the 1960s.

A substantial portion of disaster damages are in Asia, nearly half the total losses. The following chart details damages by geographic region.

Figure 12.6 Total Amount of Disaster Damage between 1991 and 2000 in millions of US dollars (2000 values)



Source: EM-DAT: The OFDA/CRED International Disaster Database.

In the last two decades, more than one and a half million people have been killed by natural disasters. The total number of people affected each year has doubled over the past decade. According to UNDP, human deaths are the most reliable measure of human loss and are the indicator used in designing their recent disaster risk index (DRI).

Examining casualties from different disasters by region provides some revealing information relative to the costs of disasters. The Asia-Pacific region experiences the greatest impacts both in terms of total lives lost and when lives are calculated as a proportion of regional population, due to earthquakes, tropical cyclones and floods. The exception to this comes from the high concentration of deaths associated with drought in Africa. Drought events are often part of a bigger picture that can include armed conflict, extremes of poverty and epidemic disease with death touching only the surface of livelihood disruption and human suffering. The erosion of development gains under such circumstances is clear.

Natural disasters occur when societies or communities are exposed to potentially hazardous events, such as flooding, earthquakes, or typhoons and when people are unable to absorb the impact of or recover from the hazardous impact. While it is commonplace to speak of about natural hazards, both vulnerability and hazard are conditioned by human activities. Reducing the number and effects of natural disasters means tackling the development challenges that lead to the accumulation of hazard and human vulnerability that prefigures disaster. The accumulation of disaster risk and the unequal distribution of disaster impacts prompt a questioning of the development paths that have been undertaken by countries at risk from disasters. Natural disasters destroy development gains, but development processes themselves play a role in creating disaster risk. When a school built without earthquake resistance collapses, is this disaster risk undoing development or inappropriate development creating disaster risk?

The losses from disasters clearly impact economic development. This interrelationship is described on the following chart from UNDP:

Linking disasters to economic development is complex. A recent publication by Charlotte Benson and Ed Clay detail the most recent thinking on the subject.⁶ The findings of the study indicate that major natural disasters can and do have severe negative short-term impacts. Disasters, especially when they occur frequently, have negative longer-term consequences for economic growth, development, and poverty reduction, although these effects are more difficult to isolate and quantify. The vulnerability of countries to natural hazard risk is determined by a complex, dynamic set of factors such as economic structure, stage of development, and prevailing economic and social conditions. Vulnerability can be reduced

by appropriate investment in disaster mitigation and favorable developments in the structure of the economy, in production technologies, and in the wider economic and domestic policy environment.

Table 12.7 Disaster Development

| | Economic Development | Social Development |
|--|--|---|
| Disaster limits development | Destruction of fixed assets. Loss of production capacity, market access or material inputs. Damage to transport, communications or energy infrastructure. Erosion of livelihoods, savings and physical capital. | Destruction of health or education infrastructure and personnel. Death, disablement or migration of key social actors leading to an erosion of social capital. |
| Development causes disaster risk | Unsustainable development practices that create wealth for some at the expense of unsafe working or living conditions for others or degrade the environment. | Development paths generating cultural norms that promote social isolation or political exclusion. |
| Development reduces disaster risk | Access to adequate drinking water, food, waste management and a secure dwelling increases people's resiliency. Trade and technology can reduce poverty. Investing in financial mechanisms and social security can cushion against vulnerability. | Building community cohesion, recognising excluded individuals or social groups (such as women) and providing opportunities for greater involvement in decision-making, enhanced educational and health capacity increases resiliency. |

Source: Reducing Disaster Risk: A Challenge for Development (UNDP 2004).

The growing urbanization of the world's population has compounded the problem: now, a minor event can cause significant damage in a heavily populated area. The proportion of people in developing countries living in cities has doubled since 1960. More than 40 percent of all people live in urban areas, and this figure is expected to surpass 55 percent by 2030. Nearly half of these cities are subject to extreme weather events. The same features that made them attractive to settlers—such as natural flood plains, alluvial soil, and river or sea access – also bring danger. Thirteen of the world's 19 mega cities—cities with 10 million or more inhabitants—are in coastal zones, and over 70 of the world's 100 largest cities can expect a strong earthquake at least once every fifty years.

The vulnerability of the poor

Twenty-four of the 49 poorest countries face a high level of disaster risk; at least 6 of the world's poorest nations have been hit by between 2 and 8 major disasters in each of the past 15 years. A recent UN study has shown that at least 13 of the 25 countries most prone to disasters—particularly storm surges, landslides, extended droughts, and floods—are small island

states (SIDS) (UNDP 2004). SIDS are particularly vulnerable because of their small economies, dependence on agriculture and tourism, and narrow resource base. Given their vulnerability and the extent of the environmental risk, some of these small states may eventually disappear.

Economic losses from natural disasters are smaller, in absolute terms, in developing than in developed countries. However, because of lower levels of infrastructure and capital stock, the economic impact is far higher, relative to GDP. Between 1985 and 1999, the world's wealthiest countries sustained 57.3 percent of measured economic losses because of disasters, representing 2.5 percent of their combined GDP. Among the world's poorest countries, however, economic losses from disasters accounted for 24.4 percent, or 13.4 percent of their combined GDP.

Loss of life is far greater in developing countries. Between 1990 and 1998, more than 97 percent of all deaths from natural disasters were in developing countries. Developing countries also tend to suffer more deaths in each disaster—an average of 1,052, compared with 22.5 in highly developed nations.

Vulnerability of Specific Countries to Natural Disaster Risk

Munich Re's analysis measuring vulnerability to specific natural disasters among developed nations that was used in Section 1.11 is not available for most developing countries. While aggregate figures are known, the analysis lacks specific details regarding many developing countries. The United Nations Development Program (UNDP) has an initiative to measure the vulnerability of specific countries to different hazards. For example, the top five countries most vulnerable to earthquakes are Iran, Yemen, Turkey, Afghanistan and India. Floods: Somalia, Morocco, Papua New Guinea, Egypt and Botswana. Tropical cyclones: Honduras, Nicaragua, Cape Verde, Swaziland and Bangladesh. It is critical that the governments of these countries have the capacity to finance post-disaster reconstruction; otherwise, their long-term ability to reduce poverty will be significantly restricted.

Many countries in the developing world already face daunting challenges to increase economic growth and decrease poverty. Responding to substantial socioeconomic and climatic changes with its resultant impact on key economic sectors will add to an already difficult burden. Sudden-onset extreme natural hazard events are a chronic problem for a select group of developing countries: 28 have suffered direct losses of more than \$1 billion from natural catastrophes in the past 20 years⁷.

Need to Plan for Catastrophes

The most vulnerable countries need to account for the costs of natural catastrophes as a component of overall planning. In creating country-level assistance programs, the international aid and finance community prepares macroeconomic projections and analyses of macroeconomic policies as a component of development strategies. Estimating levels of future growth and identifying the existing and prospective resources required to meet those growth objectives are key to developing economic projections. Historically, estimates have not accounted for potential natural disaster losses. To be meaningful, however, projections must account for items that significantly impact the estimates. As the size of the losses increase, the need to formally include disaster losses in the planning process is needed (Gilbert, Kreimer 1999).

Three reasons compel the need to incorporate catastrophes into economic projections. First, if disaster impacts are not anticipated, the diversion of scarce financial resources to relief and reconstruction efforts causes high opportunity costs as other projects contributing to economic growth and the eradication of poverty cannot continue as planned. Second the continuing and significant reallocation of resources post-disaster wrecks havoc on the budgetary planning process. The creation of annual budgets is often a complicated, politically difficult process. Shifting resources in response to disaster needs disrupts fragile compromises formed to create initial budgets. For many countries, this shift creates considerable institutional friction (Lewis, Murdock 1999). Third, poorer countries rely on international assistance to pay for a substantial portion of their losses. The resources available to the international development community are limited and have remained stagnant for nearly 10 years. As the cost of disasters increase, the demand on the international financial community to provide needed resources has also increased. For example, the Inter American Development Bank has increased its average annual disaster related spending by a factor of 10 in the past five years in comparison to the previous 15 years (Clarke 2000). A step in relieving pressure on domestic fiscal and international aid budgets is to quantify the potential exposure to disasters for the countries they assist. Once quantified, alternatives to plan for the disasters can be developed.

Planning for disasters is not simple: Planning requires both reliable estimates of the probable damages that a disaster may cause and a framework to incorporate catastrophe shocks to capital stock into economic models. Obtaining reliable estimates for future probable damages is challenging. As detailed earlier, the losses from disasters have been increasing at an accelerating rate. To estimate the economic impact of chronic exposure to natural disasters, one must measure both the expected *severity* and the

expected *frequency* of catastrophic events. Once the severity and frequency of an event is determined, it must be matched to the assets at risk.

During the past decade, scientific understanding of the causes and consequences of natural catastrophes has dramatically improved. Models to predict the frequency and severity of catastrophe events have been blended with sophisticated techniques to identify assets at risk (Swiss Re 2003). In the developed world, the substantial catastrophe risk insurance market has driven catastrophe modeling. The lack of extensive catastrophe insurance in developing countries means little catastrophe modeling exists for these countries. This makes effective planning difficult. Without knowing the catastrophe exposure, it is difficult to make plans to cope with the magnitude of the risk.

The international financial institutions have been interested in focusing their clients on the need to fiscally plan for catastrophe risk. They have undertaken a number of technical assistance projects in highly vulnerable countries to generate the needed information to create a contingency financing plan. The current programs in Mexico and Turkey benefited from significant contributions from the World Bank and other international financing organizations.

Despite the apparent need for proper planning, there are countervailing pressures that limit the willingness of countries to plan for and finance *ex ante* risk management measures. Some of these pressures will be discussed in the following section.

3.2. Priorities for Risk Management in Developing Countries

As discussed in Part 1, an active role of governments in financing losses from catastrophes in the developed world is a recent phenomenon. Governments in developed countries have gradually assumed risk for catastrophes since World War II. David Moss, in his book *When All Else Fails: Government as the Ultimate Risk Manager* details the willingness of governments to assume increasing responsibility for its citizen's welfare is a function of development. Historically, governments address different risks as their societies move through stages of growth. Governments tend to first focus on risks associated with business development. In the second phase, governments shift their attention to risks linked to the employment of labor in the economic development process. In the third phase, governments increasingly assume more risk on behalf of the consumer and their citizens. In this phase, governments take on greater responsibility for consumer, environmental and natural hazard risk. Moss argues that as governments move through these three main phases, they aspire to two main roles in risk:

(1) reallocate/shift risk away from citizens and consumers; (2) reduce risk through subsidies or mitigation programs.

According to Moss in the first phase, governments tend to support businesses as the country shifts from an agrarian to an industrial-based economy. The government uses its law-making power to shift risk among different segments of the economic community to advance and encourage trade and development. “By the end of the nineteenth century, American lawmakers had enacted a wide range of risk management policies, all intended to promote trade and investment. Most notable among them were limited liability, banking regulation, bankruptcy law, a fixed exchange rate, and the predictable enforcement of property rights.” Limited liability is a prime example of government’s risk management ability. It shifts risk away from investors to greater economic activity.

During the second phase, governments shift their focus to labor. Issues related to minimum wage, proper working conditions, health protection, social security, worker’s compensation and other risk issues relative to labor are addressed. As a result, “instead of worrying about how best to allocate default risk among debtors and creditors, leading reformers and policymakers now pondered how best to allocate worker risk.”

The third phase sees an overall increase in the government’s risk burden, assuming broad “social protection” risk for citizens at large. In some cases, the government reallocates risk from consumers and borrowers to manufacturers and lending institutions. In other cases, the national government assumes an increasing role in risk borne by its citizens. The government involvement in natural hazard risk is a reflection of this Phase III role of national governments.

The experience of Japan highlights the Phase III concerns of a country as relates to catastrophe risk. After the Second World War, the Japanese government’s role as relates to catastrophes has significantly increased. Japan’s first comprehensive disaster law was the 1961 “Disaster Countermeasures Basic Law,” which centralized and consolidated a comprehensive disaster management system. National aid provision was reinforced by a 1962 law. During the 1970s and 1980s, special laws were enacted to refine disaster management for earthquake, heavy snow, and volcanoes. Importantly, many of the 1960s laws emphasized non-structural mitigation through policies such as land use restriction. The disaster law was updated significantly in 1995 due to experiences during the Great Hanshin-Awaji Earthquake. Today, Japan has a disaster management system that is among the most sophisticated, comprehensive, and centralized of the OECD countries.

Most poor countries are still in Phase I and II of Moss’s model. They are focused on economic development and labor protection. . Moss aptly points

out that developing countries are faced with a tremendous balancing act. “How to manage economically dysfunctional risks without stopping up the wellspring of economic progress is one of the most difficult challenges facing policymakers in every developing country.”(Moss 2002) Many emerging countries are simply overwhelmed with their development needs so that catastrophe management is relegated to the sidelines.

3.3. Funding from the International Aid Community

There is a second process at work that restricts the interest of poorer countries in financial planning for disasters. Historically, the wealthy countries in the world provide needed assistance after a catastrophe occurs. This creates the same moral hazard at the national level that was described at the individual level earlier. This particular moral hazard is known as the Samaritan’s Dilemma. The dilemma arises when those at risk (including governments of vulnerable countries) expect to receive support if disaster strikes and therefore under invest in protective measures-physical and financial-to reduce the costs they will incur when disaster does strike. And, given the humanitarian imperative, it is hard for those in a position to help to make a credible commitment to scale back post disaster assistance even if those suffering did not take appropriate protective measures.

Cambodia provides an example. After the 2000 floods, the government relied extensively on assistance from the international community. The World Bank and the Asian Development Bank provided new credits and diverted approximately \$80 million of existing loans. In addition, a range of international groups provided funding for relief efforts (UN and Red Cross played critical roles), reconstruction of highways (Japan has committed substantial sums to improve the levees around Phnom Penh and to rebuild portions of the national highway system), and flood control projects. Cambodian response to the 2000 floods consisted of utilizing funding from sources other than the national government.

Of course, there are some measures underway in the developing countries to cope with the financial costs of disaster. There are other efforts underway to have governments focus on *ex ante financial* planning for disasters. Technical assistance projects in the Caribbean basin, the Pacific Island states, Honduras, El Salvador, Vietnam, India and the Philippines have been recently financed by the international financial institutions to analyze possible *ex ante* catastrophe financing programs.

Understanding the limited interest in poorer countries to allocate resources for government funded or supported catastrophe financing programs, what lessons can be applied from the experience of the surveyed countries?

3.4. Policy Implications for Emerging Countries

Based on the experience of the surveyed countries, the following principles have application for developing countries:

- It is appropriate for governments to play a role in managing the financial risk of catastrophes for their citizens. All the surveyed countries developed an active *ex ante* role for the government in financial management of catastrophes;
- Developing countries should define and measure their exposure to catastrophe risk. By identifying their risk, it is likely that more effective planning can be done to gather financial resources to cope with that risk. For many highly vulnerable developing countries, catastrophe risk is an issue of economic growth. As such, it should receive the same attention as other Phase I style economic development risks;
- Countries should focus their efforts on coping with their high vulnerability catastrophes. Comprehensive programs like those in France and Spain operate in countries with low catastrophe vulnerability. The highly vulnerable developed countries like Japan limit their resources to their high hazard risks;
- There is enormous advantage to having an operational private insurance industry. A viable private market may be able to absorb some catastrophe risk that would otherwise become the responsibility of the government. Even if the industry is too lightly capitalized to provide any meaningful financial protection, the administrative resources of a viable insurance industry can provide a platform for establishing a government funded and directed program. The private industry can help in performing needed services like marketing, premium collection, and claims payment;
- There is a wide constellation of possible governmental options to cope with losses from catastrophe risks. The OECD study (2004) describes a full range of governmental options. Which options to choose are a reflection of the level of hazard risk, the financial condition of the government, the strength of the private insurance market, and the political culture and preferences of countries. The 'right' approach for any individual country needs to include an understanding of these various components of the decision process.

For emerging countries in the midst of building political, judicial, economic and social institutions, managing natural hazard risk is difficult. However, the experiences of the surveyed countries show that meaningful efforts to protect countries from the losses of catastrophes are possible.

Conclusion

The last fifty years have seen two linked phenomena: the rising costs of catastrophes worldwide and the willingness of governments in OECD countries to adopt programs to protect their citizens from the costs of catastrophes. The willingness of governments to assume a greater risk management burden is a reflection of the economic prosperity of the past 50 years. Once governments have secured economic development and looked after worker rights, they have been willing to assume greater responsibility for broader social protection. The assumption of catastrophe risk on a large scale basis by OECD countries is a reflection of the increased role of governments in providing social protection.

The selected surveyed countries represent various alternatives of different governments to cope with the financial costs of catastrophes. At their core, all of these are *ex ante* programs that define the terms and conditions of governmental financial support after a disaster. The compensations schemes generally entail a partnership between the government and the insurance industry. These partnerships use the administrative capacity of the insurance industry to handle operating details of the programs. The relative roles of the government and the private sector reflect the financial strength of the insurance industry in the various countries as well as the budgetary limits of the governments in each country.

There are two primary financial models. The first model is the government as insurer of catastrophe risk. In this model, the government collects fees and absorbs defined catastrophe risk. This type of programs is generally mandatory with government set premiums. The other model is the government as reinsurer. In this model, the government provides financial support to the private market. The private market retains a portion of the risk for its own account. These programs can be either mandatory or voluntary, but all have actuarially set rates and defined reserve funds. The Japanese Earthquake Reinsurance Company is a representative example of this approach.

The different models tradeoff identifiable characteristics. The government as insurer has high moral hazard risk but provides lower cost protection to a wider range of insureds. The government as reinsurer with actuarially set rates reduces moral hazard risk but at a higher cost and more limited protection. The acceptability of the tradeoffs for each country is a function of political values. As such, there is no right program.

The programs developed by each country also reflect the level of catastrophe risk to the country. Countries with high catastrophe risk limit their programs to the identifiable risk. The varied hurricane, flood, and

earthquake programs in the United States represent programs that cope with high hazard risks. Countries with low levels of risk provide broader protection that covers a wider range of risks. The program in Spain is a good example of this model.

As developing countries recognize catastrophe risk as an issue requiring government attention and resources, the OECD experiences provide a wide array of policy alternatives to finance the losses from catastrophes. At a minimum, the experience of the OECD countries illustrates a few key principles: it is appropriate for governments to play a role in absorbing the costs of catastrophes; that governments should develop an *ex ante* program to define their responsibilities; and an active private insurance industry is an invaluable resource in assisting the government in creating its role in catastrophe risk management. As the role of governments in providing social protection expands, the relative role of the private sector and the government in managing risk will be subject to debate. The experiences of the OECD countries in creating and managing their varied catastrophe compensation schemes provide a broad variety of alternatives for coping with the costs of catastrophes. Current experience does not identify any clear winning or losing strategies. Rather, it identifies highly diverse alternatives to cope with a complicated problem.

Notes

- 1 This discussion relies on an article by George Priest that appeared in the May 1996 issue of *Journal of Risk and Uncertainty* (Priest 1996).
- 2 *The Financing of Catastrophe Risk* is a 1999 book edited by Kenneth Froot that focuses on the role of private insurance and catastrophe risk (Froot 1999). The role of insurance in managing environmental risk was the focus of the 1997 book *Managing Environmental Risk through Insurance* by Paul Freeman and Howard Kunreuther (Freeman and Kunreuther 1997).
- 3 The OECD completed a short paper Flood Insurance in June, 2003. The paper surveys selected flood insurance programs in various OECD countries. The statistics related to insurance penetration and percentage of loss payments related to floods is from this publication.
- 4 This work has been pioneered by Professor Georg Pflug of the University of Vienna. The application of the technique can be seen in work done for the Inter-American Development Bank in Disaster Risk Management: National Systems for the Comprehensive Management of Disaster Risk and Financial Strategies for Natural Disaster Reconstruction (Freeman *et al* 2003).
- 5 In 2004, the United Nations Development Program issued its report, Reducing Disaster Risk: A Challenge for Development (New York: UNDP). The report contains detailed information on the impact of natural catastrophes on developing countries. The information and charts in this section come from this report.
- 6 Benson and Clay (2004), Understanding the Economic and Financial Impacts of Natural Disasters (Washington DC: The World Bank).
- 7 These are Algeria, Egypt, Mozambique, China, India, Bangladesh, Taiwan, Indonesia, Philippines, Korea, Afghanistan, Armenia, Georgia, Iran, Mongolia, Thailand, Argentina, Brazil, Chile, Colombia, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Venezuela (Munich Re 2001).

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Annex 1

List of Speakers and Presentations at the Conference*

Session 1 - Insurability of catastrophic risks

- Economics of catastrophe risk insurance, *Christian Gollier (University of Toulouse)*.
- Insurability of terrorism risk: challenges and perspectives, *Howard Kunreuther and Erwann Michel-Kerjan (Wharton School, University of Pennsylvania)*.
- Industrial, technological and other catastrophes, *Christian Lahnstein (Munich Re)*.
- Recent trends in the catastrophe risk insurance/reinsurance market, *Patrick Murphy O'Connor (Benfield)*.
- Role of the reinsurance industry in the management of weather related risks, *Peter Zimmerli (Swiss Re)*.
- Issues and options in the management of terrorism risk through insurance, *Robert Reville (Rand Corporation)*.
- Current state of the coverage for war and terrorism risks - including NBC - in the aviation sector, *Eugene Hoeven (IATA)*
- Free market solutions for terrorism risks coverage, *Ben Garston (MAP Underwriting and Lloyd's Terrorism Panel)*.

* Power point presentations summarising papers included in this publication as well as other presentations made at the conference are available on the OECD Insurance homepage: <http://www.oecd.org/daf/insurance>.

- Improving insurability and affordability: the role of insurance in hazard identification, risk assessment, risk prevention and mitigation for industrial/chemical accidents, *Satyananda Mishra, IAS, Disaster Management Institute, Bhopal - Government of Madhya Pradesh, India*).

Session 2 - Financial market solutions to manage catastrophic risks

- International financing solutions to catastrophic risk exposures, *Torben Juul Andersen (Copenhagen Business School)*.
- The use of risk linked securities to manage catastrophic risks, including terrorism, *Christian Mumenthaler (Swiss Re)*.
- Current challenges in terrorism risk securitization, *Gordon Woo (RMS)*.
- Financing catastrophic risks in non-OECD countries: challenges and perspectives, *Reinhard Mechler (IIASA)*.
- Current market trends for catastrophe bonds and risk linked securities, *Christopher McGhee (MMC Securities, Guy Carpenter)*.
- The potential for new risk transfer instruments to cover terrorism risks, *Michele David (The Bond Market Association)*.
- Rating agency's perspective on catastrophe bonds and risk linked securities, *Rodrigo Araya (Moody's)*.

Session 3 - Role of governments and development of public-private partnerships for catastrophe risk management

- Role of governments in natural catastrophe risk management and financing in OECD countries, *Paul K. Freeman (University of Denver)*.
- Catastrophe insurance programs in emerging countries: field experience, *Eugene Gurenko (World Bank, Financial Sector Operations and Policy Department)*.
- Potential role for governments in terrorism coverage, *Dwight Jaffee (Haas School of Business, UC Berkeley)*.
- Public-private partnerships to cover terrorism risks in OECD countries, *John Cooke (International Economic Relations Consultant, London)*.

- Role of the US government in the prevention and mitigation of terrorism risks, *Robert Liscouski (Infrastructure Protection Office, Department of Homeland Security, USA)*.
- Disaster risk management policy in Japan, *Kazuhiro Kawachimaru (NIPPONKOA Insurance Company Ltd)*.
- The Spanish experience in the management of extraordinary risks, including terrorism, *Ignacio Machetti (Consorcio de Compensación de Seguros)*.
- A stakeholder approach for developing a public-private partnership: the Hungarian case, *Reinhard Mechler (IIASA)*.
- Disaster risk management policy in China, *Yuanchang Zheng and Jianguo Mu (Department of Disaster and Social Relief, Ministry of Civil Affairs)*.
- The French experience in natural catastrophe risk management, *Suzanne Vallet (Caisse Centrale de Réassurance)*.
- Earthquake risk management policy in Indonesia, *Werner Bugl (PT Asuransi, MAIPARK Indonesia)*.
- Disaster risk management policy in Mexico, *Carlos Bayo Martinez (FONDEN)*.
- Disaster risk management policy in the Philippines, *Ronald I. Flores (Department of National Defense, Office of Civil Defense, National Disasters Coordinating Council)*.
- Disaster management in India, *D. Madan (Under Secretary, National Disaster Management Division, Ministry of Home Affairs, Government of India)*.
- Management of extraordinary risks, including terrorism, in India: achievements and perspectives, *C. S. Rao (Indian Insurance Regulatory and Development Authority)*.

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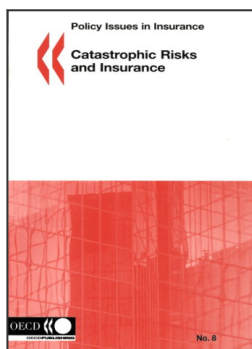
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* Background Note of Mr Kawachimaru's presentation (NIPPONKOA Insurance Company Ltd), based on *Governmental Earthquake Insurance System in Japan*, from *Earthquake Insurance in Japan*, written and published in March 2003 by Non-Life Insurance Rating Organization of Japan.



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