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Foreword

Natural hazards present important challenges for the attainment of the social and economic development goals of the countries in Latin America. The costs of disasters are increasing and exacerbated by a regional underinvestment in prevention and mitigation, and the lack of financial protection strategies. Post-disaster financing of damage creates a serious drag on development, contributing often also to greater vulnerability to future events. Policymakers in the region recognize that their economies may be seriously affected because post-disaster investments for reconstruction may cause increased indebtedness, potentially higher inflation, and dampened investment in important geographical areas and sectors not included in reconstruction. Post-disaster borrowing causes development priorities such as poverty reduction efforts, public health, education, and other social goals to be sacrificed.

Some countries in Latin America and the Caribbean have established specific financial protection strategies to meet disaster-related expenditures. Financial instruments are available to meet hazard losses. They include budgetary transfers, use of reserve funds, contingent credit and insurance. More advanced techniques such as catastrophe bonds, weather derivatives, and index-based (parametric) insurance are not yet widely used to manage disaster risk in the region, but are receiving increased interest.

This technical paper analyzes the potential practical application of financial instruments for natural hazard risk finance and transfer in Latin America. The study first presents an overview of the role of financing and risk transfer in disaster risk management. It then investigates the sources of natural hazard risk and presents use of financial instruments for managing risk for the cases of Chile, El Salvador and Peru. The document also discusses the role donors and multilateral development banks should have in supporting disaster risk financing in the region.

This publication follows the path outlined in the Action Plans of 2000 and 2005 for Disaster Risk Management. It will create awareness in the Bank and among its member countries, of the opportunities for risk financing and transfer involving both public and private sectors, particularly in Chile, El Salvador and Peru. We hope that the publication will be useful to officials from ministries with responsibilities in areas such as finance, planning and civil protection as well as to Bank staff working in disaster risk management to support the development strategies of its borrowing member countries.

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Executive Summary

The Importance of Financing for Risk Management

Natural hazards have significantly disrupted socioeconomic development in Latin America and the Caribbean over the past 30 years, with yearly loss estimates in the order of US\$3.8 million. Financial protection helps improve resilience against social and economic losses and should be implemented within a coherent framework of national risk management and institutional development.

This study first analyzes the role of financing and risk transfer in disaster risk management; it then investigates the application and potential use of financial instruments for managing natural hazard risks in Chile, El Salvador and Peru and discusses the role of donors and multilateral development banks in supporting disaster risk financing.

Risks associated with natural hazards include both natural and socioeconomic elements. The frequency and severity of natural hazards are mainly determined by nature. Vulnerability is influenced by society, as the potential loss is directly related to prevention and mitigation investments. It is impossible to avoid all losses; therefore risk financing will become a necessity.

The basic objective of risk financing is to improve the ability of asset owners and governments to effectively re-establish living conditions and productive capacity in a post-disaster situation. Effective risk financing may cover the direct losses caused by the natural incident and indirect losses resulting from discontinuity in economic activities in the aftermath of an incident, thereby enhancing overall economic stability. Underfinancing disaster risk may have substantial negative consequences on current and future consumption, unfulfilled and potential investments and long-term growth. Adequate financial protection should form a central element of national risk management policies. An effective risk finance system will require a clear set of commitments, the necessary

institutional arrangements and the appropriate financial instruments.

Properly constituted risk financing systems will also contribute to sustainable economic growth through strengthened incentives for risk mitigation. For example, allowing insurance premiums to vary according to reduced risk due to prevention investments creates an incentive to explore and strengthen risk mitigation measures. It is, however, important to note that some forms of risk transfer contracts may effectively reduce risk mitigation and induce moral hazard. This may be the case with the situations listed below.

- Pure loss-based insurance, where premiums are independent of the insured's own risk mitigation.
- Government intervention to ensure the sustainability of living standards in the case of natural hazards.
- The availability of post-disaster relief assistance from the international donor community, which may undermine the development of risk mitigation and financing in developing countries.

It is also important to take into account that different financial instruments should be used to finance different aspects of risks depending on the probability and the scale of the impact. By selectively combining a set of instruments, the risk manager may both improve risk coverage and reduce total costs.

The main challenge of financing risk management is ensuring that it becomes an integrated part of an overall risk management process, and that this process includes the establishment of a proper institutional framework within which financial entities can function appropriately.

General Obstacles for Risk Financing in Latin America and the Caribbean

The net benefit of risk financing depends on three cost factors that must be weighed against welfare gains. The costs include: the defined level and pricing of risk related to natural hazards, transaction costs, and the net social costs of losses and changes in consumption. If these costs are high, the usefulness of financial instruments to cover natural hazard risks in Latin America and the Caribbean may be limited.

Transaction costs are generally significant when institutions are weak and when risk statistics are not well developed or unreliable, which is unfortunately common for most countries in the region. Spreads (the yields offered in order to attract investors) are often more than five percentage points above the risk-free interest rate for bank loans.

Policymakers' incentives for national risk management and finance may also be insufficient. Many countries in the region face severe public budget constraints while simultaneously having to address a variety of basic needs presented by their populations. It may be politically difficult to assign resources to protect against a probable future impact. In addition, natural hazards that manifest themselves in the form of infrequent natural disasters often induce international relief assistance and remittances. Reliance on these resource transfers (especially when they are grants) may be attractive and thereby reduce the incentives for mitigation.

Insufficient Risk Financing in the Three Countries Studied

The three countries studied for this report, Chile, El Salvador and Peru, are exposed to significant natural hazards, particularly earthquakes and El Niño-related weather phenomena.

The public sector and some housing segments are poorly covered by risk transfer or financing arrangements in all three countries (for instance, insurance penetration is limited). Though risk financing in these sectors was found to be insufficient in all three countries, the lack of financial protection against natural hazards is most evident in Peru and less so in Chile. The three case studies

suggest that the underdevelopment of risk financing stems from a combination of supply and demand factors, with the latter being more significant.

All three countries pursue policies of open financial markets. Peru, however, still has a relatively undeveloped financial sector, particularly with respect to supply-side hindrances. The penetration of mortgage financing is low in Peru and plays a limited role in private real estate financing, partly due to a weak legal and institutional framework that limits value assessments and building. In Chile and El Salvador there is a rather well-developed supply of risk financing and insurance available. Although national insurance markets are open to international competition in these countries, the limited size of the markets in El Salvador may restrict supply.

In all three countries, the public sector generally lacks well-founded policies on risk financing, and typically acts as a self-insured asset owner. Furthermore, the public sector fails to sufficiently coordinate financial and physical emergency planning. In Peru, funds are allocated to finance future crises management, but the total amount of funding is small and the deployment of the resources is limited. In Chile, infrastructure and public services assets are increasingly being insured.

As noted, it seems the supply side of risk financing is relatively well developed in Chile and El Salvador. Therefore, it is likely that the underfinancing of hazard risks in these countries stems from deficient demand from both the public and private sectors. As discussed above, this lack of demand might be explained by the incentive structure governing current versus future spending. In addition, populations are well acquainted with volatile living conditions due to a wide range of risk factors, including political instability, crime and natural hazards. Protection against other types of risks may or may not be more desirable than against natural hazard risk.

Independent of the interest in risk transfer through insurance, all three countries exhibit a need to strengthen risk prevention and mitigation investments. Investment decisions should be based on adequate risk and vulnerability analyses. The three

country studies indicate that a national natural hazard financing pool initiated by the government may be an appropriate option in certain situations. Pooling could help aggregate sufficient assets to manage financial instruments. However, the necessary, efficient public/private sector cooperation may be difficult to accomplish.

The conclusions arising from the studies vary and there is a need to further investigate the social value of institutional and financial measures to improve risk financing, in particular with regard to Chile. Chile has achieved a significantly higher rate of economic stability and growth than Peru and El Salvador. Chile's policies have, to a large extent, been based on no interference and liberalized market economics. The challenge for national policies is therefore to understand the importance of market imperfections and the role for the public sector in managing market failures in risk management and finance sectors.

In general, natural hazard risks are underfinanced in Latin America. Findings from the national studies and from the general economic development experience of the region indicate a need to combine mitigation and risk financing in any financial protection approach.

Steps That May Lead to Improved Risk Financing

The challenges of sound risk management and financing are great. The conditions for success resemble those for sustainable growth in general. Instruments for risk financing have proven to be of most value in countries with well functioning institutions for risk management and financial markets, where the volume of assets, risk statistics, transaction mechanisms, claim settlement procedures and supervisory institutions are well-developed.

It is important to highlight that good risk financing is dependent on a coherent framework for specific national risk management policies. The selection of particular financial instruments requires consideration of the political and institutional contexts within which they will function. Integrated risk management and risk financing require a political commitment to include risk management as a nec-

essary component in achieving sustainable economic growth.

The first step to establish sound natural hazard risk financing is to define the objectives by answering important questions such as: What share of risks should be retained? What are the government's responsibilities? How will risk management be integrated into the overall development perspective? The benefits of expected future socio-economic resilience to natural hazards must be valued against the costs. These costs may be substantial.

The second step is to develop the proper institutional framework for coordination and financial risk management that corresponds to the defined national objectives. Scale is a critical variable in risk financing and must be considered in the establishment of these institutions. In any case, most countries in the region would benefit from institutional developments in the financial sector. There would be important positive effects, for example, from well-coordinated actions in mortgage financing, microfinance and risk finance at the national level. International cooperation can also play an important role in facilitating institutional developments.

The final step is the development of a portfolio of financial instruments that may be used to cover potential losses. Rational risk financing requires continuous risk assessments and monitoring, estimations of potential losses, and supervision of the effectiveness of risk mitigation. In addition to insurance and reinsurance, new instruments for risk transfer, such as catastrophe bonds and derivatives, have proved an ability to enhance the funding of disaster risk underwriting.

The extended range of options for risk financing has motivated multilateral development institutions to investigate the potential for socially profitable application among less developed countries. So far, no issues of catastrophe bonds (or "cat bonds") have covered risks in the developing countries of Latin America, Africa or Asia.

Based on this study, it seems likely that sound macroeconomic and fiscal policies are important in contributing to resilience and economic stability

in the event of socioeconomic losses caused by potential natural hazards. Our conclusion raises serious doubts about the value of implementing new, sophisticated securitized risk instruments in a weak institutional environment with unclear asset management practices in the public sector, poor risk statistics and inadequate systems for loss valuation and claim settlements. Financial resources are only part of the remedy in case of an incident. The physical capacity to provide effective prevention and response mechanisms must be secure.

The Role of Donors and Multilateral Development Banks in Risk Financing in Latin America

Donor countries that seek to stimulate longer-term economic growth should aim to support the replacement of the currently predominant emergency transfers with risk mitigation practices and national risk finance. To succeed, developing countries should be motivated to pay attention to long-term institutional development for improved risk management rather than rely on relief in acute and often repetitive emergency situations.

There are some solutions that may be implemented relatively easily without the need for deep-rooted institutional changes. These include support of natural hazard-related credit risk insurance for microfinance institutions and existing ordinary credit institutions. Such institutions have well-established relations with asset owners, a proven capacity for asset valuation, and experience with reducing risks on their own books (e.g., through credit risk insurance) to enable more effective long term asset financing.

Donors currently operating as *de facto* disaster risk underwriters have good cause to redirect a significant share of resources normally spent in emergency situations to supporting well-founded mitigation investments and national risk-financing schemes. Helping exposed countries develop their own capacity for rational risk financing is a natural element in the development of proper frameworks for sustainable growth in the countries of Latin America.

Introduction

Direct and indirect losses from natural hazards in Latin America are an important obstacle to reducing poverty and increasing environmentally sustainable economic growth in the region. Improved natural hazard risk management is therefore high on the agenda of most national authorities and multilateral development institutions.

Natural hazard risk management covers a chain of activities prior to, during and after the incident. Risk financing forms an important element of this chain. The purpose of this study is to better understand the potential value of new instruments for risk financing and transfer. This introductory chapter first presents the purpose of the study in more detail and then introduces the risk management concept and key elements of risk analysis and finance. The report reviews the available financial instruments for natural hazard risk management and discusses the potential social value of introducing these new instruments into national natural hazard risk management. The national and international framework for risk financing and the potential application of the instruments are discussed with reference to the risk exposure and general risk management in three Latin American countries: El Salvador, Chile and Peru.

The report shall discuss the benefits and costs of the use of financial instruments, specific financial instruments that could be adequate for Latin America and the Caribbean, and relevant guidelines for implementation of the identified instruments in Chile, El Salvador and Peru.

This paper explains the basic concepts of risk management and finance. Next chapter presents our suggested practical guidelines for application of improved natural disaster risk financing, including institutional reforms, donor country participation and selection of an optimal finance structure. The three country studies are summarized in the third chapter, and the main conclusions are presented in the last chapter of this paper.

Risk Management and the Role of Risk Finance

The next sections describe observed risks and practical aspects of risk management and offer a general assessment of the attractiveness of risk financing and transfer for Latin American countries. The chapter goes on to introduce some theoretical aspects of financial risks and the characteristics of individual financial instruments to better manage natural hazard risks. First, we describe the loss potential and define direct and indirect losses, which are important for the valuation of risk financing.

Financial protection forms part of overall risk management activities. An integrated perspective on risk management is needed to properly relate risk financing to risk assessment, prevention and mitigation; the management of emergency situations, and reconstruction.

Figure 1 defines risk management as a set of activities in the pre and post hazard situation. The development of proper institutional solutions is constant throughout all phases. Risk finance and transfer is the main topic of this study. Every element described in the chart contributes either directly or indirectly to resilience. The elements are interdependent as the performance of each impacts the performance of the others.

Risk finance is the provision of financial resources to match the economic value of potential losses. Risk transfer is one way of financing risks by establishing a third party, an underwriter, to absorb risk and guarantee the economic value of the loss if and when it occurs.

The correlation between risk financing, institutional frameworks, and prevention and mitigation investments is important for implementation of comprehensive risk management. Prevention and mitigation may lower the loss potential and thus also the need for risk financing. It will normally not be possible to develop physical resilience to the extent that all potential loss is removed. Ra-

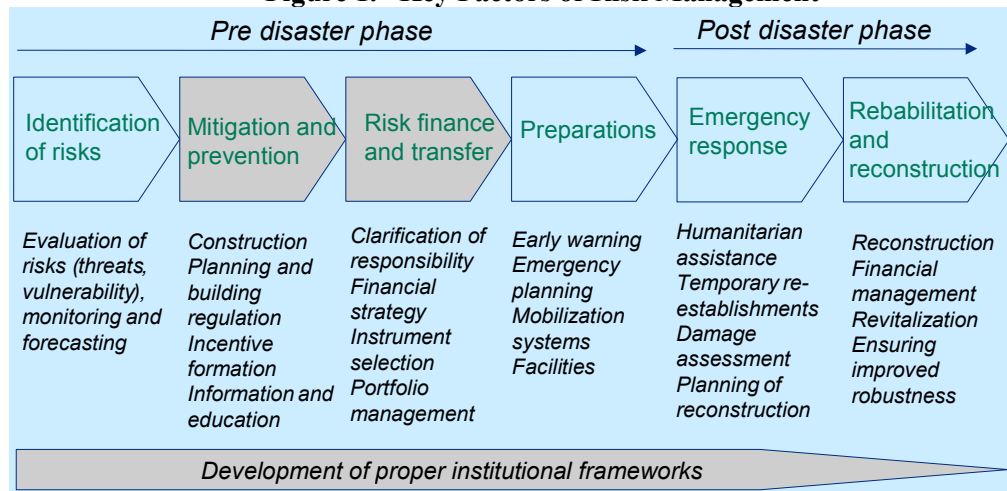
tional risk management involves developing an effective balance between prevention, mitigation, risk financing and deciding how much potential residual risk to leave without financial protection.

The relationship between mitigation and risk finance is reciprocal; mitigation requires financing and risk financing schemes may impact incentives for mitigation. Risk financing schemes must therefore take into account the potential effects of risk financing and transfer on risk mitigation.

The theoretical argument for risk transfer runs parallel to the argument for open economies. Goods and services are exchanged internationally as a result of differing resource endowments. National risk characteristics also vary and risk pricing would benefit from an international exchange of risks through the purchase and sale of risk transfer instruments like insurance contracts and risk-linked securities.

Governance issues play a significant role in disaster risk management. The establishment of a national system is a worthwhile goal for countries with high vulnerability. The adequacy of emergency and risk management institutions may be critical to the provision of security for the population living in risk-prone areas. Furthermore, financing of losses and relief assistance imply the transfer of substantial amounts of money that, in turn, may cause corruption. The disruption of normal infrastructure, communication, and control mechanisms provides room for illegitimate transactions. The capacity to regulate private sector behavior (e.g. through the enforcement of building codes in the construction sector) is itself an important prerequisite for effective risk mitigation. Natural hazard risk management therefore depends fundamentally on the quality of national institutions.

Figure 1. Key Factors of Risk Management



Source: Keipi and Tyson, 2003, ECON Analysis

Financial Aspects of Natural Hazard Risks

The Loss Potential and Direct and Indirect Losses

Natural hazard risk depends on underlying risk and vulnerability. Actions taken before the disaster occurs and the capacity to absorb post disaster losses will determine vulnerability. The social function of risk finance is to ensure sufficient capacity for appropriate actions during and after the disaster situation.

Depending on the availability of resources, and the adequacy of planning and organization, the indirect losses of a natural disaster may be significant compared to the direct losses. The relationship between direct and indirect losses as defined here is illustrated conceptually in Figure 2.

Insufficient risk financing may result in a serious lack of resources to limit damage from the incident and salvage remaining assets from complete destruction. Furthermore, when interrupted operations lack resources to reestablish infrastructure or recover input factor flows, further deterioration in production capacity will ensue. Finally, uncertainty about the capacity for, and timing of, reconstruction in general may cause new investments and productive resources to neglect the affected communities.

Risk financing is one important factor for avoiding unnecessary indirect losses. However, financial resources will not help limit losses if the institutional capacity required to aptly fulfill the planned mitigation and response activities is inadequate. Again, risk financing will only provide the social benefits intended if implemented within a framework of rational risk management.

Adjusting Risk Profiles

Provided that a framework for rational risk management is in place, the question still remains: What risk profile should be established to serve the social interest of the community?

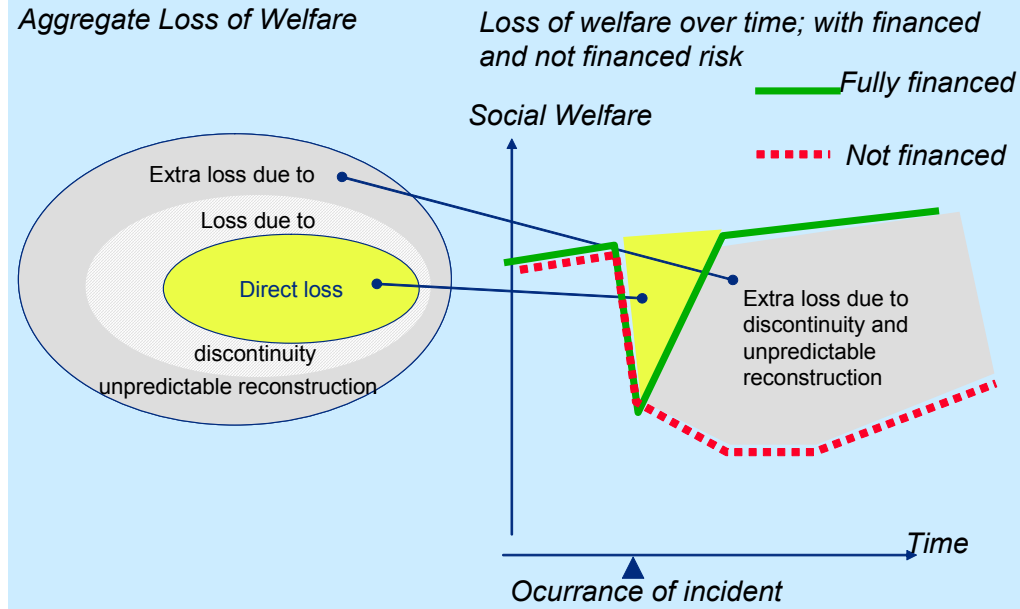
From a financial perspective, risk management is the adjustment of an investment portfolio to regulate the variability of returns. The risk profile of any asset portfolio may, through the use of various financial instruments, be selectively adapted to suit the preferences of its key stakeholders, owners or creditors. When risks related to natural hazards are well described statistically, there is reason to believe that a national economy can use a portfolio of financial instruments to adjust its risk profile to suit its social preferences. The underlying idea is that the application of financial instruments may enhance welfare by adjusting the variability of social welfare over time.

Table 1 classifies the four types of risk associated with financial instruments for managing risks: timing risk, credit risk, investment risk and underwriting risk. Pure risk financing implies the asset owner still carries the underwriting risk, that is, the risks associated with the calculated loss potential. The asset owner undertaking a pure risk finance scheme is still responsible for the full coverage of losses, but coverage of losses and the financing of reconstruction are spread over time in a predictable way. Risk transfer, as defined previously, means the underwriting risk is transferred to another party

When discussing relevant financial instruments of risk finance, this report makes a distinction between *risk finance* and *risk transfer*. Risk financing schemes redistribute all or some of the elements: timing risk, credit risk, investment risk and underwriting risk. Alternative risk financing instruments are defined by the way various risks are distributed in time and between asset owner and the financing agents.

In risk transfer arrangements, the underwriter (e.g. the insurance or reinsurance company) accepts the liability to settle the insured's future claims for losses covered by the insurance contract.

Figure 2. Aggregate Potential Loss and the Relation Between Direct and Indirect Loss. Conceptual Illustration



Source: ECON Analysis

Table 1. Four Types of Financial Risk

Risk element	Underlying uncertainty	The effect of risk transfer
Timing	Time of occurrence of a loss.	The time period used to accumulate funds or entitlements to loss compensation is independent of the time of occurrence of a loss.
Credit	Creditors' solidity e.g. the solidity of the reinsurer in case of heavy losses or creditor's solidity in contingent credit line arrangements.	Resulting risks are not impacted by financial solidity.
Investment	Return on deposits and funds set aside to finance future losses, e.g. in cat bond arrangements.	More predictable annual costs of financing a particular risk.
Underwriting	The potential loss that is transferred to the underwriter/insurer	The potential loss is for an agreed period of time converted into a predictable stream of payments. The asset owners' may be left with no remaining basis risk.

Source: ECON Analysis

Timing risk may be transferred from the asset owner to a financing agent through a pure risk financing arrangement like a savings and loans scheme. This enables an asset owner to develop full risk financing irrespective of the timing of a

subsequent incident provided that the asset owner is solvent and able to make deposits or pay the necessary installments. A risk transfer arrangement will imply the transfer of timing as well as underwriting risk.

Pure risk financing and risk transfer normally distribute *credit risk* elements differently. A credit institution providing credit facility to finance post-disaster reconstruction accepts the credit risk related to the future solvency of the asset owner. An insurer normally does not take on any credit risk because the transfer of underwriting risk normally expires when the insured is no longer able to pay his premiums. However, the insured will always be exposed to the credit risk related to the balance sheet and solvency of the underwriter. Insurance-related credit risk gives rise to significant price and premiums differentiation among insurance and reinsurance companies.

Investment risks arise from the accumulation of funds to cushion future losses. An insurance company normally accumulates funds to finance future losses. The returns on these funds will have an impact on the premiums necessary to finance a specific risk or the potential compensations. Pure risk financing may also have an impact on the distribution of investment risks depending on the specific arrangements made.

The insurance contract will determine how the insured and the *underwriter* share the investment risk.

Risk Financing Instruments

There are two basic types of risk financing instruments. Pure risk financing transfers the timing risks to (for example) a savings and credit institution. The asset owner still has to pay his/her loss through the withdrawal of savings or down-payments on loans. The risk transfer arrangements relieve the asset owner of any obligation. The repayment will be received from the insurer.

There are also numerous alternative mechanisms for risk transfer. Traditional means of risk transfer are insurance and reinsurance. More recently, a range of instruments categorized as risk-linked securities have been developed. Catastrophe bonds (cat bonds) and weather derivatives are examples of such instruments and were introduced during the 1990s. Most of these instruments apply mainly to the insurance or reinsurance industries. Only a few among the almost 80 issues of cat bonds so far

Table 2. Examples of Instruments for Pure Risk Finance

- **Ordinary financing**
 - Standby LOCs (Letters of Credit)
- **Captives** (normally among insurance/reinsurance companies)
 - Ordinary Captives at direct insurance, reinsurance or group/association level
 - Rent captive (rent out the balance sheet to a 3rd party)
 - Protected cell captives
- **Finite structures** (mainly for insurance companies)
 - Spread loss (pre and post funding)
 - Loss portfolio (transfer of liabilities for losses already occurred/usually long tail)
- **Contingent Capital**
 - Contingent Equity Plus/contingent surplus notes
 - Subordinated Debt Finance via. Debentures/Preferred shares

Source: Andersen (2002), ECON Analysis

have been made directly by the primary insured (i.e. the exposed asset owner). Normally, a reinsurance company sponsors the cat bond issue (see e.g. Swiss Re, 2004) while individual asset owners, including public authorities, address ordinary insurance companies for the purpose of risk transfer. The insurance companies usually reinsure to strengthen their underwriting capacity and reduce basis risk. For the reinsurance industry, cat bond issues and ordinary equity capital are potential sources for increased underwriting capacity and reduced basis risks (see table 3).

Risk transfer arrangements may have different formulas for measuring losses. The distinction between loss-based and index-based or parametric risk transfers in table 4 is important. Loss-based risk transfer implies claims and compensations are determined according to observed losses. Index-based or parametric risk transfer replaces actual loss valuation with a pre-determined index or parameter. Loss compensation is then a function of the objective value of the parameter or index, and only indirectly related to the actual loss. An example of a typical parameter may be the strength of an earthquake or hurricane in a certain region.

Table 3. Examples of Financial Instruments for Risk Transfer

- **Insurance: the contract with the primary insured**
 - Direct insurance company
 - Mutual insurance
 - Governmental insurance provision

- **Reinsurance: serving insurance industry**
 - Traditional reinsurance
 - Finite reinsurance
 - Cat bonds;
 - Index linked (parametric)
 - Real loss based

- **Other financial market instruments** (normally parametric)
 - Derivatives (weather) i.e. Caps(calls)/Floors(puts)/Collar/Swaps
 - Catastrophe Derivatives like CBOT/Bermuda Exchange instruments (discontinued since 1999)

Source: ECON Analysis

The two types of risk transfer give rise to distinct risks, claims settlement procedures and transaction costs related to the issuance. The use of a parametric instrument simplifies the contracting, transactions, and claim settlements, and reduces the negative impacts on risk mitigation incentives. However, parametric-based insurance leaves the risk to some extent with the insured. Loss-based insurance means the insured will be compensated according to the loss suffered, while parametric or index-based insurance implies that there is no fully predictable relationship between the actual loss suffered and the compensation received.

The difference between a parametric and loss-based risk transfer varies from case to case. Cummins, Lalonde and Phillips (2004) have tested the degree to which a catastrophic-loss index to be used for hurricane risks in California would cover the insured's basis risks. They found that a state-wide index would effectively cover basis risks for the majority of assets (i.e. of asset owners comprising the two quartiles of the population possessing the largest asset portfolios). Most insureds in the quartile possessing the smallest asset portfolios would, however, still encounter significant risk. This result implies that parametric risk transfer covering windstorm-related risks might provide satisfactory risk transfer for the majority of insureds. A significant share of asset owners may, how-

ever, need complementary loss-based risk transfer in order to fill the gap between loss-based and index-based risk transfer.

A study by Doherty and Richter (2002) investigates the potential for combining index-linked and loss-based insurance. The sole use of the former will, as already mentioned, leaves an uncovered gap of basis risks for a significant group of insureds. Rational agents will, according to the authors, prefer to combine the two instruments to take advantage of the attractive features of the index-linked coverage and, at the same time, the ability of loss-based insurance to match risks more exactly.

The authors stress the importance of transaction costs associated with loss-based risk transfer. These specific costs arise to counter behavioral problems like moral hazard and adverse selection. The loss-based and index-based instruments are different from the perspective of both insurers and insureds. In particular, the two raise different needs for monitoring risk management practices; they have different risk profiles, require distinct types of retail distribution and claim settlement systems, and so on. The associated transaction and administrative costs are clearly lower for parametric risk transfer.

Parametric and loss-based risk transfer may thus be regarded as complementary. Doherty and Richter (2002) postulate that rational asset owners will always apply indexed instruments to some extent when there is a positive correlation between the index and the actual loss. So-called “gap insurance” may be used as complementary loss-based insurance to transfer remaining risk.

Evidence suggests that temporary shortages of capacity experienced in reinsurance markets have been a major reason for the need to remove obstacles to growth in the market for risk related securities, such as cat bonds (Ozimir, 2002). According to Doherty and Richter (2002), the need for more efficient means of risk transfer is the main reason for the spread of risk-linked-securities. Today, cat bonds are predominantly parametric or index-based. The authors expect that tailored financial instruments for gap insurance will develop as markets for risk-linked securities develop further.

Table 4 reviews the relative value of the three main types of instruments; pure risk financing, parametric-/index-based and loss-based risk transfer. The table delineates the extra costs and subsequent benefits associated with each instrument.

It follows from the arguments listed in table 4 that the attractiveness of different instruments will vary with market segments due to the distinct risk and cost characteristics of individual instruments. Table 5 presents a simplified evaluation of alternative risk financing mechanisms. The relative attractiveness of alternative instruments is seen as a function of two factors: (i) the quality of distribution networks for risk transfer arrangements, including claim settlements, and (ii) the relative importance of systemic versus non-systemic risks. Pure risk finance, loss-based risk transfer and parametric risk transfer are considered in each segment.

Table 4. Costs and Benefits of Various Categories of Risk Financing

Position	Extra costs	Extra benefits	Net benefit
1. Pure risk financing	Pre-disaster: The costs of postponed consumption net of interest. Post-disaster: debt servicing costs	More robust consumption and investment levels Reduced indirect loss due to discontinuity and uncertainty regarding reconstruction	Always positive longer term effects provided that there is risk aversion and risk assessments are correct.
2. Parametric risk transfer	Risk premiums Transaction costs for establishing and managing the parametric instrument	Reduced basis risk to the extent that parametric values correlate with actual losses.	Positive if low transaction costs and efficient pricing of risk, and significant positive correlation between index and losses. Net value depends on risk premiums, risk preferences and transaction costs.
3. Loss-based risk transfer	Risk premiums Extra transaction costs to document loss potential, to monitor risk management and settle claims.	Basis risk transferred to the underwriter	Positive if low transaction costs and efficient pricing of risk. Potentially positive as a supplement to parametric risk transfer.

Source: ECON Analysis

**Table 5. Alternative Financial Instruments to Improve Risk Management:
A Simplified Approach to the Valuation of Alternative Instruments**

Quality of distribution networks

	<i>Low</i>	<i>Medium/varying</i>	<i>High</i>
High systematic risk	Parametric risk transfer	Parametric risk transfer with supplementary gap insurance designed for selected segments	Primarily parametric, loss-based gap insurance used for selected segments
Combination of systemic and non-systemic risks	Parametric risk transfer combined with pure risk finance	Parametric risk transfer with supplementary pure risk financing or loss-based transfer dependent of segment	Parametric risk transfer with general supplementary gap insurance
Non-systemic risk (low correlation)	Mainly pure risk finance. Loss-based risk transfer might serve major institutions like governments and banks. Some parametric risk transfer if critical mass is achievable.	Pure risk financing combined with loss-based transfer dependent of segment. Some parametric risk transfer if critical mass is achievable	Loss-based insurance. Some parametric risk transfer if critical mass is achievable

Source: ECON Analysis

The table describes the relative attractiveness of alternative instruments as a function of the share of systemic risk, which, in turn, is defined as the correlation between objective parameters and actual losses, and distribution network characteristics. The distribution network is defined as the set of interrelated agents and systems that facilitate risk finance contracting, and the associated exchange of information, documentation and payments of premiums, commissions and claim settlements. The relevance of pure risk financing is highest when both the quality of distribution networks and share of systemic risk are low. The reason is that low quality of distribution networks (ineffective claim settlement procedures, low capacity to enforce contract fulfillment and lack of standards for insurance contract formulation), implies high, and often unpredictable, transaction costs for risk transfer arrangements. Even parametric risk transfer would have to rely on the distribution network to establish the necessary contractual and payment transfer framework. High shares of systemic risk would call for parametric risk transfer. The use of loss-based insurance seems highly unattractive in an environment of ineffective distribution networks due to the resulting high transaction costs.

Criteria for Determining Risk Finance Schemes

Various criteria will determine the net benefits of implementing an assortment of risk financing instruments.

The scale of the expected loss relative to current income levels will influence the need to finance risk ex ante. Reduced levels of consumption and investment in case of a disaster mean extra loss to asset owners and consumers. As argued above, the magnitude of indirect losses depends on the ability to finance reconstruction and bridge temporary income losses.

A country's tolerance for variation in production and welfare is an important consideration. The impact from sudden variations in economic capacity may depend on consumption levels among social groups and the interdependency of planned investments. Unplanned variation in consumption levels reduces social welfare. The costs of variation may be higher for low-income levels since basic values like life and health may easily be threatened for people with current incomes close to subsistence levels. It is also reasonable to assume that the indirect costs of an incident will be higher for low-income countries with fragile institutions and infrastructure than for more advanced

economies. If planned investments are interdependent, unplanned variations in investment capacity may severely hurt returns on investments already undertaken. Previous financing on uncompleted projects is wasted if investments are discontinued due to a disaster.

The relationship between natural hazard risk and parametric risk will determine the effectiveness of parametric risk transfer. Parametric risk transfer will, as explained above, suffice to transfer the main share of the underlying risk when there is a high correlation. If, for instance, the losses from El Niño for a farmer's captive pool in Peru are strongly correlated with objective characteristics like changes in water temperatures, wind scale and so on, then parametric insurance will provide a good and cost-effective substitute for loss-based insurance. In the opposite situation, a parametric risk transfer will not be useful.

The time horizon and geographic scope of the risk financing arrangement may be important to enable the full exploitation of parametric risk transfer. The correlation between parametric characteristics and actual losses may increase with the geographic scope and time horizon. The expected gap between actual loss and expected loss, as a function of the parametric index, will normally diminish when the number of cases increases. Parametric insurance is

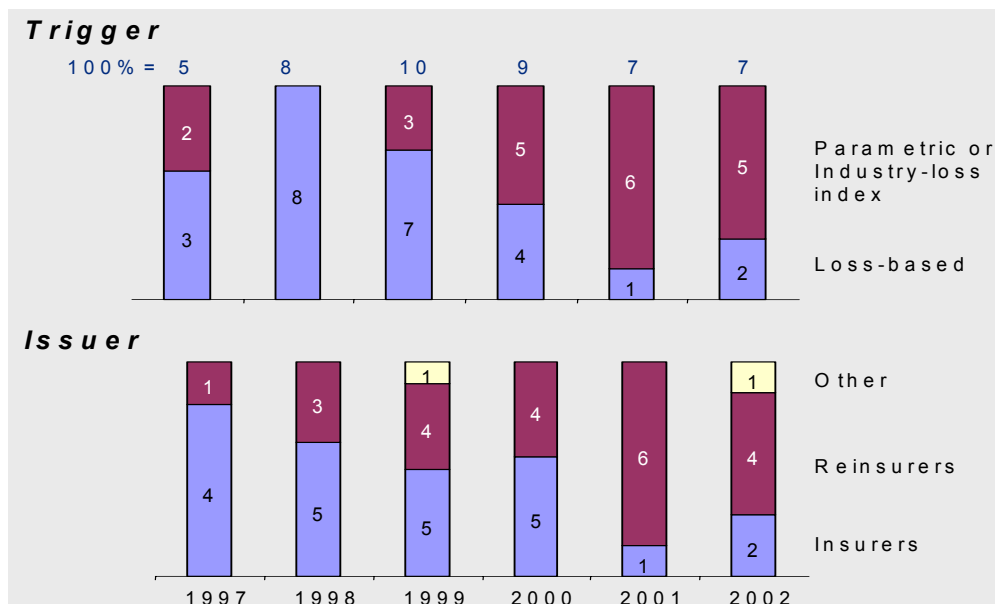
therefore primarily relevant for reinsurers or pool arrangements that cover a range of individual insurance contracts and a broad geographic scope.

Individual asset owners will primarily combine pure risk financing and loss-based insurance. For governments, large companies holding broad asset portfolios, or pools and underwriting agents, the most efficient way to finance risks may involve a combination of pure risk finance, like contingent capital arrangements, parametric insurance, and gap insurance in the form of a loss-based insurance contract.

Figure 3 shows the distribution of cat bond issues since 1997. There are two clear tendencies. Firstly, cat bond issues have moved toward a strong dominance of parametric over loss-based claim settlements. Secondly, reinsurers dominate over insurers as issuing agents. Both characteristics emerge substantially over the five-year span.

According to Marsh & McLennan (2003), cat bonds are typically targeted toward layers of risk with high estimated annual losses but very low probabilities, typically less than 1 percent per annum. Cat bonds are receiving increasing support from international investors. Investment companies are forming targeted investment funds to channel investments into the risk-linked securities

Figure 3. Characteristics of Cat Bond Issues by Trigger and Issuer. 1997 – 2002. Number of Issues



Source: Marsh and McLennan Securities, 2003

markets. Returns from investments such as cat bonds have thus far been attractive and no cat bond has been hit by catastrophic losses. Marsh & McLennan (2003) explain the reason for the growing predominance of index-based settlements by

the relative characteristics of the two. Their rather detailed review of the advantages and disadvantages of loss-based risk transfer and industry-loss index and parametric-based risk transfer is summarized in Table 6.

Table 6. Overview of Triggers – Advantages and Disadvantages for Issuers and Investors

Trigger	Advantages	Disadvantages
Loss-based	<ul style="list-style-type: none"> –No basis risk for issuer– reflects ceding exact loss –(Investors have no preference for indemnity based compared to index or parametric) 	<ul style="list-style-type: none"> –Detailed risk analysis by modeling firms needed –Longer ratings process with high scrutiny –Disclosure for portfolio details to competitors –Possibly less liquidity –Adjustment to provide for growth of ceding company’s portfolio –Longer loss recovery period adds uncertainty and extra costs for issuers and investors –Severe moral hazard issues
Industry-loss index	<ul style="list-style-type: none"> –Simpler process to execute than loss based coverage –Possible cost advantages due to greater investor interest –Shorter rating process –No need for ceding entity to disclose confidential information –Shorter payout period reduces uncertainty and costs to issuer and investor –No moral hazard –More liquid securities 	<ul style="list-style-type: none"> –Basis risk retained for issuer –Requirement that “modeled-loss” approach be used if industry loss estimates are not available –Possible adjustment needed to provide for industry’s portfolio growth –Reliance on a black-box approach for modeled loss
Parametric index	<ul style="list-style-type: none"> –Simple process to execute –Possible cost advantages due to greater investor interest –Short rating process –No need for ceding entity to disclose confidential information –Same advantages for investors as industry-loss index based 	<ul style="list-style-type: none"> –Probably more basis risk retained for issuer

Source: Marsh and McLennan (2003), ECON

Practical Steps Toward Improved Financing of Natural Hazard Risks

The first two chapters of this paper presented the financial aspects of natural hazard risk management and specific tools of risk financing and transfer. Based on the alternative concepts of risk finance and observations from three selected Latin American countries, a synthesis of practical steps to improve natural hazard risk financing is suggested below. The main challenge described is to manage risk financing as an integrated part of overall risk management, implying that institutional aspects deserve particular attention.

Practical guidelines for improved risk financing are presented in three steps setting the goal, developing institutions, and financing.

Setting the Goals

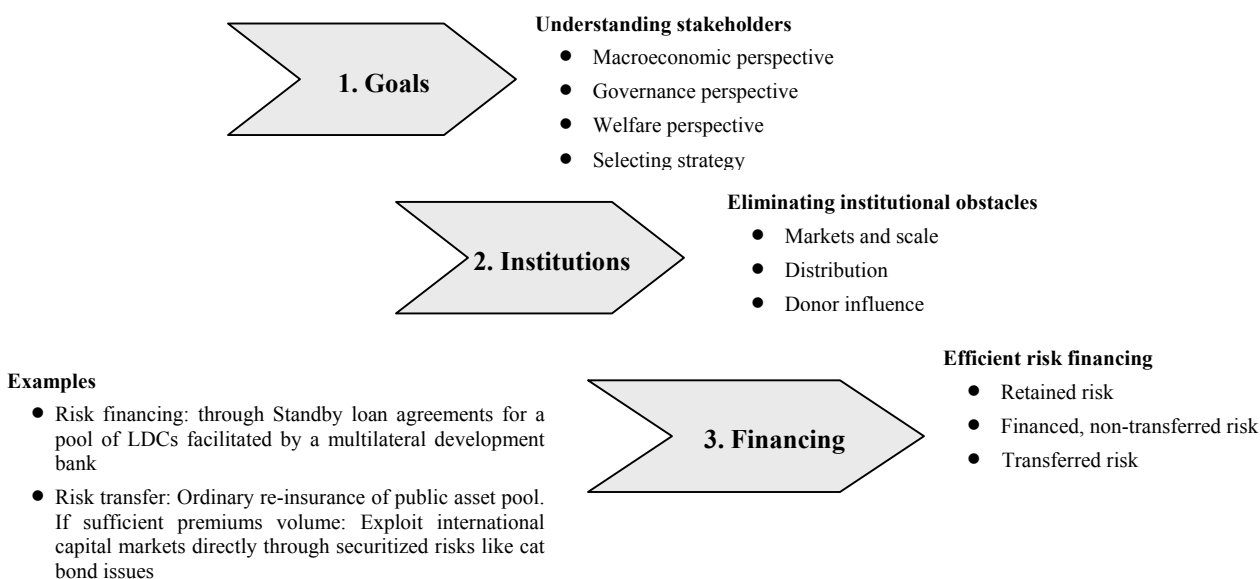
The first challenge is to establish a goal to institute an integrated risk management system at the national level. The initiative will include a comprehensive strategy for national risk financing (figure 4).

Rational risk financing for individual asset owners and public authorities generally implies that risks are treated in a stratified way. A significant share of the risk will be retained. Another share of the risk can be financed via pure risk finance and/or through other risk transfers (a combination of parametric and loss-based risk transfer). Rational risk financing must be based on a relevant set of risk preferences, that is, relative values of alternative risk profiles. This chapter starts with the definition of stakeholders, whose preferences should guide the development of risk financing. Then four perspectives on the risk management and finance goal are described before alternative coherent strategies are defined.

Understanding Stakeholders and their Interests

The rationale for moving from ex post to ex ante risk financing depends on the value it provides to individual stakeholders. Stakeholders may comprise a variety of interest groups such as central and local governments, private companies and

Figure 4. Steps toward improved risk financing



Source: ECON Analysis

households, providers of financial services and donor countries. The various stakeholder groups are described in the sections that follow. The interests of donor countries are given particular attention.

Stakeholders are individuals and institutions likely to benefit or suffer losses from a shift in natural hazard risk financing. The groups that are likely to gain or lose directly are either involved as asset owners, consumers of services and goods with vulnerable supplies, or as providers of services that will be affected by the shift in risk financing.

Governments are important disaster finance clients due to the many assets they hold. However, several countries have problems valuing the public sector asset inventory. Later in this chapter we will discuss the extent to which private assets should be subject to public risk financing.

The second group essentially includes a country's entire population. No inhabitants are completely independent of public services. However, there may be a question of prioritization among groups as some groups are more reliant on public services than others.

The third group consists of a set of service providers. In the case of Chile, El Salvador and Peru, financial institutions are important stakeholders. Private insurance companies are also an important stakeholder group. For example, there is a concern that the implementation of publicly organized risk finance may undermine the penetration and market share of private insurance companies. Conversely, a public pool may stimulate the demand side of the insurance market. If the pool is to transfer risks directly into the reinsurance market, the pool in itself represents extra state-supported competition for national insurance companies and a huge buying block for the reinsurers.

The manner in which premiums or annual savings are financed may also imply negative impacts for some stakeholders. Financing these systems via tax bills or fiscal budgets necessarily implies reallocating resources from private consumption or other forms of current public spending.

Two main arguments are used to undermine the case for ex ante risk financing. Firstly, there is the normal strain on public finance implying that risk financing has to compete with other forms of public spending. Secondly, improved financing of prevention and mitigation may result in reduced motivation among international private and public donors to provide emergency transfer of financial resources after an incident. Ex ante financing itself reduces the visible loss and suffering which could decrease the motivation to donate money. The substitution of ex post financing may therefore mean that the nation leaves significant potential sources of external emergency and reconstruction finance untapped. In the case of El Salvador, donations form a significant source of funds. Ex ante international donations to fund insurance premiums or the payment of interest on disaster loans or cat bonds are unlikely. It may be difficult to convince potential international donors of the benefits of ex ante financing compared to ex post emergency funding.

Involving Donor Countries

Donor countries usually respond to requests for emergency aid in the wake of a disaster. However, it has often been difficult to motivate donors to contribute to building long-term disaster risk management programs as an alternative or supplement to relieving victims of a natural hazard from their acute and highly visible suffering.

Donor countries' actions can have an impact on the risk financing behavior of developing countries in several important ways. Donors and relief organizations often act as de facto underwriters and international donations of relief money tend to substitute for ordinary risk finance and transfer. This substitution may be socially ineffective as emergency funds generally do not contribute to long-term development. It is likely that ex post transfers in place of long-term assistance to ex ante financing actually causes substantial losses in the long term. Ex ante financing requires integrated planning of physical and financial emergency management, while ex post financing requires expensive ad hoc organization. Furthermore, emergency assistance is often provided as tied and in-kind aid, which may not respond effectively to the real needs of the receiving country.

The challenge of implementing ex ante financing of natural hazard risks is therefore, to a significant extent, related to motivating donor countries to favor long-term capacity build-up for effective risk and crises management rather than ex post relief. Since the interest for support after an emergency may be quite significant, it should be possible to reallocate resources into long-term programs.

A shift from ex post to ex ante financing may provide a double dividend as the total loss is reduced due to a more predictable supply of funds and enhanced incentive to develop the institutional capacity that will secure long-term economic growth. Donor countries can contribute by offering long-term disaster risk management financing as a component of regular development programs in high risk areas or sectors. Such risk financing may be stimulated by conditioning certain development programs on preventative risk financing in high risk areas. In such instances, differentiated credit terms may be in order.

Donor and Recipient Country Responsibilities

The need to finance natural hazard risk management is obvious. Underfinancing enhances potential losses. Several explanations could be offered as to why developing countries seem to pay limited attention to risk financing, even where risks are obvious and acute.

The countries of Latin America and the Caribbean are only in the initial stages of incorporating disaster risk management into their development agendas. The populations are more likely to seek government support for urgent poverty and short-term development needs rather than shifting resources to prevent potential events that may arise only every 50 years.

Incentives provide one explanation for current risk management behavior. Donor country behavior reduces the reward and incentive for responsible risk financing. The propensity to spend resources on risk finance will vary with the availability of alternative mechanisms to reduce risk exposure. Kelly and Kleffner (2003) have summarized findings on the behavior in markets for risk management services. The penetration of risk transfer varies in response to behavior within the insurance

industry, the availability of mitigating options, and the propensity of the authorities to intervene with assistance in post disaster situations. A more interventionist government tends to lower the rate of insurance and private mitigation.

Among less developed countries it is common to have a substantial and loyal emigrant population, and this community often provides an important source of ex post emergency transfers. The amount of such transfers naturally depends on the visible seriousness of the losses. Remittance funds are seldom assigned for prevention and longer-term emergency funding discourages proper risk management. The lack of incorporation of disaster risk management in the culture impedes the development of necessary institutions and structure for long-term risk management.

Ultimately, the responsibility to establish the commitment to developing an effective risk management system lies with the recipient country. Donor countries will subsequently be in a position to support these efforts. Multilateral lending institutions can encourage progress in this area by incorporating the risk management goals of each country into their development agenda and conditioning assistance on achievement of such goals. Again, establishment of the necessary institutional capacity within the countries will be essential to garnering support from donor countries.

Macroeconomic Perspective

Improving the motivation for socially effective natural hazard risk management and finance is a real and important challenge in Latin America and the Caribbean. If the motivation is there, the ensuing steps to improving risk financing are rather practical and easily implemented technical applications. Defining the goal is a natural starting point when there is an interest among stakeholders to improve the state of risk financing.

Defining the goal involves the consideration of two aspects of economic policy formation: macroeconomics and governance. *The macroeconomic perspective* refers to the issue of acceptable variations in welfare due to natural hazards. *The governance perspective* relates to loss prevention through the valuation of reduced damages and to a

welfare approach that defines the role of public sector versus decentralized market-based decision-making.

National economic development planners must define the acceptable levels of variation in welfare based on underlying risks. Risk with low probability but high potential cost is often left without specific coverage since it may be impractical to finance (Miller and Keipi 2005). If it is not cost-effective to finance residual risk, a rational solution would be to develop the necessary macroeconomic flexibility in order to avoid negative long-term effects.

The valuation of alternative levels of macroeconomic volatility should be based on assessments of the willingness to pay for stable economic environments. Unless a study of preferences for stability and willingness to pay to avoid volatility is made, there is little reason to draw a specific conclusion regarding what should be the appropriate goal for economic robustness and risk financing. In addition to the preference for stable macroeconomic conditions, the need for resources to prevent future losses from natural hazard events will also determine the need for finance.

Governance Perspective

Risk financing provides resources for both the reconstruction of damaged or lost assets and the restoration of production capacity. Preventing further indirect losses from deteriorated productivity and uncertainty creates social value, whereas loss compensation mainly redistributes welfare.

The stability of disposable income will never be the full responsibility of the public sector. There is no reason for the public sector to substitute private risk finance and to protect all private property from natural hazard risks. Instead, the task is to ensure that private demand and supply reflect social values and to provide complementary services where private markets are insufficient. The studies of the three Latin American cases in this paper illustrate the importance of national risk financing for minimum standards of housing and consumption for the poor, continuity in the provision of public services, and ensuring efficiency in financial markets.

Natural hazards may endanger fundamental life standards, especially for the poor. Social security is considered a public good in democratic nations. Supporting minimum sustainable standards of living for the poor is a public priority. For the middle- and high-income population there is little reason to consider the security of future income a public good if there are effective markets for insurance services. However, the provision of effective markets for risk finance and transfer is a natural priority for public authorities.

Ensuring the continuous operation of public services is itself a public good. This means that central and local governments need to finance their risks with the prospect of safeguarding continuity and certainty regarding operations and reconstruction of public services. This should include measures to restore employment and income for the necessary well-being of the affected population.

The existence of efficient markets for risk finance and transfer is also a public good and therefore within the scope of the social perspective of natural hazard risk management. The required efficiency will depend on the availability of financial services in a competitive price environment. Specific policies may include competition guidelines, surveillance bodies and measures to stimulate the demand for risk financing.

Having established a maximum acceptable variation in disposable income and the expected loss potential, the role of the public sector in risk management and finance, the gap between acceptable retained risks and potential loss may be quantified. The next steps in the implementation process are steps to fill this gap as described previously in figure 4.

Alternative mechanisms for financing risks and the appropriate trade-off between risk mitigation and finance have to be analyzed before specific goals are formulated. Therefore, the commitment at the outset of the process must be stated in terms of a rather general goal to reduce loss potentials through a mixture of mitigation, pure risk finance and risk transfer.

Provided that the goals have been agreed upon and resources are made available, the next step is to formulate a strategy.

Selecting a Strategy

A viable strategy is needed to link goals and specific institutional and organizational solutions in a logical and realistic way. This section illustrates potential strategic options that seem relevant for the countries studied.

Figure 5 portrays four potential strategies that seem relevant for Latin American countries like Chile, El Salvador and Peru. Two dimensions are used to identify the strategies; one is related to the issue of pooling risks (vertical axis) and the other to the downstream relation, that is, how end customers relate to risk financing institutions (horizontal axis).

The two strategic dimensions shown in the chart are central characteristics of the supply chain for risk finance services. The issue of pooling illustrates how risk (timing risk, underwriting risk, etc.) is transferred to financial institutions. The two alternatives highlighted here are via a captive pool or without pooling. The downstream relation reflects how financial services may be distributed to end customers. The first alternative is direct distribution via branch offices, agents that are controlled or commissioned by the financial institutions or the clients. Distribution networks for direct distribution are normal in mature markets. It

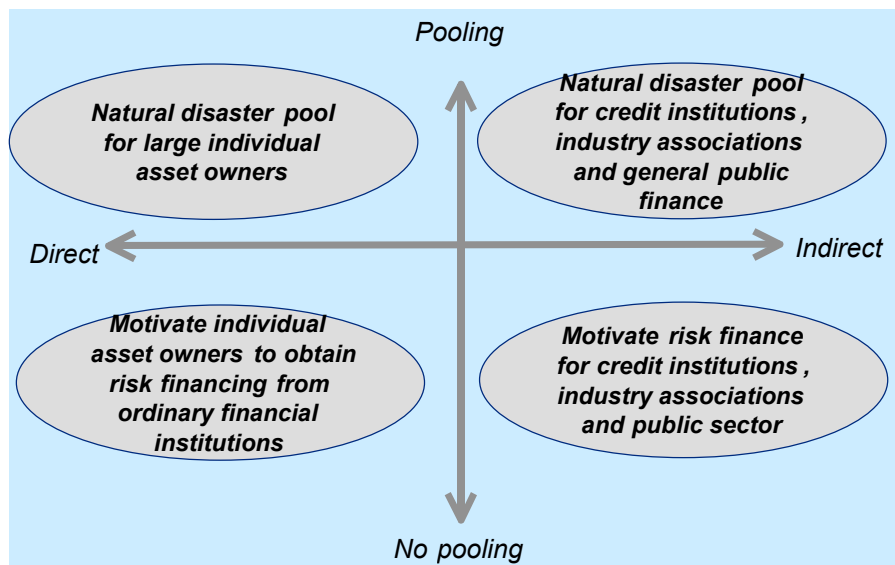
is, however, also possible to distribute risk finance indirectly via, for example, state social support systems, national natural hazard risk pools or credit insurance for ordinary banks.

Pooling: Risk finance may be organized through a captive pool or directly without a pool. Pooling provides three main benefits. First, a higher volume of premiums may be placed in the market under one single contract. Second, pooling reduces the risk carried by individual pool members since the relative standard deviation is diminished when the number of assets is increased. Third, the pool is an institution that may also be organized to take extended responsibility for risk management incentive regulation, information and distribution of services, and claim settlements.

Downstream Relation and Distribution Networks: The downstream relation links individual asset owners to the risk financing or insurance level. Effective downstream relations through modern distribution networks are costly and difficult to establish. Where, as in Peru, mortgage financing is rare, there is normally limited reliable information on property values and physical standards of real estate. The indirect approach to risk finance may be the only feasible solution when distribution networks for financial services are weak. However, indirect solutions will only cover the risks of individual asset owners to a limited extent.

Four alternative strategies are suggested based on this particular selection of risk finance strategic

Figure 5. Four Strategic Options for Financial Protection



dimensions: (i) pooled, indirect (upper, right corner of figure 5), (ii) pooled, direct (upper, left corner), (iii) non-pooled, direct (lower, left), and (iv) non-pooled, indirect (lower, right). The pooled, indirect strategy involves establishing a captive pool, including the central government, industry associations and individual credit institutions as members. End customers, including schools, hospitals, private enterprises and homeowners, would be covered indirectly through a cushion on the real balance sheets of public authorities, credit institutions, and other such organizations.

Indirect provision of risk finance, through credit insurance of mortgage banks, for example, has the potential to reduce interests since the risks for credit institutions related to natural hazards are financed more effectively than before. Public service providers will see a de facto reduction in risks since the state will have funds to compensate losses after a disaster. A substantial share of asset values will, however, remain uncovered since debt financing will be the only way to achieve risk finance or transfer if these services are provided in combination with ordinary loans. Some uncertainty for public service providers will also remain if the distribution of extraordinary public budget allocation is unpredictable.

Pooled, direct risk financing strategies involve individual asset owners, such as large industrial enterprises, municipalities, hospitals, universities and infrastructure companies, as pool members. The pool will normally be wholesale oriented, that is, it would not be oriented toward the retail market of private individuals. Private individuals will be limited to indirect coverage via their relationship with ordinary credit institutions, public services and social security systems.

Non-pooled, direct risk financing provides services via ordinary financial markets directly to asset owners. To achieve risk financing there may be a need to improve the penetration of risk transfer among asset owners due to market imperfections. As noted above, mandatory risk finance or insurance as well as subsidies, tax exemptions, and other such measures may be appropriate to reinforce private incentives. Chile has implemented policies to combine natural hazard insurance with private housing finance.

Non-pooled, indirect risk financing represents a situation where pooling is inappropriate or unrealistic and the capacity for distributing risk financing to end customers is underdeveloped. Policies aiming to improve risk financing are, in this case, directed toward institutions that provide financial services to end customers (e.g., mortgage banks, ordinary and life insurance, health insurance and the government itself). Incentives and regulations may be used to stimulate the financing and transfer of natural hazard risks for these institutions. The studies undertaken by multilateral development banks have paid particular attention to risk financing for state budgets.

Operational goals and institutional solutions need to be based on a clear strategy. Different economic characteristics will determine the choice of strategy, the necessary institutional development and the selection of specific risk financing instruments. The three countries studied vary according to distribution systems, status of insurance and financial markets, and the potential for pool organization. The two strategic dimensions forming the four strategies are also relevant as a basis for strategy formulation in the three countries.

Imperfect Markets for Risk Management

Risk management and finance are subject to normal supply and demand dynamics. There are several reasons why market conduct may require public regulation. Some of the reasons relate to insufficient distribution systems and inadequate dissemination of information. The confidence needed to attract financing is achieved through the interaction of asset owners, intermediaries and financing institutions on several levels over time.

The importance of both market imperfections and the distribution network is described below with reference to the basic properties of markets for risk management services.

Most countries pursue policies of extensive regulation of risk management and finance. Risk financing of natural hazard risks is a particular area for governmental intervention in the economies of Western Europe and North America. The main arguments for regulation (for example, through mandatory insurance, public guarantee funds, etc.)

focus on the demand side. The reasons for government intervention in risk management markets include the undervaluation of risks, imperfect or asymmetric information, and undervalued effects of risk management.

Undervaluation of Risks: Risks may be undervalued for a range of reasons, including the financial situation of the asset owners and unclear property rights. Poor people are primarily concerned with near-term needs. The government can be seen to carry the risk exposure of the poorest part of the population. When coffee growers in El Salvador give low priority to natural hazard risk financing, they take only private risks into consideration. Their valuation may thus not reflect the preferences of the workers, the financing institutions supporting the coffee growers and the need for stable economic development. Unclear property rights may generally contribute to insufficient motivation for risk financing and mitigation.

Imperfect or Asymmetric Information: Adverse selection and moral hazard tend to arise from imperfect or asymmetric information. Distribution networks should include comprehensive control mechanisms to fix and differentiate premiums, monitor conduct and facilitate claims settlement. The penetration of insurance and other risk transfer instruments will be limited if the monitoring of risk management is particularly complicated. Only national natural hazard risk pools (e.g., the Norwegian pool) can afford to dismiss adverse selection and moral hazard as insignificant or politically unimportant compared to the value of universal and evenly distributed social security.

Undervalued Effects of Risk Management: The undervaluation of the effects of risk management tends to result in lower investment in risk mitigation than socially desirable. Private mitigation may benefit additional agents. One example is deforestation and soil erosion. While forestation may reduce flooding and landslide risks along the lower reaches of local rivers, the moving of soils may destabilize land surfaces over surrounding areas. Increasing insurance volumes may cause positive spillover effects by attracting additional insurance services into the market. Public policies may contribute to the undervaluation of risk mitigation. Responsibility for public risk mitigation is to a

large extent decentralized in Norway, thereby risking undervaluation of positive and negative spillover effects between neighboring municipalities (ECON, 2001).

Both complex distribution channels for risk management services and market regulations are needed to overcome some market imperfections. The distribution channels associated with the introduction and application of risk finance and transfer are discussed below.

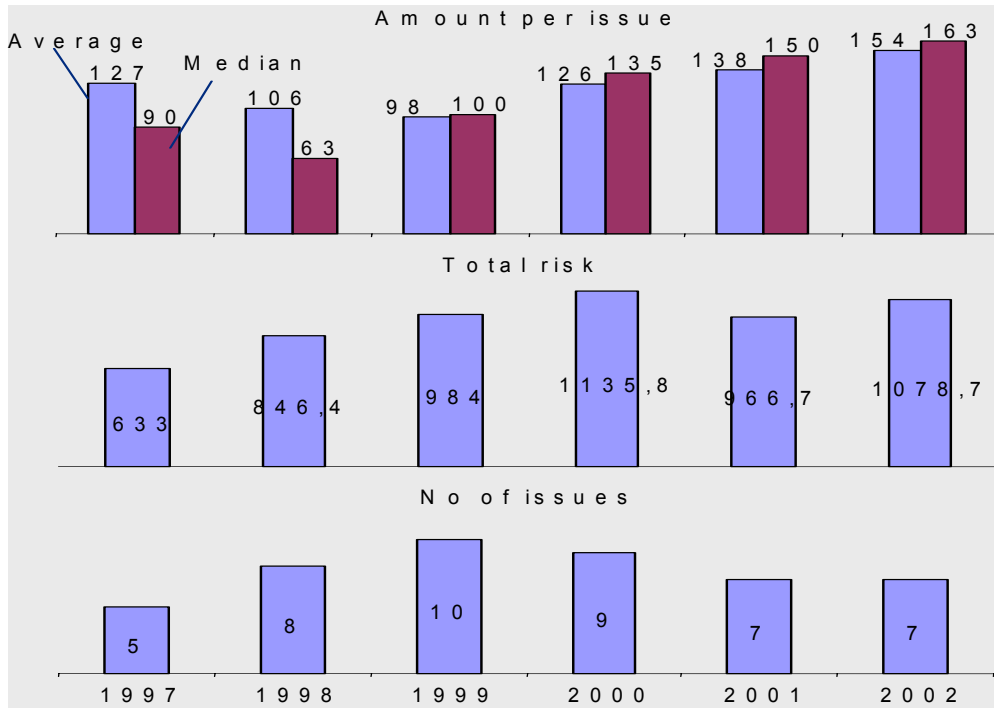
Lack of Scale

Small markets limit the scope for scale of sensitive services and effective competition among suppliers. Economies of scale arise from factors such as efficient distribution networks and lower transaction costs associated with the introduction of new financial products

The optimal institutional solution should consider the appropriate scale of operations to help diversify risks, provide purchasing power in international markets, and provide adequate risk descriptions and analysis. If pooling of risks is recommended, a larger scale will allow for greater portfolio diversification, thus lowering the risks for individual members and enabling the country to hold a higher share of retained risks, provided that incentives and monitoring mechanisms prohibit moral hazard and adverse selection. Furthermore, the three countries considered in this paper may be able to establish a sufficient premium base on their own to approach international markets if they are able to build portfolios that include a significant share of assets. Finally, improved risk descriptions may help to lower risk premiums as pricing of risk in financial markets is sensitive to the quality of risk statistics and vulnerability estimates.

Figure 6 shows the average value per issue of cat bonds. In 2002, the average value was above US\$150 million and the median was more than US\$160 million. The difference between the average and the median indicates that there may still be a significant number of smaller issues. One small issue during 2002 was a placement of US\$33 million in cat bonds for the British retail insurer Hiscox Group, which was carried out by Aon. Today, there may be reason to establish a

Figure 6. Cat Bonds: Number of Issues, Total and Average Risk Per Issue. 1997-2002.
Number and US\$ Million



Source: Marsh and McLennan Securities, 2003

US\$1 billion threshold for the installation of a new cat bond issue related to natural hazards in Latin America to provide a basis for substantial investments in risk modeling, institutional developments and transaction costs.

Provided that public authorities involve themselves in the provision of risk finance and transfer, scale requirements should not be a major obstacle for Latin American countries. The potential losses from natural hazards in the three countries studied may amount to five to seven percent of GDP when incidents of a frequency of 1 every 100 years are taken into account. In comparison, transferring risk of US\$200 million (i.e. slightly above the current average) would cover 1.5, 0.45 and 0.1 percent of GNP in El Salvador, Chile and Peru respectively (figure 7). Provided that cat bonds would only be used for a margin of total loss potential, it may be difficult to issue cat bonds to the amounts of US\$1 billion for one single country.

Both the private and public sector demand for risk financing and transfer is limited. The subsequent country studies show all three lack sufficient risk

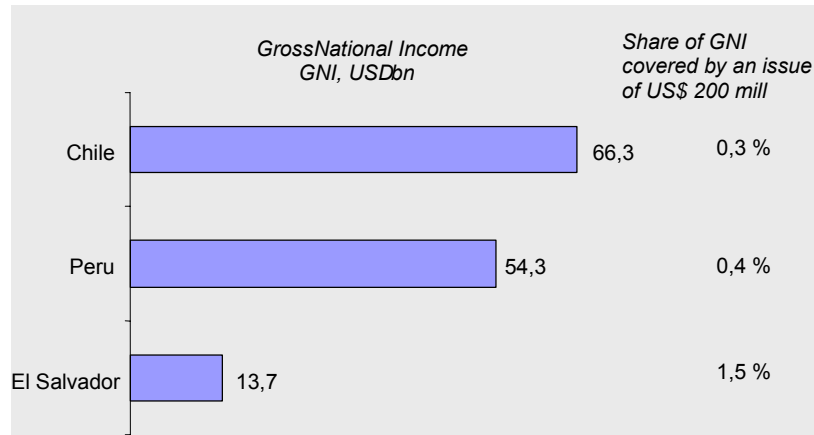
financing for public sector assets and private housing. Industrial assets are to a larger extent covered, often due to international ownership. There is, therefore, a need to coordinate individual agents and sectors in order to generate sufficient demand for the establishment of new insurance products.

Inadequate Distribution Networks

Developing distribution networks is essential for risk financing and transfer. The distribution network is the system of agents, claim adjusters, surveillance authorities and channels for money transfers that connect asset owners and risk financiers and investors.

Characteristics of the distribution networks associated with risk finance resemble those of other prominent networks (e.g., telecom networks). Extra subscribers add value for those already within the network. One subscriber may, due to certain behavioral characteristics, add more value to some networked agents than another. For similar reasons, networks for distribution of risk financing

Figure 7. Gross National Income Related to the Size of a Rational Cat Bond Issue. 2002



Source: IMF, ECON Analysis

services may not be effective unless there is a certain volume of contracting, premiums and claim settlements taking place. In addition, the agents making use of and providing networked facilities must have characteristics that make the network more attractive. In the case of insurance, all asset owners having high standards of risk management will tend to lose out if the network is open to asset owners that exploit opportunities to transfer extra risk without premium increases.

Financial markets in some Latin American countries may be immature and the distribution systems for primary insurance may be insufficient to allow for widespread use of financial instruments. Beyond the local availability of agencies and brokers dealing with risk financing and transfer mechanisms, facilities connecting the potentially insured and insurers are critical for the application of financial mechanisms. These facilities (insurance agents, asset and loss valuers, claim settlement procedures, etc.) comprise the distribution network considered here.

The distribution network may determine both the volume of insurance premiums available and the reliability of information on risks and vulnerability. Provided that a distribution system is in place, widespread use of mortgage financing may facilitate quantifying the value of exposed assets. Businesses that provide real estate appraisals may improve the claim settlement process. Each part of the network can increase participation and enhance

efficiency. The requirements of the distribution system may vary according to the financial instruments applied. For instance, with no risk transfer there is no need for comprehensive claim settlement capacities and protection against moral hazard and adverse selection. Compared to risk finance schemes, risk transfer schemes require little need for credit risk assessments.

An insufficient distribution capacity has been found in each of the three country studies, but the deficiency is especially visible in Peru. The most likely solutions in such instances may be to rely on government channels (i.e. ordinary social security programs, industry associations, microfinance institutions, NGOs, donor supported projects, etc.) to develop risk management services. Earlier studies have focused on government networks, either using the government as the hub of the network for distribution and claim settlement or through regulatory reforms to trigger private interest in risk finance.

Extensive claim settlements must be distributed in a post-disaster situation. This process has the potential to create incentives for excessive transactions and corruption. The risk of corruption may be particularly important where governmental authorities are supposed to replace privately organized distribution networks and claim settlement systems. Risk financing with no effective distribution network may therefore be incompatible with socially efficient risk management.

Donors' Influence

All organizations, for profit or nonprofit alike, are shaped by those who fund them (Lowell et al., 2001). Donor countries and development banks have a strong impact on government behavior in recipient and borrowing countries. Although El Salvador and Chile enjoy relatively attractive credit ratings in international capital markets, and the creditworthiness of Peru is strongly improving, the three countries also receive substantial credits via multilateral development organizations such as the IDB and the World Bank. All three will also most certainly depend on international emergency transfers in the case of severe natural hazards.

Donor behavior is considered a major driving force in institutional development. The way supporters shape institutions and organizations is described in both the literature on economic development and the analyses of nonprofit organizations. In a study of these organizations in the United States, Lowell, et al. (2001) concluded that:

- Most donors give money earmarked for specific programs and projects rather than for long-term investments in the organization. Tied assistance is also normal for relief and development assistance.
- Donors' time horizons are short, implying that NGOs and other nonprofit organizations are forced to focus continuously on near-term fundraising.
- Lack of substantive performance measures providing reliable and relevant information on the real value of transfers tends to cement donors' inclination to be short-term project oriented.

The World Bank's 2002 *World Development Report* identifies similar mechanisms on the macro scale. Recommendations suggest that donors should strengthen the relations between public institutions in the recipient countries. This means, inter alia, that donors should integrate their support into ordinary national budgets and service delivery systems of recipient countries rather than employ project specific distribution networks. Donor behavior has historically contributed incen-

tive-driven recipient institutions and organizations that operate at insufficient scale and capacity. Furthermore, specific field projects with tailored aid channeling are prioritized over less visible and longer-term organizational capacity building.

The priorities of donors will normally be reflected in recipient country priorities due to the incentive system in operation. Pre-hazard financing requires institutional development to enable fiscal policies that make risk financing a part of ordinary budgeting in the recipient country. It is arguably easier to motivate governments to finance emergency relief in post-disaster situations, but long-term effects are far less attractive.

The result, as observed by Lowell, et al. (2001), is that the receiver of donations pays too much attention to short-term finance. According to the World Bank, the compacts between policymakers, service providers and the population are bypassed and weakened by typical donor behavior.

Inappropriate donor behavior may increase the loss potential of developing countries. The lack of longer-term financing to prepare for emergency situations exacerbates the difficulties of developing economies to develop their institutional capacities. On the other hand, spontaneous organizing will certainly take place when money and in-kind transfers enter the economy in the aftermath of an incident. Such ad hoc organizing may, however, tend to increase corruption and provide more porous transfer systems for emergency relief than the preferred stable and long-term oriented transfer systems.

Elements of Institutional Development

The practical tasks associated with institutional development are well documented. Operational objectives need to be formulated in accordance with the chosen strategy. However, objectives are insufficient without addressing the incentive systems for key stakeholders (e.g., participating agents and governors). The effects of inconsistency between objectives and incentives vary from general ineffectiveness to large-scale corruption.

Organizing institutions also means that certain resources must be provided. Competence and sur-

veillance capacity are among the most important factors in effective risk financing systems. Competence relates to motivational, financial and regulatory elements of the implementation process for improved risk financing. Sufficient surveillance capacity is needed to avoid moral hazard, corruption and fraud in a system where money transactions are numerous, often very large and, at the same time subjectively valued by claim adjusters.

An additional element is the provision of scale in financial operations. For risk transfer schemes (for example, cat bonds) to be viable, a certain minimum loss potential or volume of premiums is required. The pricing of other financial instruments also varies with volume.

Integrating Risk Finance with General Risk Management

Risk financing should be integrated into other aspects of risk management such as national crisis management systems. According to Freeman et al. (2003) the proper integration of financial and physical aspects seems difficult to achieve.

Several aspects of the institutional development are discussed in the literature (including various case studies and normative reports). The Asian Development Bank's *Disaster Manager's Handbook* has a rather detailed description of a hierarchical and centralized national emergency system. The balance between local autonomy and flexibility on the one hand, and the need for central coordination on the other, is one important challenge that needs to be considered.

Another issue that deserves attention is the involvement of private financial institutions. Recommended institutional solutions for national risk and civil emergency management traditionally give little attention to the involvement of the private insurance industry. In addition, there are often weak links between the physical and financial aspects of risk management. This point was clearly made by representatives of the emergency services systems during the Chile case study.

Developing National Capacities

There is no scope for a public authority to develop full risk financing services networks (unless moving toward a centrally planned economy). Rather, the institutional challenge is to make sure that two conditions are met: First that there is sufficient aggregation of demand and management capacity for socially important risk financing; second, that there is sufficient and effective surveillance of conduct among services providers. Decentralized decision-making alone may be expected to produce inefficient scale and market inefficiency due to asymmetric information, imperfect competition, and so on.

When financial markets are poorly developed and risk statistics and modeling capacities are underdeveloped, there is a need to aggregate volumes of risks and premiums to successfully finance national risks in international markets. Where there are inefficient distribution systems, a pool of assets may be needed in order to provide a critical mass. A substantial pool of public assets may also be more likely to enable the financing of important infrastructure like risk research and modeling capacity than individual insurance companies and asset owners.

Aggregation at the national level is also needed in order to achieve critical mass for the use of risk-linked securities (e.g., cat bonds). Substantial transaction costs necessitate scale. Issues of cat bonds may need to be of around US\$1 billion each with duration of one to three years. Limited periods of duration also make transaction costs substantial over time.

Finally, national pool arrangements imply a risk of negative incentives that may cause moral hazard and adverse selection. A pool administration should therefore have the capacity and power to implement incentive schemes and surveillance systems that motivate risk management for the benefit of the total group of pool participants.

Regional Efforts to Improve Risk Management

Several Latin American countries may be able to secure a more efficient scale through international cooperation. Several transnational initiatives were