4. Risk-Sharing and Financing Opportunities Between Economic Sectors in Developing Countries

4.1 Preliminary remarks

In the preceding section, various impacts of disasters have been discussed. Benificial factors in reducing potential economic impacts of disasters include actions to limit exposure at a sectoral level by financial protection through risk sharing between economic sectors and risk spreading through insurance.[95]

There are many ex-ante instruments for financing natural disaster risks and for actively managing catastrophe risk exposure. This section will explain various mechanisms and financial instruments used to ensure the finance of restoration and reconstruction and to spread risks associated with covering these losses. Afterwards, the focus lies on the need for protection against natural catastrophes for ensuring private assets and wealth as well as the role and the ability of both the private and public sector to cope with the impacts of financial disasters.

Costs and benefits of ex-ante risk transfer instruments have to be compared in order to assess their usefulness to developing countries. The specific structure of transfers in financing for disaster risk management determines its costs and benefits.[96] The important factors determining their effectiveness are the criteria chosen for risk transfers at the local, national or international level, the instrument and facility through which transfers are effected, and the conditions attached to the use of transfers.

In the following, in the specific context of the efficiency of financing catastrophe risk, these types of transfers are discussed, along with setting up insurance, calamity funds including public-private funded insurance programs, alternative risk transfer solutions and contingent credit. Furthermore, different methods of sector-specific risk-sharing or horizontal diversification across private and

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95 Cp. BENSON, C.; CLAY, E.: Dominica: Natural Disasters and Economic Development in a Small Island State, The World Bank, Washington D.C. 2001, p. 34.

96 Cp. MECHLER, R.: Natural Disaster Risk …, loc. cit., p. 78ff.

public sectors will be explained; special features of motivation and completion are highlighted.

4.2 Hedging and Financing Instruments of Natural Disaster Risk

4.2.1 Insurance

4.2.1.1 Basic Features

The dominant risk financing instrument used for coping with the effects of natural disasters is risk transfer by insurance or reinsurance. Insurance is an economic institution that allows the transfer of financial risk from an individual to a pooled group of risks.[97] On macroeconomic level, insurance protects countries against a deterioration in their debt position after disaster events and also provides current period incentives for investment in mitigation; the entire payment of damages caused by natural hazards is guaranteed. Despite the fact that public assets are assured, many studies have shown an inefficient purchase of insurance due to low insurance penetration, regulatory requirements or limited knowledge about catastrophic risk.[98]

For low-income countries, the ability to assume catastrophe exposure depends on their economic prosperity. The state itself can generally absorb the lower levels of risk more efficiently using its own resources such as domestic savings, taxes or credit from the financial sector.[99] With regard to this, the average percentage of insured losses in developing countries is relatively low. The share of the use of insurance in these countries is shown in figure 6. The spreading of risk by means of diversification at the government level indicates that insurance should be purchased for the highest but least expensive levels of risk. Higher-level risk can be transferred to insurance or reinsurance institutions. With regard to this, the average percentage of insured losses in developing countries is relatively low. The percentage of insurance coverage is shown in figure 6. Due to the increase in risk exposure and the rising number of catastrophe events, the

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97 Cp. CHARVÉRIAT, C.: loc. cit., p. 77.

98 Cp. FREEMAN, P. K.: Catastrophe Risk: …, loc. cit., p. 9.

99 Ibid., p. 29.

need for insurance may become more and more necessary. Swiss Re estimates that insurance in emerging countries still accounts for more than 95% of the market for catastrophe risk shifting.[100]

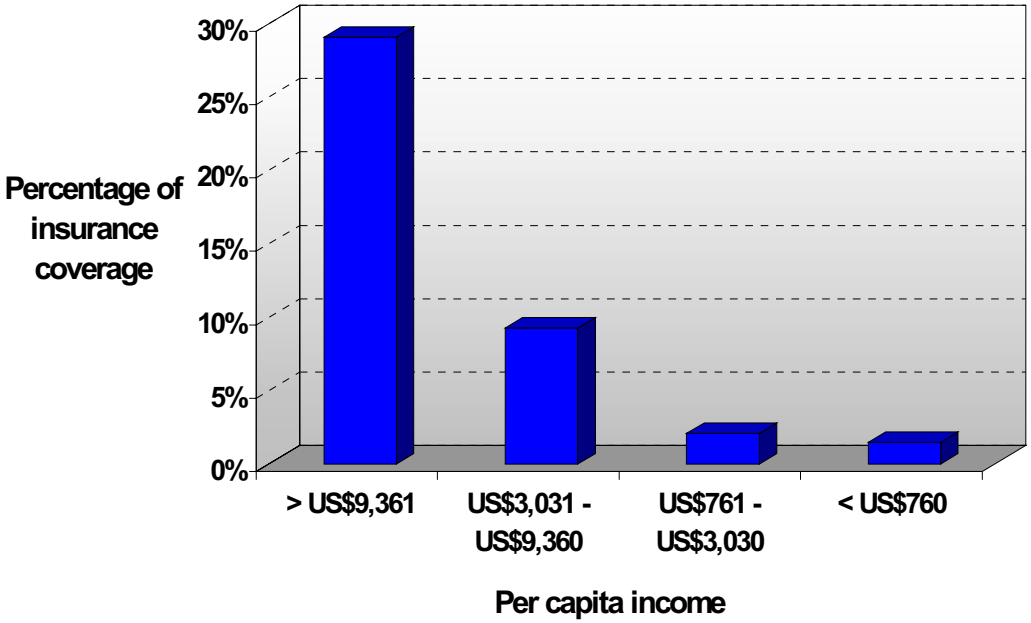

Figure 6: **Risk Transfer / Insurance in Low-Income Countries**
Source: LINNEROOTH-BAYER, J.: Insurance Related Actions and Risk Assessment in the Context of the UN FCCC, background paper for FCCC workshop, IIASA, May 2003, p. 22.

4.2.1.2 Costs and Benefits of the Instrument

The insurance mechanism can be regarded as a strategic financial instrument for transferring risks which are too great for individual property holders to bear by themselves, regardless of whether they are in the public or private sector. Premium payments are based on risk-adjusted calculations, and the entitled payments result immediately after hazard risk occurs.[101] Insurance as safeguard on macroeconomic level is financed by public sources through reallocation of revenues from taxes. According to FREEMAN; KUNREUTHER, the use of insurance, has five key advantages: (1) it permits the spreading of risk between parties, (2) it reduces the variance of risk for part of a country, (3) it permits the

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100 Cp. SWISS REINSURANCE COMPANY (ED.): Emerging markets: the insurance industry in the face of globalisation, sigma No. 4/2000, Zurich 2000, pp. 4 ff.

101 Cp. CUMMINS, D.: Risk-Based Premiums for Insurance Guaranty Funds, in: Journal of Finance, Vol. XLIII, No. 4, 1998, pp. 1702ff.

segregation of risk, (4) it encourages loss reduction measures, and (5) it provides a tool to monitor and control behavior.[102]

The main obstacle to the formation of an efficient insurance market is that insurance coverage might be too costly for low-income countries' saving capacities and the attendant perceived benefits of risk transfer. Reasons are excessive exposure to hazards, limited financial reserves, and high administrative costs. As most of a country's income is allocated to the immediate fulfilling of obligations, the low frequency risk of a natural disaster – though catastrophic in its effects – is not sufficiently taken into account.

One way of reducing these costs would be the regional pooling of insurance coverage. Several countries combine nationwide insurance markets or combine public/private insurance schemes for enhancing their limited risk absorption capacity.[103] This way, the risk is distributed more broadly, both by hazard exposure and geographically. It also generates the benefits of cooperating power especially for small states and the ability to negotiate prices based on economies of scale.

As a manageable risk transfer opportunity and tool for mitigating damage caused by natural disasters, insurance achieves its aim relatively fast in developing countries. Due to insufficient local insurance markets in most of the observed countries, it can be used in practice only as an additional mechanism alongside the other relevant instruments.

4.2.2 Catastrophe Reserve Funds

4.2.2.1 Basic Features

Calamity funds were set up as one potentially effective method of smoothing the volatility of economic activity after natural disasters.[104] The primary purpose of

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102 FREEMAN, P. K.; KUNREUTHER, H.: Managing Environmental Risk through Insurance, Boston et al. 1997, pp. 97ff.

103 Cp. POLLNER, J.: Managing Catastrophic Disaster Risks: Using Alternative Risk Financing and Pooled Insurance Structures, The World Bank, Washington D.C. 2001, p. 12.

104 Ibid., pp. 83ff.

these funds is to ensure that adequate financial resources are available to meet obligations following the extreme event, financed by local, national or international sources. This fund seeks to pre-finance expected catastrophe losses by spreading risk across a larger base.[105] These funds are based on the principle that, as self-insurers, governments or private institutions should, on a voluntary or compulsory basis, set aside the funds to cope with disasters. Funding sources can be insurance premiums, taxation or other compulsory costs.

BARAHONA concludes that "at least five elements are needed in these funds: (1) enough quantity to respond sufficiently, (2) focus on the poorest and most vulnerable areas to ensure recovery of the economic productivity sector, (3) institutional capacity to identify the target population and make sure resources actually reach them and are used properly; (4) accountability to beneficiaries and to the rest of society; (5) avoidance of charity."[106]

Only countries that have better access to international private markets turn to international markets to raise finance. One example of a government-funded pool is the Mexican catastrophe reserve fund FONDEM; another notable example is the Turkish Catastrophe Insurance Pool (TCIP).[107] India, Costa Rica, Nicaragua and Honduras also have, or are planning to create, national funds.[108,109]

4.2.2.2 Costs and Benefits of the Instrument

The supply of funds is determined by such factors as the size and flexibility of

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105 This relates to the law of large numbers, also known as the insurance principle. It states that for a series of independent and identically distributed random variables (such as catastrophe claims), the variance of the average amount of a claim payment decreases as the number of claims increases. [Cp. KUNREUTHER, H.; ROTH, R. J.: Paying the Price: the Status and Role of Insurance Against Natural Disasters in the United States, Washington D.C. 1998, p. 24.]

106 BARAHONA, J. C. ET AL.: Facing Natural Disasters in a Vulnerable Region: Hurricane Mitch in Central America (Lessons learned), Costa Rica 1999, p. 15.

107 Compare section 3.5 for further examination of the TCIP.

108 Cp. OAS as cited in CHARVÉRIAT, C.: loc. cit., p. 89.

109 According to the statement of specialists of the insurance secretariat of Barbados, there was also an initiative by the World Bank to establish a pool for Barbados and the countries of the Eastern Caribbean. This pool was intended primarily for Government assets in the first case but would eventually include private assets. [Email from staff member of the Insurance Institute of Barbados, online in internet: 2003-11-21.]

national budgets, the depth of the domestic credit market, expected insurance payments and the government's ability to reallocate existing loans and place new loans in the international markets.

The advantage of a disaster fund is that financial resources can be made available immediately after a disaster and without restrictions, unlike external assistance, private debt or even insurance payments. However, if the funds remain undercapitalized, subsequent payouts may jeopardize other investment commitments.[110]

Many of the most vulnerable countries have counted on post-disaster funding to deal with natural disasters.[111] However, because of limited supply and growing demand, funding sources can no longer be taken for granted.[112] The domestic capacity restrictions are manifested in excessively high exposures to disasters, limited fiscal capacities to fund major disaster reconstruction for developing countries and public properties, insufficient vulnerability reduction measures taken for properties and physical assets, limited reserves of domestic insurance capital, or resulting under-insurance in the economy.[113,114] International cooperation and partial privatization might provide better results.[115]

4.2.3 Alternative Risk Transfer Solutions

4.2.3.1 Basic Features

Over the last 12 years, new financing tools for transferring the risk of catastrophic events directly to the capital markets have grown increasingly popular. The basic idea is to use capital market sources for financing extreme disaster by packaging insurance obligations into tradable risks.[116] Alternative

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110 Cp. ANDERSEN, T. J.: Managing Economic Exposures …, loc. cit., p. 28.

111 Cp. POLLNER, J.: loc. cit, p. 7.

112 Ibid., p. 7.

113 Ibid., p. 12.

114 Further information on that issue may be found in SWISS REINSURANCE COMPANY (ED.): Too little reinsurance of natural disasters in many markets, sigma No. 7/1997, Zurich 1997, pp. 7ff.

115 CHARVÉRIAT, C.: loc. cit., p. 93.

116 Cp. POLLNER, J.: loc. cit., p. 65.

instruments are pre-disaster arrangements, the risk transfer spreads risks before a catastrophe occurs and requires the use of hedging instruments.[117] The range of instruments is growing; there are six main types of capital market instruments used. They are described as follows:[118]

- **Catastrophe Bonds (cat bonds)**. The bonds pay high yields that depend on the occurrence of a defined catastrophe during the life of the bond. Funds obtained from the sale of the bonds are normally invested in risk-free instruments and the interest earned reduces the net cost of the bond to the issuer.
- **Contingent Surplus Notes**. These financial notes are essentially "put" rights which allow the insured party to issue debt to pre-specified buyers in the event of a catastrophic event. The notes are a risk financing (as opposed to risk transfer) mechanism which can be regarded as part of the insurer's available surplus or capital. Notes can be issued in exchange for cash or liquid assets which are received from investors.
- **Catastrophe Swaps**. Catastrophe swaps are another method of paying catastrophe insurance premiums; swaps use capital market players as counterparties. In the event of a catastrophe, an insurance portfolio with potential payment liabilities is swapped for a security and is associated with cash flow payment obligations.
- **Exchange-Traded Catastrophe Options**. The property claims service (PCS) options give the purchaser the opportunity to receive payments if the claims index surpasses a specified limit. The indexes reflect aggregate reported claims in the insurance industry and covers different areas of the United States.
- **Catastrophe Equity Puts**. Equity puts are also a form of an option and permit the insurer to sell equity shares on demand to investors. The insurer

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117 DOHERTY, N. A. distinguishes between pre-disaster hedging opportunities and post-disaster financing. [Cp. DOHERTY, N. A.: Financial Innovation in the Management of Catastrophe Risk, University of Pennsylvania, Philadelphia 1997, pp. 1ff.]

118 Cp. CGCED: Managing Catastrophic Risks using alternative Risk Financing and Insurance Pooling Mechanisms, Caribbean Group for Cooperation in Economic Development, the World Bank, Washington D.C. 2000, pp. 67ff. and MISANI, N.: Risk Management between Insurance and Finance: New instruments for the Management of Pure Risks: Catastrophe Bonds, Insurance Derivatives, Contingent Capital, Risk Fusion, Milano 1999, pp. 25ff., pp. 71ff., pp. 100ff., pp. 127ff.

pays a fee for the put option. Such instruments are risk financing instruments and do not actually perform the traditional insurance function of risk transfer, though they provide immediate liquidity.

- **Weather Derivatives**. Weather derivatives are contracts against unexpected weather changes and generally take the form of premium payments for contracts which provide payouts in the insured event. This insured event could be a pre-defined number of days where temperatures, rainfall or sunshine hours are higher or lower than the trigger point within a specific time period.

Since 1996, nearly US$7 billion worth of catastrophe hedges have been placed in the capital markets worldwide.[119] The global capital market capacity stands at approximatively US$42 trillion and comprises almost 50 times the capital of the insurance markets.[120] The total outstanding amount of catastrophe bonds – the most widely issued alternative risk transfer instrument – was estimated at around US$836 million worldwide for 2003.[121]

4.2.3.2 Costs and Benefits of the Instrument

The described alternative risk management options can lead to real benefits to all participants (clients and sellers; private or state) in the financial markets. The primary benefit of such structures are that they made as well large sums available immediately. They are meant as supplement source to pay for the potentially very large losses. Appendix II illustrates the typical "full risk transfer" catastrophe bond arrangement showing the pre-event and post-event cash flow payments. The disadvantage is that especially bonds are generally more expensive than a credit line and require the immediate payment of interest. It is difficult to predict precisely why the private sector does not always fully respond to such market trends.

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119 The share of developing countries is not precisely quantifiable. The Caribbean, Asia and Latin America are partly involved. Unpublished information from LANE FINANCIAL L.L.C. [Email from staff member of Lane Financial L.L.C., online in internet: 2003-10-26.]

120 Cp. POLLNER. J.: loc. cit., p. 12.

121 Covering the January 2003 – July 2003 period. Unpublished information from LANE FINANCIAL L.L.C. [Email from staff member of Lane Financial L.L.C., online in internet: 2003-10-26.]

The most noteworthy limitation to using alternative non-insurance hedges is their cost.[122] The purchaser makes payments in return for the right to receive a much larger amount of money after a disaster occurs; the incidental charges are relatively high. The consideration of new risk transfer instruments must wait until primary insurance coverage becomes sufficiently extended. The opportunity to acquire capital market resources to absorb catastrophe losses will be extended to emerging countries in the coming years.

4.2.4 Contingent Credit

4.2.4.1 Basic Features

Contingent financing is still the main financial instrument used by disaster-prone developing countries. A contingent credit is available upon the occurrence of a pre-defined disaster event.

Most of the contingent financing consists of national or international assistance in the form of grants and conditional or non-conditional lending. For giving new credits, the Inter-American Development Bank (IDB) focuses on reducing long-term vulnerability to loss from natural disasters. It has to be said that in most Latin American and Caribbean countries, central bank borrowing is constitutionally permitted only in the case of natural disasters.[123] The availability of low-cost contingent financing tends to create perverse incentives to rely on post-disaster reaction rather than managing risks.

4.2.4.2 Costs and Benefits of the Instrument

The beneficiary effect of credit depends on whether the credit is used to replenish income-generating assets or finance immediate consumption.[124] Credit arrangements require a smaller up-front payment relative to other ex-ante options, but they increase the debt load after an event. The lender pays the fee as long as the trigger event does not occur. The borrower can rapidly draw down

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122 Cp. LINNEROOTH-BAYER, J.; MACE, M. J.; VERHEYEN, R.: Insurance-Related Actions and Risk Assessment in the Context of the UN FCCC, IIASA, Laxenburg 2003, pp. 16ff.

123 Cp. FREEMAN, P. K. ET AL.: Natural Disaster Risk Management: National Systems for the Comprehensive Management of Disaster Risk: Financial Strategies for Natural Disaster Reconstruction, Washington D.C. 2003, p. 55.

124 Cp. CHARVÉRIAT, C.: loc. cit., p. 71.

the funds if the defined event does occur.[125] Low-interest ex-post borrowing is more attractive than contingent credit agreements if it is quickly available after an event.[126]

4.3 External Aid

Because of the inability to spread risk internally and insufficient national resources, Third World countries are not able to cope with the high costs of disasters. Additional aid comprises regional or national support of public or private institutions, as well as foreign bilateral and multilateral support.[127]
Multilateral institutions play a special role in disaster management by providing assistance in coping with the financial impacts of disasters. The assistance can be broken down into the UN system, inter-governmental organizations (for example the Organization of American States (OAS)), and regional development banks (for example the Inter-American Development Bank (IDB)).[128] The World Bank, the International Monetary Fund (IMF) or regional development banks therefore provide help both before and after a disaster occurs, and offer assistance to member countries in risk mitigation, preparedness and financing needs in the wake of natural disasters.[129] External aid also comprises bilateral governmental assistance and assistance from non-governmental international organizations and is provided directly by other countries' governments; it represents the bulk of foreign assistance.[130]

External aid should be designed precisely to reduce vulnerability of a country. According to a report by GILBERT; KREIMER the World Bank identified investments of US$14 billion in 56 natural post-disaster reconstruction countries

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125 Cp. MECHLER, R.: Natural Disaster Risk …, loc. cit., p. 52.

126 Cp. FREEMAN, P. K. ET AL.: National Systems for Comprehensive Disasters Management: Financing Reconstruction, Phase II: Background Study for the Inter-American Development Bank: Regional Policy Dialogue, Washington D.C. 2002, p. 9.

127 Cp. ALBALA-BERTRAND, J. M.: Political Economy …, loc. cit., p. 31.

128 Ibid., p. 31.

129 Cp. GURENKO, E. N.: Managing Catastrophe Risks at the Country Level: The World Bank Group Perspective, presentation paper at the World Bank conference: ESSD Week "Risk Transfer: Financial Instruments to Manage Climate Risk", The World Bank, Washington D.C. 14 March 2003, p. 2.

130 Cp. ALBALA-BERTRAND, J. M.: Political Economy …, loc. cit., p. 31.

approved since 1980.[131] An IMF Factsheet states that, since 1962, the organization provided more than US$2.2 billion in emergency assistance to 33 countries.[132] Disaster-related assistance in risk mitigation techniques exists in the form of technical support and financial design of feasibility studies.[133] Mitigation receives the main attention in disaster risk management activities; multinational institutions try to intensify their assistance to decrease the effects of natural disasters by reducing their likely impact before they occur.[134] External ex-ante financing is provided to support the economic conditions of a Third World country; contingent credit lines through international banks are guaranteed.[135] A comparison of the World Bank's involvement and IMF's financial assistance in disaster-prone countries for disaster risk management and recovery are shown in appendix III.

Also the opportunity of loans to finance risk management programs is offered. As ex-post financing, the World Bank has provided over US$38 billion in reconstruction loans over the last 20 years.[136] For heavily indebted countries, aid can also come through debt relief, which is common in the aftermath of major disasters. Most of the countries depend on "external public borrowing from multilateral and bilateral lenders to sustain its program of infrastructure investment, including post disaster reconstruction."[137]

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131 Cp. GILBERT, R.; KREIMER, A.: Learning from the World Bank's Experience of Natural Disaster Related Assistance, The World Bank, Washington D.C. 1999, p. 21.

132 Cp. IMF: IMF Emergency Assistance: Supporting Recovery from Natural Disasters and Armed Conflicts: Factsheet, Washington D.C. April 2003, p. 1.

133 Technical assistance deals mainly with hazard and vulnerability assessment in the country as well as with estimations of financial value exposed to natural hazards. [Cp. GURENKO, E. N.; LESTER, R.: Disaster Relief, in: Global Reinsurance, 1999, p. 35 and GILBERT, R.; KREIMER, A.: loc.cit., p. 36]. UNDRO provides technical assistance in preparedness and mitigation, too. [ALBALA-BERTRAND, J. M.: Political Economy …, loc. cit., pp. 32ff.]

134 Cp. GILBERT, R.; KREIMER, A.: loc. cit, pp. 36f.

135 Cp. KEIPI, K.; TYSON, J.: Planning and Financial Protection to Survive Disasters, Inter-American Development Bank, Washington D.C. 2002, p. 19.

136 Cp. GURENKO, E. N.: Introduction to the World Bank Insurance Practice: Key Lessons Learned and the Road Ahead, paper presented at the conference "Financing the Risks of Natural Disasters: A New Perspective on Country Risk Management", The World Bank, Washington D.C. 2-3 June 2003, p. 2 and GURENKO, E. N.; LESTER, R.: loc. cit., pp. 33ff.

137 IMF: Honduras: Initiative for Highly Indebted Poor Countries: preliminary draft, International Monetary Fund and International Development Association, Washington, D.C. 1999.

Because of the rising costs, the share of emergency-related assistance in total aid is incentives, insofar as governments may prefer to depend on these foreign resources rather than adequately manage risk to forestall the impact of disasters.[138] Nevertheless, international assistance after a disaster has occurred will never be able to fully offset the negative impact of it, which can be very significant for example related to impacts on GDP.[139]

4.4 Financial Protection Against Natural Disasters Risk

4.4.1 Risk-Sharing Through Private Finance

4.4.1.1 Motivation

In many developing countries, the insurance sector is still in its infancy, the private insurance markets are relatively underdeveloped. "The poor economic and social conditions in the Third World are reflected in the business of insurance and reinsurance."[140,141] The use of insurance for hedging catastrophe risk is just beginning to take place in both the private and public sector.[142] The structure of most countries is very simple and consists substantially of foreign insurance agencies and branches or state-owned reinsurance institutions;[143] insurance markets in Third World countries played a subordinated role in past years.

The conception of individual responsibility for catastrophe insurance and a feasible private (re-)insurance market for providing protection of natural disasters are not fully developed. Reasons why many of the developing countries use very limited catastrophe insurance include *inter alia* the absence of cover for catastrophe perils, lack of reinsurance to protect country insurer, absence of local and regional information about both the exposure to catastrophes and values at

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138 Cp. KEIPI, K.; TYSON, J.: Planning…, loc. cit., pp. 11ff.

139 Cp. section 3.4.2.

140 IRUKWU, J. O.: loc. cit., p. 89.

141 A brief description of the reinsurance business and its problems in the Third World is given by the UNCTAD: Reinsurance problems in developing countries, study by the UNCTAD secretariat, UNCTAD/TD/B/C.3/106/Rev.1, Geneva 1973.

142 For a further discussion of the economic effectiveness of using insurance in the private and public sector, cp. section 4.4.

risk.[144] Another reason may be a misunderstanding of the long-term nature of catastrophe insurance because insurers in developing countries are more familiar with traditional insurance.[145]

An additional point exists in terms of the market's inability to accommodate the risks of developing countries. Insured values in these low-income countries even for disaster limits are relatively small compared to the developed countries. The interest of international insurer to cover such risks fully is not attractive enough when compared with much higher values in the developed world.[146,147]

4.4.1.2 Implementation

Demand for private insurance has grown due to the stabilizing effects on the economy, together with economic growth and privatization of state-owned companies. A *sigma* study of SWISS REINSURANCE examined in depth the growth potential of the insurance industry in emerging markets.[148] Starting from a low level, over the past few years growth was three times higher than in industrialized regions.[149] For catastrophe insurance to be effective and available within a country without delay, local insurers must offer more catastrophe cover alongside traditional services.[150]

Efficient insurance markets are important in encouraging domestic production, innovation and trade; they are decisive to the ability of Third World countries to

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143 Cp. IRUKWU, J. O.: …, loc. cit., p. 90.

144 Cp. UNCTAD: Reinsurance problems …, loc. cit., p.12.

145 Ibid., p.12.

146 Ibid., p. 6.

147 Other opinion according to experts of Swiss Reinsurance Company, Zurich [email from staff member of Swiss Reinsurance Company, online in internet: 2003-10-09], and talk with experts of Converium Reinsurance, Zurich [email from staff member of Converium Reinsurance, online in internet: 2003-10-20]. Both would welcome and appreciate catastrophe covers in developing countries due to economies of scale. For a further information compare the following section 4.4.2.1.

148 Cp. SWISS REINSURANCE COMPANY (ED.): Emerging markets: the insurance industry in the face of globalisation, sigma No. 4/2000, Zurich 2000.

149 Ibid., p. 3.

150 Cp. UNCTAD: Problems Faced by Developing Countries and Countries in Transition in the Area of Insurance Against Catastrophe Perils, Study by the UNCTAD secretariat, UNCTAD/TD/B/CN.4/54, Washington D.C. 1995, p. 10.

achieve integration into global economy.[151] From the macroeconomic point of view, widening the insurance market could help mobilize national savings and reduce financial catastrophe gaps in developing countries.[152]

Catastrophe losses can be better absorbed by functional insurance markets, with resulting financial benefits to local industries, domestic insurance companies, households, international reinsurers, and governments, through the use of more optimally structured risk-sharing arrangements. The government's financial burden can be reduced if the private sector assumes part of the risk.[153]

4.4.2 Risk-Sharing Through Government Finance

4.4.2.1 Motivation

For post-disaster coverage it is essential to identify the responsibility of the government for a country's catastrophe exposure. It does not generally carry basic catastrophe insurance on public buildings, infrastructure and other public assets. The state is heavily involved in the costs of catastrophic events and has a great interest in providing assistance and financial support to the affected area of the country. Depending on its financial ability to absorb losses, federal assistance is broken down in order to cope with: (a) the risk to publicly owned assets; (b) the risk assumed by the government from other economic agents in the country; and (c) the risk of obligations of the government to the poor.[154,155]
Public responsibility for construction, maintenance and reconstruction of infrastructure is a huge liability for the state in hazard-prone countries, especially in case when assets are not insured. They participate in reducing and absorbing the losses from catastrophic events by funding prevention measures,

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151 Cp. SWISS REINSURANCE COMPANY (ED.): Emerging markets: …, loc. cit., p. 41.

152 Ibid., p. 41.

153 Cp. KEIPI, K.; TYSON, J.: loc. cit., p. 28.

154 Cp. FREEMAN, P. K. ET AL.: National Systems for …, p. 14.

155 Social obligations of the government in Third World countries to the poor are not particularly examined in this paper, although "it's a World Bank's mission to improve living standards through sustainable growth and investment in people". [Cp. Kreimer, A.: Arnold, M.: loc. cit., p. 2.] For further discussion on that subject compare in particular ALBALA-BERTRAND, J. M.: Political Economy …, loc. cit., pp. 92ff.

emergency response, repairing public infrastructure as well as compensating disaster victims.[156]

Following the common theory, risk preferences will affect the decision on how governments consider fully retaining or sharing risks. A brief example is given in ARROW; LIND, under which conditions a "government might act either in a risk neutral or risk averse way."[157] By contrast, FREEMAN as well as OAS, in their studies, state that, under normal circumstances, governments in developing countries should assume generally a risk-averse attitude.[158,159]

In their endeavor to achieve macroeconomic stability, many developing countries face severe budgetary constraints. Using expanded credit lines or domestic resources as ex-post finance instruments makes it possible to support recuperation and reconstruction efforts.[160] Nonetheless, economic losses and impacts constitute a large developmental burden for governments. This places considerable pressure on governments to absorb a large part of these losses due to their role as "insurers of last resort"[161] for the private sector, particularly the poor, and due to the losses to their own public assets.[162]

4.4.2.2 Implementation

About one-quarter of all damages worldwide from natural catastrophes are sustained by public infrastructure. Governments own 90% of the essential

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156 Cp. WARNER, K.: The role of governments in the disaster cycle and disaster finance, IIASA, Laxenburg 2002, pp. 7f.

157 ARROW, K. J.; LIND R. C.: Uncertainty and the Evaluation of Public Investment Decisions, in: The American Economic Review, Vol. 60, 1970, pp. 370ff.

158 Cp. FREEMAN, P. K. ET AL.: Catastrophes and Development: Integrating Natural Catastrophes into Development Planning, The World Bank, Washington D.C. 2002, pp. 40f.

159 Cp. OAS: A Probable Maximum Loss Study of Critical Infrastructure in Three Caribbean Island States, Washington D.C. 2001. Online in Internet: URL: http://www.oas.org/en/cdmp/document-/pml/pml.htm [Cited 2003-08-23].

160 Compare section 4.3 for information on external aid.

161 The government act as an "insurer of last resort" by assuming responsibility to provide guarantees and further preventive measures if there are no commercial institutions willing to cover catastrophe risk. [Cp. UNCTAD: Review of Developments …, loc. cit., pp. 22ff.]

162 Cp. MECHLER, R.: Natural Disaster Risk …, loc. cit., p. 15.

infrastructures in developing countries;[163] they directly bear the risk of loss in the developing world.

FREEMAN ET AL. state in their analysis[164] that governments absorb risk by relying on their own resources. In the pre-disaster period, governments bear the risk themselves by relying on their internal resources domestic savings, taxes or credit from the financial sector and absorb the lower levels of risk more efficiently using their own resources. These financing mechanisms are currently the most widely used instruments by the countries; they mainly involve the allocation of resources of the national budget toward rehabilitation and reconstruction activities.[165] This is generally right for developed countries.

The governments in poorer countries often do not have the domestic resources to absorb catastrophe risk. Third World countries are not able to internally spread the cost of loss. An analysis should be emphasized by FREEMAN ET AL.[166] who compares the impact of disasters on economic indicators and uses data series as it relates to catastrophe risk to illustrate the different capacity in the developing countries of Argentina, Honduras, and Nicaragua.[167] For each country, the largest historical losses are compared to important economic indicators to finance post-disaster relief and reconstruction. These are loss per capita, loss compared to GDP, loss compared to tax revenue, loss compared to gross domestic savings, and loss compared to net domestic credit. In addition, as an indicator of existing reliance on external aid, aid received by each country as a percentage of GDP is also provided.[168,169] GURENKO at the World Bank paid additional attention to governmental efforts.[170] He compared fiscal and economic effects of disasters what is seen in the following graph:

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163 Cp. FREEMAN, P. K.: Catastrophe Risk: …, loc. cit., p.19.

164 FREEMAN, P. K. ET AL.: Catastrophes and Development: …, loc. cit., p. 38.

165 Cp. KEIPI, K.; TYSON, J.: loc. cit., p. 19.

166 Cp. FREEMAN, P. K. ET AL.: Catastrophes and Development …, loc. cit., p. 38.

167 Ibid., p. 38.

168 Ibid., p. 39.

169 For a detailed description of the variables see section 3.3.1 and appendix IV.

170 Cp. GURENKO, E. N.: Managing Catastrophe Risks …, loc. cit., p. 3ff.

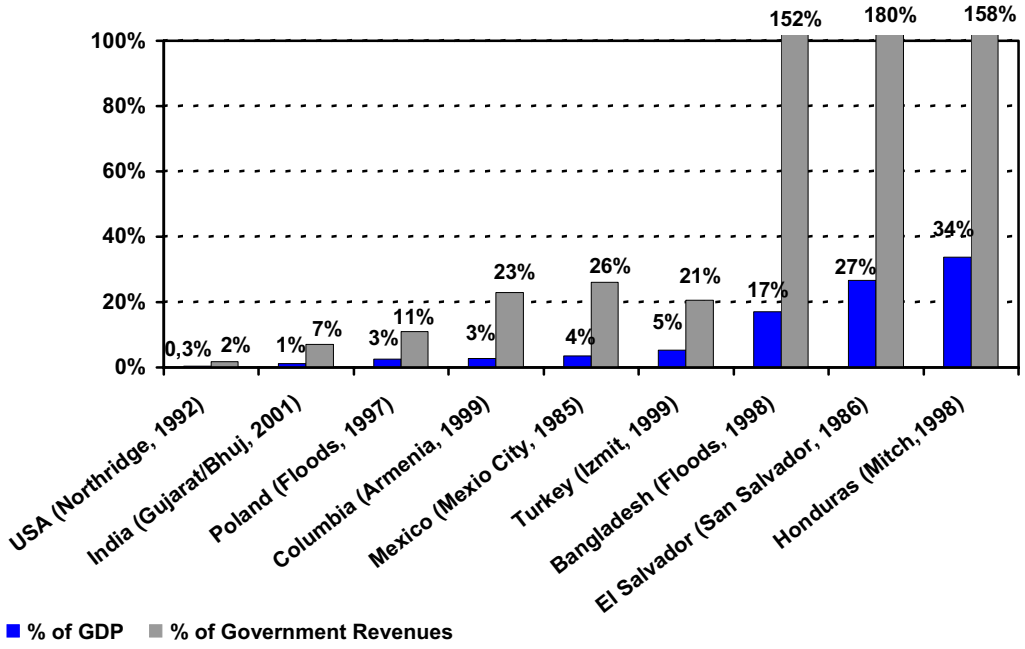

Figure 7: **Fiscal and Economic Effects of Disasters: Uninsureed Economic Loss as % of GDP and Government Revenues**
Source: GURENKO, E. N.: Managing Catastrophe Risks …, loc. cit., p. 3.

Catastrophe risk financing by governments especially for developing countries by means of, for instance, insurance is seen as a (partial) alternative to risk assumption and ex-post loss financing.[171] But non-functioning national risk markets and an insufficient financial system as elucidated in section 2.1 justify very low quantities of risk transfer at the government level. It may be not a problem of the risk size, but of the overall extent.[172] "From an economist's perspective, such ex-post financing should be viewed as a form of market failure. The federal government cannot credibly commit not to fund disasters after the fact: even if it says it will not provide disaster relief ex ante, the political incentives to do so ex post are overwhelming."[173]

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171 Cp. MECHLER, R.: Natural Disaster Risk …, loc. cit., p. 46.

172 According to a study by KEIPI; TYSON, the insurance against catastrophes in developing countries, is the most cost-efficient method of insuring a state against the disastrous impacts. [Cp. KEIPI, K.; TYSON, J.: loc. cit., p. 14.]

173 FROOT, K. (ED.): The Financing of Catastrophe Risk, Chicago 1999, p. 18.

4.4.3 The Challenge of Public-Private Partnerships in Catastrophic Risk Insurance

4.4.3.1 Motivation

Public-private partnerships are arrangements between the government and the private sector. These partnerships became more and more important due to the catastrophic damage caused by natural disasters in the United States and other parts of the world.[174] Past catastrophes in developing countries generated considerable losses, like Hurricane Mitch in Honduras, or the Marmama earthquake in Turkey.[175] Neither the insurance or reinsurance industry nor the governments of these countries were able to absorb losses and protect the economy from the devastating impacts.

The World Bank decided to intervene and led initiatives with the private sector to enhance capacity for catastrophic insurance coverage in constrained markets while cushioning the impact of large disasters.[176] Public and private sectors can work together more effectively in reducing the future impact of natural disasters.[177] While financing programs can provide the framework for establishing the requisite institutional support, the magnitude of catastrophe risks requires more radical solutions to ensure that governments can minimize fiscal exposure. By ensuring that sufficient liquidity exists after a disaster, risk transfer mechanisms can help to speed up economic recovery in the private sector and local communities and reduce government exposure to natural disasters.

4.4.3.2 Implementation

These "alternative" capital market schemes have many possible variations. The structure depends on a partnership itself: it can contain elements of insurance on a primary level, compulsory government finance, long-term credit structures

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174 Cp. KUNREUTHER, H.: Mitigation and Financial Risk Management for Natural Hazards, University of Pennsylvania, Philadelphia 2001, p. 2.

175 Cp. GURENKO, E. N.: The Role of World Bank in Supporting Turkish Catastrophe Insurance Pool, paper presented at the World Bank conference "Innovations in Managing Catastrophic Risks", Washington D.C. 8-10 January 2000, p. 13.

176 Cp. POLLNER, J.: loc. cit., p. 92.

177 Cp. KUNREUTHER, H.: Incentives for Mitigation Investment and More Effective Risk Management: The need for Public-Private Partnerships, University of Pennsylvania, Philadelphia 2001, p. 12.

used by the state, as well as reinsurance or catastrophe risk transfer to capital markets.[178] Serving as one of the upper levels of governments risk, hazard-indexed bonds can also be combined with public-private arrangements. For governments, there exists the opportunity of using it in a manner individually adjusted to the structure of the economy. By purchasing cat bonds as both completion and condition for other loans unrelated to natural disasters, the countries will be able to obtain the needed capital to cover large losses, and their investments are protected from external market participants.[179]

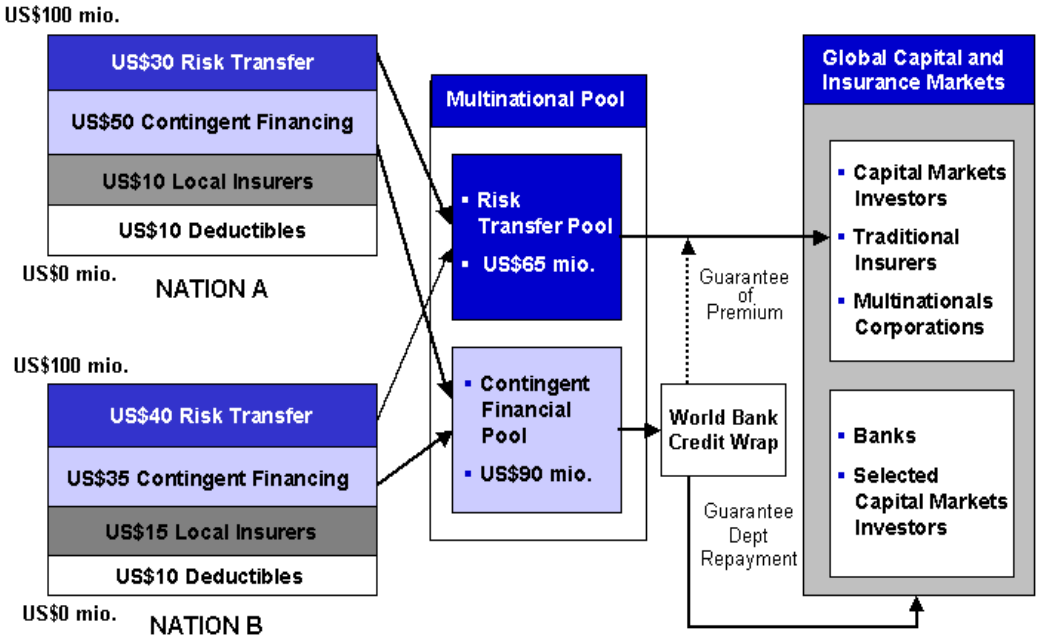

Figure 8: **Natural Catastrophe Protection for Developing Countries: Potential Multinational Structure**
Source: Own compilation based on MILLETTE, M.: paper presented at the World Bank Conference on Small States, Washington D.C. 1999, p. 10.

Such initiatives go hand in hand with the needed restructuring of local economy. The involvement of multilateral institutions could help strengthen the financial sectors and improve hazard mitigation. A possible structure of risk-sharing between public and private sector on a multinational basis and natural catastrophe protection for stabilizing developing countries is shown in figure 8. Additional securitized disaster risk elements are additionaly involved. The figure

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178 Cp. section 4.2.3 in this paper for further information on alternative risk transfer solutions.

179 Cp. KUNREUTHER, H.: Incentives for Mitigation …, loc. cit., p. 19.

highlights also the risk flows of a multinational pool, in which several small states could participate, to global capital and insurance markets.

The World Bank can play an important role in these arrangements by encouraging the governments of Third World countries to protect themselves against large-scale disaster losses by using alternative risk transfer solutions in connection with public-private partnerships. The success of these partnerships can be seen in the recent creation of the Turkish Catastrophe Insurance Pool. A few other structures already exist and are listed in appendix V. Further proposals for such public-private arrangements are being explored in Mexico, the Caribbean, Central America, and Africa, the idea being to enlist the government in providing risk transfer options.[180]

4.5 Practical Experience: The Turkey Catastrophe Reinsurance Pool in Turkey – (TCIP; December 1999)

4.5.1 Economic Situation in the Country

Turkey is home to major to seismic activity and hence highly vulnerable to earthquakes. Since 1984, around 120 earthquakes with of over 5.0 on the Richter scale have struck Turkey. The estimated annual economic losses due to seismic activity are around US$1 billion.[181] The domestic insurance industry has a low capital base and a low level of reserves against earthquake. Currently 70% of the population live in the 1st and 2nd earthquake zones, which are highly vulnerable to seismic risks.[182]

Following the losses suffered during the two major earthquakes that struck Turkey in 1999, there has been a broad recognition among Turkey's governmental, non-governmental and academic organizations of the need for extensive risk analysis and abatement of damages due to natural catastrophes.

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180 Cp. POLLNER, J.: loc. cit., pp. 96ff.

181 Cp. YEZER, A. M.; RUBIN, C. B.: The Local Economic Effects of Natural Disasters, National Hazard Research, George Washington University, Washington D.C. 1987, pp. 4ff.

182 Ibid., p. 4.

Distribution of direct financial losses and the resultant expected economic losses are shown in figure 9.

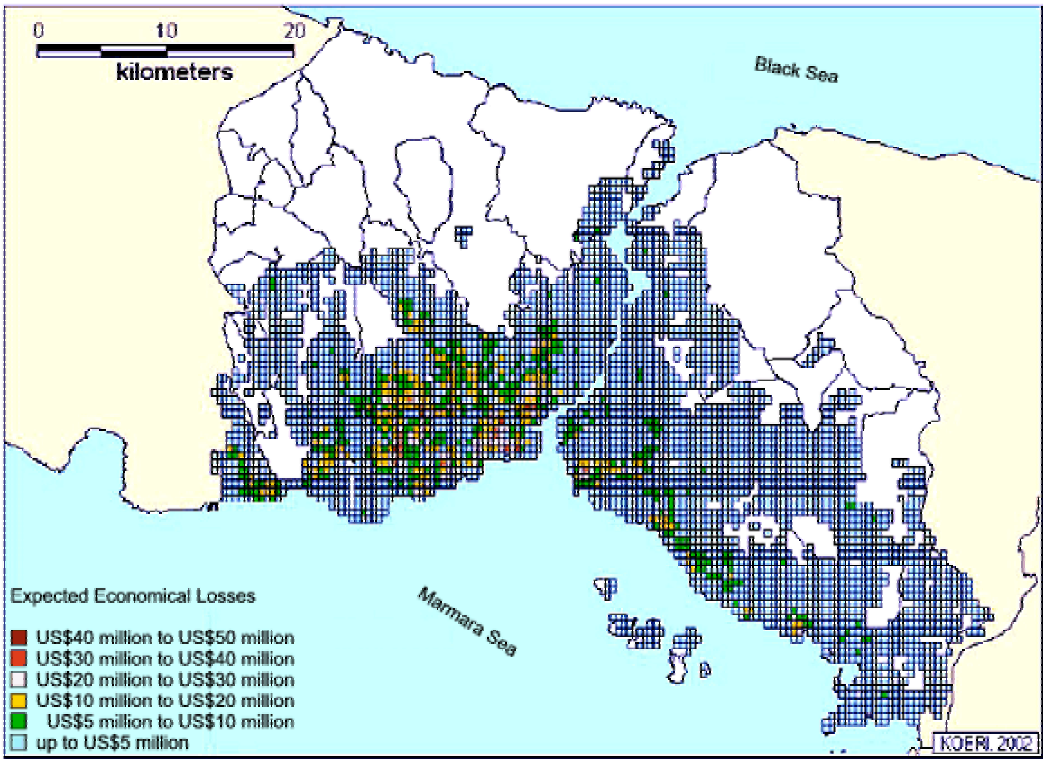

Figure 9: **Distribution of Direct Financial Losses in Turkey**

Source: Earthquake Specials, Bogaziçi Üniversiteti: Kandilli Obervatory and Earthquake Research Institute (KOERI). Online in internet: URL: http://www.koeri.boun.edu.tr/depremmuh/default.htm [Cited 2003-08-16].

4.5.2 Structure of the Instrument

The Turkish *Catastrophe Insurance Pool (TCIP)* is a national public-private partnership that involves international support, and the first catastrophe fund of its kind in a developing country. The fund was launched on September 27, 2000 and introduced following multiple earthquakes that struck the Istanbul area.[183] Initiated by the World Bank, this is the first attempt to combine government insurance pools with the government issuance of cat bonds in the local and international capital markets.[184] The main objective of this transaction is to reduce the death toll and to decrease the financial exposure of the government

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183 Cp. GURENKO, E. N.: The Role of World Bank …, loc. cit., p. 4.

184 Cp. THE WORLD BANK PRESS RELEASE: World Bank Project Improves Risk Management and Earthquake Mitigation in Turkey: "Turkish Catastrophe Insurance Pool", No. 2000/8/ECATR, The World Bank, Washington D.C. 2000, p. 2. Online in internet: URL: http://www.worldbank.org/wbi-/banking/insurance/natdisaster/pdf-/WBPress_TCIP.pdf [Cited 2003-10-11].

due to natural catastrophes by transferring risks away from individuals and firms.[185]

The World Bank designed the Turkish Insurance Catastrophe Program using hedging instruments in the client country with reinsurance and capital market participation. Successful examples are the *Californian Earthquake Authority (CEA, USA)* as well as *The Earthquake Commission (EQC, New Zealand)*. All models aim to distribute risk while at the same time spreading the financial charges arising from earthquakes to the international reinsurance and capital markets through risk pooling, risk-sharing, and risk transfer. As example, the structure of the TCIP is shown in figure 10:

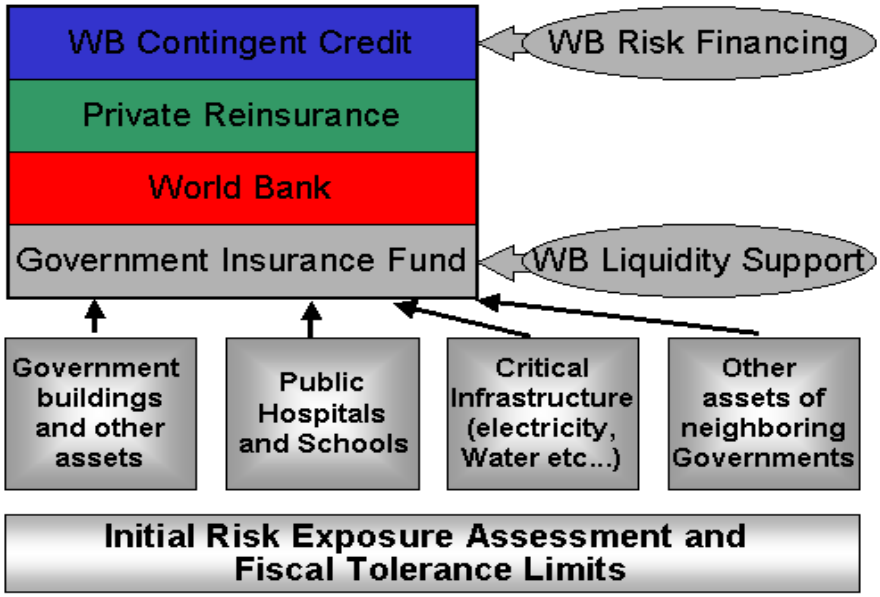

Figure 10: **TCIP Structure**

Source: GURENKO, E. N.: The Role of World Bank …, loc. cit., p. 7.

The TCIP operates as a catastrophe risk transfer and risk financing facility.[186] *Milli Re,* a pool management company established for that purpose, manages the insurance pool. Funded by a mandatory fee paid by these property owners, the TCIP engages World Bank support as reinsurance if disaster costs exceed the funds collected in the pool. The TCIP provides coverage for total earthquake losses up to US$1 billion (including US$850 million in reinsurance), and only

185 Cp. GURENKO, E. N.: The Role of World Bank …, loc. cit., p. 7.

186 Cp. WORLD BANK NEWS RELEASE, loc. cit., pp. 8ff.

holders of insurance policies receive government assistance if disaster strikes.[187] If insured damages exceed the financial reserves from the fund, the World Bank finances the next layer.[188] A large share of the next upper risk part is transferred in the global reinsurance market, whereas the highest risk layer is again funded by the World Bank. Indirect losses like costs of debris removal, loss of profit and business interruption are excluded. The TCIP will fund the first 12 months of reinsurance cover financed by the government and will continue to be used for rehabilitation after earthquake disasters in the affected area of Turkey.[189]

4.6 Interim Result

In the preceding section, a number of possible solutions to cope with natural disaster risk were discussed. It presented different hedging and financing instruments of natural disaster risk. Additional attention has been given to the need for external assistance, including a description of different bilateral and multilateral institutions. Further on, mechanisms of risk-sharing between economic sectors were explained.

Specific characteristics of underdeveloped insurance markets countries need to be taken into account before assessing several financing instruments.[190] To judge different risk-sharing opportunities – private, governmental, or public-/private risk-sharing – precisely, the overall economic situation in the Third World has to be considered.[191] For emphasis and in order to highlight risk financing opportunities for both the public and private sector, features and characteristics are summarized as follows; in table 3, the pros and cons of each instrument are summarized:

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187 According to the website of Milli Re: www.millire.bn [Cited 2003-10-17].

188 Coverage provided within the loss range, determined by attachment point and the exhaustion point, is usually called *layer*. [Cp. ANDERSEN, T. J.: Innovative Financial Instruments for Natural Disaster Risk Management, IDB, Washington D.C. 2002, pp. 21ff.]

189 Cp. ERDIK, M.; AYDÝNOGLU, N.: Earthquake Risk to Buildings in Istanbul and a Proposal Towards its Mitigation, Bogazici University, Istanbul 2000. Online in internet: URL: http://idrm03.dpri.kyoto-u.ac.jp/Paperpdf/23erdik.pdf [Cited 2003-11-05], p. 5.

190 Cp. POLLNER, J.: loc. cit., pp. 5ff.

191 Cp. with the terms given in section 2.2 and 2.3.

	Insurance	Reserve Fund	Contingent Credit
Cost before event	• Premium times number of year before event	• Payment into fund time number of years before event	• Holding fee times number of years before event
Benefit after event	• Loss indemnification for elements insured • Increased capital inflows from abroad to affect economy	• Reserve funds and interest available • Funds will not be lost in case of NO event	• Funds available immediately • Increased capital inflows from abroad to affect economy
Cost after event	• None	• None to the extent that enough reserve has been accumulated	• Additional debt service, reduction in ability to take out future debt
Risks	• Theoretically risk of (re)-insurer going bankrupt	• Risk of depletion before disaster events due to political pressures • Risk of insufficient funds	• Risk of insufficient funds • Theoretically risk of financial entity going bankrupt

Table 3: **Costs and Benefits of Risk Transfer in Third World Countries**

Source: Extended on basis FREEMAN, P. K. ET AL.: National Systems for Comprehensive Disasters Management: Financing Reconstruction, Phase II: Background Study for the Inter-American Development Bank (IDB): Regional Policy Dialogue, Washington D.C. 2002, p. 49.

The insurance industry is concerned with their inadequate capacity to provide sufficient coverage to cover the losses from large scale natural hazards.[192] The need for ex-ante financing instruments to reduce large risks depends on the economic situation and the ability of the responsible institutions to manage risk transfer mechanisms. The available instruments have to be aligned with the individual condition of the country.

One must bear in mind that developing countries tend to rely heavily on external resources to finance catastrophe losses.[193] International assistance after a disaster

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192 Cp. KLEINDORFER, P.; KUNREUTHER, H.: The Complementary Roles of Mitigation and Insurance in Managing Catastrophic Risks, paper presented at the conference "Public Private Partnership 2000: Uncertainty of Managing Catastrophic Risks", Washington D.C. 11 December 1997, p. 14.

193 Cp. GILBERT, R.; KREIMER, A.: loc. cit., p. 43.

will never be able to fully offset the negative impact, which can be very significant for their further economic prosperity and independence.[194]

The private insurance sector contributes important funding for natural disaster reconstruction in developed countries, but insurance and reinsurance markets in developing countries are still at the beginning in their efforts to manage catastrophe risks effectively.[195] With its very limited private insurance coverage, the private sector's low income forces it to fall back on government resources for financing of catastrophe losses.

The state alone can not assume responsibility for private sector risk. To cope with disasters more effectively, strategies have to be developed to assist the private sector in managing disaster risk. In considering any catastrophe insurance opportunities, the government must be informed of the extent to which it can voluntarily (or involuntarily, in the absence of alternative insurance) become involved as the "insurer of last resort".

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194 Cp. section 3.3.

195 Cp. GILBERT, R.; KREIMER, A.: loc. cit., p. 45.