

Mexican rural population is predominantly living in poverty and vulnerable to a number of stressors. This work focuses on natural disasters. Mexico is very prone to natural disasters. Although from the macro-economic perspective natural disasters do not cause serious negative consequences to the country as a whole, the agricultural sector is remarkably vulnerable (most of the rural-poor workforce is employed in agriculture). During the period 1980-2000, 70% of total damages from weather-related events accrued to agriculture. Though natural disasters are not the only factors contributing to poverty in Mexico, they are becoming more socially and economically destructive as they drive small-scale farmers out of business, and possibly increase out migration from rural areas.

The purpose of this analysis is to examine how natural disasters affect agricultural livelihoods and the implications of these stressors upon the poor in the agricultural sector. Special emphasis will be given to the effects of natural disasters on migration patterns. In addition, this project analyzes selected policy options (e.g. government-supported insurance schemes) to reduce the vulnerability of small-scale farmers. To further this aim, this work makes use of existing surveys and of own quantitative analyses, as well as stakeholders interviews. The combination of social inequality and high exposure to disaster risks is not unique to Mexico, but is also shared by other countries (e.g. Iran, El Salvador, etc). For this reason, examining how to reduce the vulnerability of the agricultural sector in Mexico can offer valuable insights to other countries. *Key words: vulnerability, poverty, natural disasters, assets, and resources allocation.*

INTRODUCTION

Mexican agriculture has been historically affected by a number of factors, such as adverse market conditions, failures of public policy design and operation, natural disasters, among others. Most of research has focused on factors related to the first two said factors, but the incidence of natural disasters has remained less addressed. Although from a macro-economic perspective natural disasters do not cause serious negative consequences in Mexico, some economic sectors, such as agriculture, are remarkably vulnerable. Though the agricultural sector in Mexico is a small sector in GDP terms (4%, compared to 68% from services, 28% from industry –INEGI 2003c), one quarter of Mexican population lives in rural areas and 90% of them rely on

agricultural activities as livelihood. Also, Over 73% of the Mexican rural population is living in poverty (World Bank 2002). So, the relevance of agriculture's vulnerability to natural disasters goes beyond diminished production and greatly affects social conditions and increases poverty.

Historically, 80% of natural disasters in Mexico have been weather-related (CENAPRED 2001) and most of them likely linked to the *El Niño* phenomenon (Vatsa and Krimgold 2000). Though natural disasters are only one factor contributing to poverty in Mexico, they are becoming more socially and economically destructive as they drive small-scale farmers out of business. Small-scale farmers usually cannot afford crop insurance, which is also not always accessible, and in addition the Mexican government is becoming increasingly reluctant to compensate losses from these events (Milenio 2003, Wenner and Proenza 2000). The central government is withdrawing from its crop insurance support system and also from programs to enhance agricultural productivity (Hernandez 1997, Wodon and Velez 2000). So, uncertainty in productivity, together with a lack of stability in rural incomes due to damaged crops from natural disasters, makes poverty conditions more acute in the countryside and contributes to increase rural-urban migration. So, policy priorities for reducing the risks of natural disasters in Mexico can only be set with an understanding of the economic vulnerability of persons and property exposed to the risks, especially the small farmers.

This paper thus focuses mainly on agricultural-sector vulnerability to weather-related disasters and on the mechanisms Mexican government implement to deal with it. Two important policy questions arise from the vulnerability framework: If natural disasters are not serious from the macro-economic perspective, how much weight should be given to policies in vulnerable sectors (an issue of equity)? Given scarce public resources, how should the budget be allocated to reduce poverty and losses from natural hazards? To answer these and many other questions, it is important to understand the contribution of natural hazards to poverty in Mexico. This means estimating exposure of the poor, and in this case the farmers, to disaster risks. It also means understanding the current responsibility the farmers and governments assume to face disasters. Finally, it means understanding the political and institutional opportunities and constraints for policies aimed at disaster risk and poverty reduction in the agricultural sector. The purpose of this analysis is thus to examine how natural disasters affect annual agricultural performance, its relevance to the poor, as well as to identify potential areas where the

government could implement actions towards vulnerability reduction in benefit of the income of the poor.

The present research paper is divided into four sections. The *first section* discusses briefly some concepts and approaches aimed at defining economic vulnerability. Also, provides some existing concepts of disasters prevention, preparedness, among others, based on a review of the literature. Further, the *second section* provides a general picture of historic losses from natural disasters in Mexican agriculture, as well as the economic repercussions of natural disasters to subsistence farmers. This section also includes a discussion of theories and empirical analyses that explain poverty rural areas. Further, the exposure and potential losses due to natural disasters are assessed. In order to develop effective public policies to address poverty and vulnerability, one must identify its driving forces, such as deficits in education and health, and inequity in assets distribution and opportunities. Asset accumulation is one important obstacle to overcome poverty in developing countries like Mexico; it is closely linked to market failures and this must be looked at from the point of view of opportunities of the poor. This research is based on data analysis of important vulnerability factors, such as rural poverty, inequity and its linkage to out migration. *Section three* provides an assessment on the current strategies the Mexican government currently implements as response, and investigates the value of policies aimed at reducing disaster losses in rural areas. That assessment is based on both scientific surveys and on stakeholder interviews. A visit to the country from October 26-31, 2003 made it possible. The visit made possible to establish contacts with policymakers from the Mexican government and to enhance existing relations with key stakeholders concerned with natural disasters, poverty and rural development. The result of the visit was very positive. In the Mexican government there is a widespread concern in Mexico over natural disaster losses, which are viewed as an important, but little addressed policy issue. For this reason this project was considered highly valuable and interesting due to its linkage to poverty in rural areas. In general, Mexican authorities expressed willingness to cooperate by providing data and further consultation (see Appendix 1 for further details). The *fourth section* expounds some final considerations regarding possible paths to use more efficiently available public resources, as well as to reduce the risk of setting additional population below the poverty line as a consequence of disasters.

1. Economic vulnerability to disasters

Vulnerability is the key concept to our approach, and we proceed now to expound definitions of vulnerability from different perspectives, their linkages to related concepts, and to propose a definition of economic vulnerability.

In a broad sense, vulnerability is incumbent upon two sides: unit of exposure and extern force(s). So, vulnerability can be initially defined as the susceptibility of a certain unit to a specific force, and risk can be expressed as the probability of an undesired derived outcome, based on the potential occurrence of harmful events and on the susceptibility to them among those likely to be exposed (Dielley and Boudreau 2001).

The way the sustainability science analyzes the said two sides of vulnerability, as well as the complexity of their interrelations, provides excellent basis towards defining, further, economic vulnerability. So, for some scholars of the sustainability science, vulnerability is conceived, above all, as a coupled human-environment systems' interaction, which poses a likelihood to experience harm due to exposure to a hazard (Turner et al 2003). From this perspective, hazards are understood as threats to the system, which act by means of perturbations and stressors. Perturbation is a major alteration in the system -of extern origin- generating exceeding effects to those the system can cope with, and stress is a continuous increasing pressure upon the system. The novel of this concept is that expands the analysis spectrum to embrace multiple stressors and the structure of hazard's causal sequence as a complex of socioeconomic conditions and biophysical subsystems lying behind.

So, vulnerability does not involve merely active and passive factors, but rather dynamic objects and subjects in continuous motion. As pointed out in Turner et al (2003), systems have different sensitivities to perturbations and stressors strongly linked to entitlements in the case of social units. *Entitlements* are essentially the system of legal and customary rights defining the access to the society's resources.

Along with entitlements, other elements defining susceptibility of social units are *coping* and *adaptive capacity*. Coping capacity can be defined as the ability of a unit to respond to a harm occurrence as well as to avoid its potential affectation. Adaptive capacity is the ability of a unit to gradually transform its structure, functioning or organization to survive under hazards threatening its existence (Kelly and Adger 2000). Another concept contributing to vulnerability comprehension is *resilience*, which, borrowed from the ecology science, defines a system's ability to return to a

reference state after a disturbance and to maintain basic structures and functions despite disturbance (Turner 2003).

Thus, the expound linked concepts –entitlements, coping and adapting capacity, and resilience- obligate us to incorporate social, economic, institutional, and cultural structures into the set of forces shaping units' susceptibility in the vulnerability analysis, overcoming so the eventual limitations other frameworks do, i.e. risk-hazard and pressure-and-release models¹. Moreover, these concepts are useful to the present work, since their implementation into our analysis may allow us to maneuver with existing structures in the country our case of study deals with.

From its part, economic vulnerability is still sparsely defined, and one can find concepts which, though useful and valid, fail in describing vulnerability in its wide spectrum. There exists thus interesting views about economic vulnerability highly biased to the side of drivers, like those provided by some scholars of political economics in the context of international development. Germinal works on these matters from Todaro (1982) consider vulnerability as a situation in which least developed countries (LDC) find themselves in a dominance and dependence relationship *vis-à-vis* the developed countries. In this view concretely, LDC are said to be economically vulnerable to the decisions of rich nations in areas such as trade, private foreign investments, foreign aid, technological research and development, etc. This is a useful concept whose asymmetry component is closely interconnected with other concepts from the economics of development, like the center-periphery relations and terms of trade in the works of Raúl Prebisch (i.e. 1950 and 1973, respectively).

In-line-with the Todaro's definition, the United Nations Conference on Trade and Development (UNCTAD) defines economic vulnerability as the structurally more exposed position of LDCs than most other developing countries to external economic shocks. Also, UNCTAD points out that economic vulnerability implies consequences of major global and regional economic and financial disturbances and increases in the prices of critical imports such as energy products; The typical

export dominance of a single commodity or service sector makes their economies particularly vulnerable to adverse physical or economic shocks (UNCTAD 2001).

In the view of Briguglio (2002), a country can be economically vulnerable and yet register a relatively high GDP per capita. So, countries like the Small Islands Developing States (SIDS) are particularly economically vulnerable due to their limited ability to exploit economies of scale, lack of natural resources, low diversified economy, dependence on narrow range of exports, and high dependence on imports of strategic goods, i.e. fuel and food. Notwithstanding, what essentially makes a country economically vulnerable in the definition of Briguglio, is its exposure to economic forces outside its control. Thus, the *peripheral* condition of an economy goes beyond geographic insularity and remoteness (leading to high costs and marginalization from world trade), but also includes inability to influence international prices (price-taker economies).

However, being vulnerable is not only a question of poverty and smallness of a country. Vulnerability accrues to also countries of big population and large economies, whose vulnerabilities are less visible at a glance, and only through more detailed analysis exhibit differential vulnerabilities due to given dualistic characteristics (Rodriguez 1980). So, above all, Latin American countries like Mexico, Brazil, and Argentina should not be considered as entirely vulnerable, but unequally vulnerable, whose rich and poor societies, high productive and left-behind economic sectors, etc. coexist at differential degrees of vulnerability (Rodriguez 1980, Colosio 1979).

More recently, economic vulnerability is being used to refer the extent to which macroeconomic policies can exhibit performance inconsistencies, sudden loss of net national product, and hence lead to economic crises, as result of underscored development of warning systems and economy's inability to work with multiple equilibria (Yap 2002). The response to these types of vulnerabilities can consist on financial monitoring and modeling of early warning systems, as Kaminsky and Reinhart (1996) propose to concretely avoid economic crises originated in financial factors like the Asian one of 1997. However, these approaches do not address structural factors of the economy, and tend to reflect rather what this work calls risk and preparedness, instead of vulnerability and vulnerability reduction, respectively.

In defining economic vulnerability is crucial thus to consider approaches with imbedded structural factors. So, the implications of vulnerability to economic analysis are explicitly expound by Amartya Sen (1981) by relating

¹ Risk-hazard models tend to consider impacts of hazards as a function of exposure to the hazard event and the sensitivity of the unit without clarifying how the units amplify or attenuate the impacts, as well as the role of multiple stressors in defining susceptibility. In the case of pressure-and-release models (PAR), they emphasize the conditionings of unit's unsafe, including even ethnicity, class, etc. However, the PAR model does not incorporate biophysical subsystems interacting with the society.

entitlements and initial endowment in a coherent process where individual levels of vulnerability are conditioned by broader institutional structures, which sometimes reproduce or even amplify vulnerability given society's capacity to provide opportunities.

Now, let us introduce some elements, which, complementary to those from the said definitions of vulnerability and economic vulnerability, allow proposing this work's concept of economic vulnerability, like information availability, productive level, options to deal with shocks, risk management, and protection.

a) Information availability. Information availability plays a key role concerning economic vulnerability, since the common assumption of homogeneity of information among economic agents (as in the neoclassic approach of economics) does not usually apply in practice. Heterogeneity regarding information possession makes considerable differences when taking decisions and in turn when getting incomes. Better informed economic agents are more able to identify the risk their asset implies and hence to take better decisions. Connected with this way of seeing vulnerability from the perspective of economic agents, Amartya Sen (1981) addresses vulnerability not using directly the concept assets, but using entitlements. Entitlements are the package of goods and services, which an economic agent can obtain by means of trading their stakes under current regulatory conditions. In other words, there exists an intrinsic susceptibility in the way economic agents profits their assets. With a very similar meaning, Cannon (1994) calls this *vulnerability of livelihood resilience*, but this concept embraces also coping capacity. As vulnerability we are concerned with here is that associated to natural disasters, extreme events become negative shocks as they disrupt the system of assets profitability and expected income. Hence, public intervention can be justified.

b) Productive level. Productive level is a relevant concept into economic vulnerability, since vulnerability is linked to dynamic productive factors at a large extent, which in last instance determines the dynamic of accumulation processes, inequality, and marginality. Differences in these socio-economic structures result in hazards having a different degree of impact.

c) Options to deal with shocks. Options to deal with negative effects of shocks are interconnected with information availability and productive structure, given that the latter factors determine the ability of any economic agent to hedge from adverse events. As asymmetries among economic agents are present in a society, options to hedge from extern shocks are

unequally employed within economic units. Economic processes determine vulnerability in a society as allocate assets differently, and one of the task of the government should thus consist in creating mechanisms to reduce the gap of access to hedging options, to information, and to alternative productive opportunities, i.e. allocating public funds or advising actively to protect them.

d) Risk management. Derived from options to deal with negative shocks, prevailing risk management capacity in a country is crucial in reducing vulnerability. Risk management is the set of pre- and post-disasters actions towards facing negative consequences of hazards (Freeman et al 2001, Clarke 2000). Pre-disaster actions include risk transfer (i.e. insurance), risk assessment (monitoring, mapping, etc.), mitigation works (i.e. infrastructure strengthening, etc.), and preparedness. Post-disaster actions include emergency response (aid, clean-up, etc), rehabilitation, rebuilding, and loss sharing (i.e. private-public, national-local).

e) Protection. From its part, protection is a concept situated at the both sides of risk management phases (pre- and post-disaster). Protection is the network of awareness and emergency response for disaster and crisis state avoidance, initially based on various technical interventions usually known as preparedness. Preparedness is the management capability before a disaster occurs to provide an effective and efficient (prompt and due) reaction to face a disaster (Freeman et al 2001). Protection granted by governmental planning plus those from other social institutions are termed social protection, which acts complementary to self-protection (Cannon 1994).

In concordance with the conceptual discussion above developed and attempting at overcoming dispersion and partiality of available definitions of economic vulnerability, this work defines economic vulnerability as the susceptibility of an economic agent to absorb negatively exogenous shocks, given its assets possession and productive capacity, its level of knowledge and information, and its implemented options to avoid, manage, or smooth negative effects from a particular shock, under the framework of an entitlement system

Finally, reducing economic vulnerability consists basically on implementing the due changes in time to minimize negative effects from exogenous shocks upon economic agents' assets by strengthening constituting elements of vulnerability and/or improving risk management strategy.

2. Economic vulnerability profile of Mexican agriculture

Once expound key concepts and clarified some crucial relations to this work, we proceed now to provide some elements of economic vulnerability characterizing Mexican agriculture, as well as to present some estimation of economic losses from natural disasters in Mexico. Economic vulnerability in Mexican agriculture makes presence through different forms, like rural incomes decrease. The following indicators provide certain evidence about it: (i) 29% drop in real prices of basic crops experienced after started the North America Free Trade Agreement (Lederman et al 2003), (ii) 61% decrease in credit granting to farmers over the same period (ECLAC 2000), and (iii) decrease of subsidized insurance and other forms of hedging to disasters over the past fourteen years (Wenner and Arias 2002, Hernandez 1997). This section focuses on mainly the third mentioned fact. To understand the necessity for

hedging from disasters in Mexican agriculture, we proceed now to briefly expound some key elements of hazard exposure, moving forwards to elucidate the prevailing productive characteristics and rural poverty conditions that amplify the negative consequences of disasters in Mexican agriculture. Also, this section illustrates some patterns of rural-urban migration catalyzed by natural disasters in the countryside.

Hazard exposure

Weather-related events are responsible for ca. 44% of the total loss from disasters (natural and anthropogenic) over the period 1980-1999 (see Figure 1 below), and agriculture was the most heavily affected sector. Historically, weather-related events have inflicted dramatic damages to agriculture in Mexico. Although other hazards are less spectacular, like frosts or droughts, they also inflicted large losses on agriculture (CENAPRED 2001).

Disaster type	Direct losses	Indirect losses	Total losses	% of total
Weather	4,402.3	144.9	4,547.2	43.8
Geologic	4,043.7	516.4	4,560.1	43.9
Human	1,149.7	133.6	1283.3	12.3
Total	9,595.7	794.9	10,390.6	100.0

Figure 1. Losses from disasters in Mexico 1980-2000. With data from CENAPRED 2002

So, every time a hurricane strikes, over 70% of total damages are located in agriculture. In 1982, Hurricane *Paul* and floods caused MX\$7, 384 millions in direct losses to the agriculture, that is, 70% of total losses. Floods in 1985 hit Mexico, and 85% of total losses were located in agriculture, damaging especially crops. The same year, heavy rains caused losses at MX\$4,177 mil., 97% of them in agriculture (infrastructure and crops). In 1988 Hurricane *Gilbert* hit severely Peninsula of Yucatan and North-eastern Mexico, damaging all economic sectors, but losses in agricultural sector meant 86% of total losses (US \$ 65 mill.). Along the same year, three more hurricanes hit Mexico, which resulting damaged crops were three times bigger than the caused by Hurricane *Gilbert* (CNA 1998, CENAPRED 2001). Hurricane *Paulina* hit Oaxaca and Chiapas in 1997, sparking off severe damages on the whole economic

activity and housing, but 88% of total losses accrued to agriculture and livestock (Bitrán et al. 2003).

Differential vulnerability to disasters

In general, poverty makes individuals relatively more vulnerable to all types of stressors. As obvious, people worldwide living in adverse economic conditions is less able to invest in all items than those better off. So, even if all world population were exposed to the same stressors, negative consequences upon the poor are usually higher than in middle- and upper income people. So, as it is valid among people, it applies among countries as well. Developing countries have historically been the most severely damaged (Benson & Clay 2002: 11; Mechler

2002: 60). For instance, a given natural hazard with identical intensity can hit in different degree two distinct countries. Differences within individual's wealth, civil protection system, health facilities and public financial ability (i.e. for reconstruction) make countries to absorb differently the same natural hazard. In addition, as Cannon (1994) points out, what turns a natural hazard into a disaster is not simply a question of money, but also of economic and political system. The way countries

structure societies determines that similar hazard lead to very different impacts among societies. In turn, such differential impact of disasters is also observed within regions, as empirical evidence shows in the case of Mexico. In the period 1970-2000, agriculture in the southern state of Chiapas registered the largest damaged area by natural disasters (see figure 2 below), followed by its neighboring state of Oaxaca, which both are the two poorest states of Mexico.

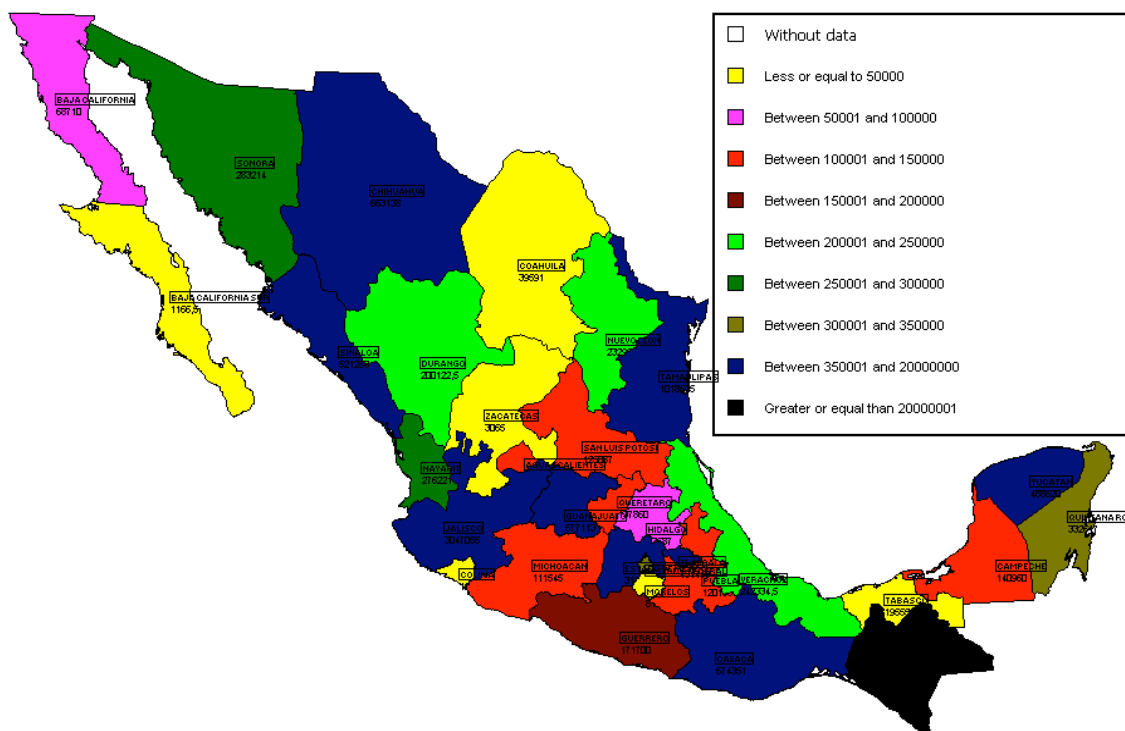


Figure 2. Damaged hectares due to natural disasters in Mexico by state (1970-2000)

With data and software from DesConsultar, La Red 2003.

Vulnerable productive structure and withdrawing governmental support

Two thirds of cultivated hectares in Mexico are rain-fed (INEGI 2003c), which reveals the high dependence of agricultural production on climatic conditions as well as evidence high risk to meteorological phenomena

exceeding normality thresholds. Weather-related disasters have damaged over 24 million hectares of crops over the period 1980-2002, but only one-fifth of the crop damage was insured (García and de la Parra 2002).

Usually, negative consequences from disasters on the Mexican economy tend to be underestimated, but one has also to pay attention to the exposed farmers, whose affection per capita can amplify dramatically current

levels of poverty. So, on the one hand, average annual losses from natural disasters in Mexico represent 0.002% of Mexico's GDP in 2002 (see Appendix 5). On the other hand, average monetary losses from disasters as share of basic crops production has been very high: for instance, it has meant 13% in the case of maize, and 21% in the case of bean on average over the past two decades (SAGAR 1998). Also, economic losses have mostly affected subsistence farmers.

In addition, crop prices have dramatically decreased during the last decade (see Figure 3 below). However, the governmental support in form of credit granting has

reduced during that period as well. Crops in figure 3 are of the most representative of Mexican agriculture in terms of number of employed agricultural units. For instance, in 1995 real price of maize was 815 pesos per ton, but in 2001 dropped to 607. Comparing the same years, total agricultural credit granting reduced from 48 to 13 million of pesos. In the same way, PROCAMPO, the official program aimed at encouraging agricultural productivity, granted farmers with less payment per hectare along the same period despite low crop prices (see Appendix 4).

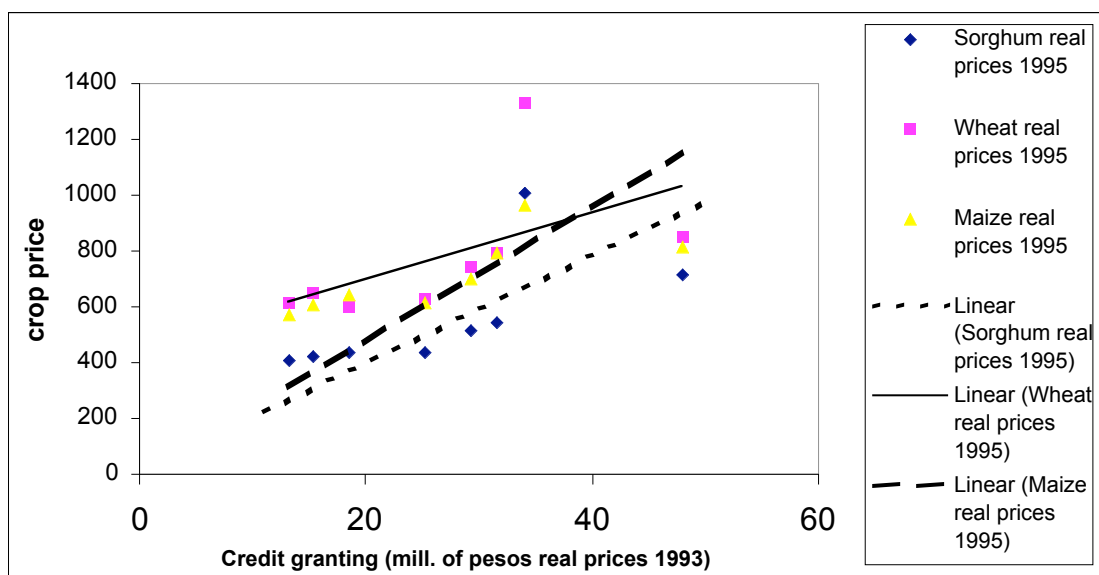


Figure 3. Prices of basic crops and credit granting in Mexico (1995-2002)

(*)With data from: ASERCA 2003, II Informe de Gobierno Vicente Fox Q., and Banco de Mexico.

(*) Prices at farm gate plus marketing assistance: Maize in Sinaloa, Wheat in Sonora, Sorghum in Tamaulipas.

The productive structure is also vulnerable given the current level of economic openness of Mexico. There were previously certain market compensation mechanisms, through which crops prices went up after disasters occurrence, helping farmers to sell non-damaged production at more convenient prices. However, under current open economy conditions domestic demand is met by means of imports, facilitating to keep prices constant as well as to ensure supply. Though it benefits urban consumers, but affects rural incomes. So, there exists a correlation between losses from natural disasters and imports of basic crops with different coefficients depending on the type of crop. For instance, based on a set of 160 observations during the period 1979-1998, Saldana-Zorrilla (2000) estimated a positive correlation between disaster losses of bean

crops and bean imports at 0.66. Also, the correlation gets greater as one run cut-series of more recent periods, coinciding with the phasing-out duties liberalization started in 1986 and further free trade agreements. That estimation takes a one-year lag between disaster occurrence and production. Also, in the same analysis can be observed that years of high losses from disasters in basic crops are followed by increasing emigration flows from agricultural regions.

Assets and the poor

The assets are key variables to understand impoverishment of poor rural families (or households), which can be defined as the stock of wealth used to

generate well being (Vatsa & Krimgold 2000). This concept is important when considering the effects of natural disasters, which may decrease the capital assets of households and businesses. Families have an initial asset, which generates an output. This output varies widely, depending on market price of the produced factor, and on the productivity of its use (profitability). As families pursue strategies to maximize their assets, they are in better position to enlarge their risk pool and reduce vulnerability.

Programs aimed at reducing poverty have tended to increase transfers, but they do not affect the long-term lack of assets in Mexico (Attanasio & Szekely 1999). Anti-poverty programs help to raise income or consumption but only in terms of flows. In addition, ECLAC (2001: 32) points out that social programs of poverty reduction in Mexico are merely of aid character, though if these programs were more substantial and long-term sustained, these additional resources could increase assets, as well as for instance improve ability to invest on education and other long term variables, which directly modify assets and in last instance income.

Among other authors, Chambers (1989) cautions about the relevance of increasing assets in low-income families, since this improves human conditions beyond poverty just in terms of flows, but also structural vulnerability. He affirms that vulnerability is even more interlinked with net assets than poverty. For authors like Vatsa & Krimgold (2000), vulnerability is a broader and more dynamic concept, which involves the poor, but also households living above poverty line at risk of falling below in case of an income shock (new poor). Given that linkage, factors that obstruct an accumulation of assets are, in turn, impeding poverty reduction and putting additional population into poverty. Losses from natural disasters impede rural households in accumulating assets, creating a vicious cycle of inefficient risk management strategy, low return, low consumption and low savings and investment (Vatsa & Krimgold 2000).

Rural poverty

Both moderate and extreme poverty in Mexico is dramatic in rural areas. 74% of rural population lives in poverty -in urban areas it represents 36% (WB 2002). From its part, 20% of the Mexican population is reckoned to live in extreme poverty², from which 65% in rural areas (WB 2004). From its part, inequity in rural areas has increased along the last ten years. Based on the *Gini*

coefficient³, rural expenditure coefficient increased from 0.41 to 0.48 between 1992 and 2002, reaching top bottom in year 2000 with a 0.56 coefficient (WB 2004). Low education is, in turn, much more concentrated in rural areas: 73% of rural extreme poverty has no education or primary incomplete –compared to 51.3% of urban extreme poverty.

Agriculture is still the main livelihood of the poor in rural areas in Mexico, especially of the extreme poor, with 72% population depending on agricultural activities (WB 2004). However, agricultural income is increasingly being complemented by income from low-salary activities. In general terms, poor rural population work in small-size rained agriculture, producing basic grains of fluctuating low prices, with inability –rather than aversion- to contract crop insurance.

The typical landholding in the Mexican agrarian system is the *Minifundio*, which is too small to provide the workers with levels of living much above the bare survival minimum. For that reason, holders of *minifundios* are forced to provide seasonal labor to *latifundios*, or even to other labor markets, working either as wage laborers in other agriculture activities in the nearby, or taking any job in non-agricultural activities in semi-rural areas. It happens regularly because agricultural incomes are so low, that it is not enough even to subsistence. In fact, only 45% of total income of rural workers in Mexico is provided by agriculture, with a decreasing trend along the past 30 years (ECLAC 2001a).

As land-tenure is smaller, a higher share of personal income must be obtained from alternative sources, as shown in an empirical study on the Mexican case carried out by De Janvry and Sadoulet (2000). Owners of two hectares or smaller properties earned only 23% from agriculture in year 1997 (see Figure 4 below), whereas holders owning more than 18 hectares earn at least 62% from this activity. Also, the dependence from remittances and self-employment decreases as the size of land increases.

² Extreme poor is that population living below the food-based poverty line.

³ The Gini coefficient is a measure of income inequality developed by the Italian statistician Corrado Gini. The Gini coefficient is a number between 0 and 1, where 0 means perfect equality (everyone has the same income) and 1 means perfect inequality (one person has all the income, everyone else has nothing).

Property size (ha)	Average	<2	2-5	5-10	10-18	>18
Agricultural income	45.1	22.9	29.1	41.8	50.3	62.0
Non-agricultural income	54.9	77.1	71.9	58.2	49.7	38.0
Self-employment	9.4	17.1	14.2	4.6	12.1	6.8
Remittances	6.5	2.6	5.4	8.9	6.0	6.0
Others	14.4	17.1	15.3	14.3	13.3	14.1

Source: De Janvry and Sadoulet 2000.

Figure 4. Income sources of households by land size in Ejidos in Mexico, 1997 (%)

Shifting economic activity (or migrating) falls outside the coping capacity of a rural household, given that it implies rather the destruction of its livelihood, forcing even to change its identity. The latter is relevant to the present work given that it makes visible that as agricultural income decreases, the coping capacity of the worst-off farmers comes to the end, and they have then either to share income source or even to shift activity. So, protection to rural households must not be thought as facilitating the transition from rural to urban economy⁴, but rather strengthening rural income generation.

Finally, another relevant characteristic of rural livelihoods is its differential dependence of transfers as part of income. At national level, remittances represent 1.2% of total income in year 2002. However, remarkable differences arise when comparing among urban and rural, where it reaches 0.5% and 3.5%, respectively. Particularly relevant are remittances to the first rural quintile (poorest 20%), where remittances represent 20% of the income. That quintile is reckoned to obtain 53% of total income from remittances, social programs, and other transfers (WB 2004:75).

Disasters and rural-urban migration

Natural disasters affect annual agricultural performance adversely. Its implications upon the poor are visible in rural-urban migration, contributing to the proliferation of slums in large cities. Further, the slums are often built in areas highly at risk to all types of disasters. As an efficient strategy for agriculture and rural areas in general was not successfully undertaken during the 80's, these rural workers have been migrating massively to urban

areas, especially to large cities i.e. Mexico City, Monterrey, Guadalajara, Puebla, etc., building irregular assets on very risky areas, prone to all kinds of natural disasters. Figure 5 relates zones at high risk to earthquake in Mexico City and slums location. Violet color represents areas whose underneath is the lake Tenochtitlán.

The severe damage and collapse historically experimented on this area occurs because the accelerating vibration of deep lacustrine soils beneath (resonance effect), as occurred in 1985 when the Michoacan earthquake hit Mexico City. In red circles are represented slums and very poor areas, which are mostly located upon this high-risk area. In general, the socio-economic map of Mexico City shows the poor located along an area that runs from Southeast to Northwest, wide in the South and narrower as running northwards, exactly on very prone areas to natural disasters, whereas richest areas run from Southeast to Northeast, on the less prone areas to disasters. Slums as percentage of population in Mexico City is 46, and the city concentrates over 20 millions people,⁵ the world's second largest city in terms of population (after Tokyo, 26 mill.), and the world largest city in terms of surface.

⁴ Like has been succeeding along the past fifty years in Mexico.

⁵ 15.6 millions people living in Distrito Federal, plus 5.1 in neighbour municipalities, which have been integrated to the metropolis. Sources: World Resources Institute 1996-1997: The urban environmental (New York: Oxford University Press) tab. 1.1; United Nations, World Urbanization Prospects.

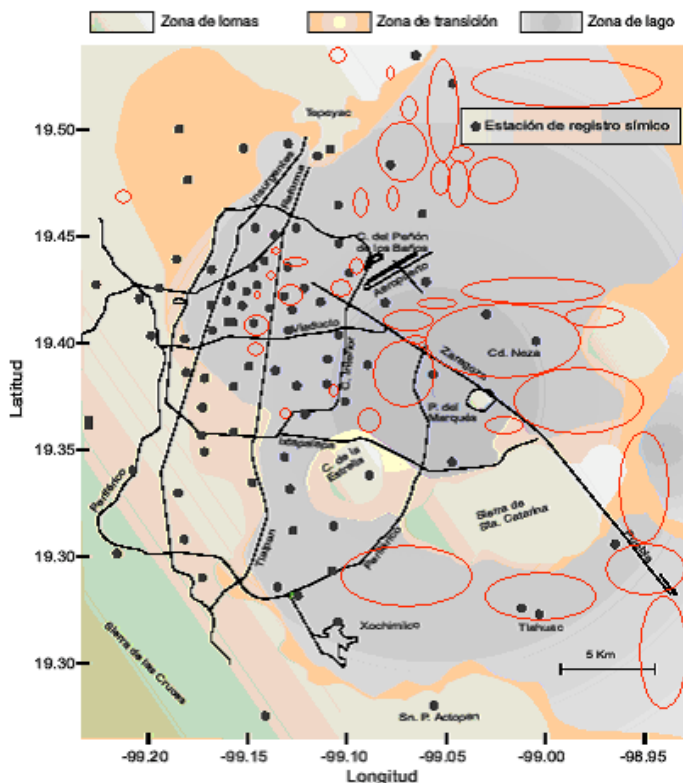


Figure 5. Slums and vulnerable areas in Mexico City

Lack of support to the countryside and agriculture, as well as inappropriate urban projecting in large cities in Mexico has contributed to growing-up of urban vulnerability after the 50's. There are theories of rural-urban migration helpful to understand better the slums proliferation (see Lewis 1954, Fei and Ranis 1964, Todaro 2000), most of which find its causes in labor market failure, centered on, basically, the incapacity of agriculture to offer enough income given states low productivity, as well as the insufficient industrial development in the cities to absorb additional workforce. For Todaro (2000: 305), migration is primarily an economic phenomenon, which for the individual migrant can be a quite rational decision despite the existence of urban unemployment.

In addition, the "Todaro model" postulates that migration proceeds in response to urban-rural differences in expected income rather than actual earnings. That decision is taken in order to maximize their expected gains in life and, for a given time horizon the urban sector results more convenient. In that sense, as natural disasters reduces future incomes expectations from agricultural activities, it stimulates in turn slums growing as well.

Also, about one-quarter of Mexico's labor force is still employed in agriculture, and as conditions in the country are each time getting worst, these rural workers will not have incentives to stop out migration not only to urban Mexico, but also to urban and rural USA (Robinson et al 1995). Mexico is the first country of origin of migrants to the USA, where nowadays 1 out of 3 migrants was born in Mexico, integrating the first majority migrating community in the USA (US Census Bureau- CMS 2002). Thus, an economic development strategy that leaves agriculture behind generates high costs on the national economy, spread social decomposition and intra-national and international out migration. It has occurred in Mexico along the past three decades, when attention has been centered on urban industrialization (Montserrat and Chavez 2003).

3. Governmental response to natural disasters

Given the prevailing levels of poverty, inequity, hazard exposure, and, in general, economic vulnerability in Mexico above discussed, the Mexican government is committed to assume risk from its population besides its own risk on public assets. There are three basic sources of risk for the government if natural disasters occur: public infrastructure, insurance markets (as insurer of last resort), and aid to the poor (Mechler 2002). In the first category is the risk of loss to government buildings, including schools and hospitals, and infrastructure like roads, bridges, airports, etc. (public assets). The second category (private assets) focuses its attention not only on the poor, but also on the risk to agriculture, strategic industries, and to local governments. The third category consists of emergency response and providing elemental health and housing facilities after disaster to the poor.

To meet these commitments, the Mexican government has implemented some policy instruments. However, overall vulnerability to natural disasters remains high. There exist some very developed public instruments to hedge disaster risk, especially regarding agriculture in Mexico: rebuilding of public assets is possible by the federal fund FONDEN; subsidy to crop insurance premia is available by means of AGROASEMEX, the public crop insurance company; mitigation works can be undertaken by the federal-state shared fund FOPREDEN; and FAPRACC is a fund designed for rebuilding, mitigation and insurance to the poorest farmers. Figure 6 below summarizes the current public instruments responsible for risk management financing in Mexico, as well as its jurisdiction. The working mechanisms through which

these instruments work will be explained along this section.

Asset	Ex-ante			Ex-post	
	Mitigation	Insurance	Reinsurance	Reconstruction	Aid
Private	FOPREDEN	AGROASEMEX <ul style="list-style-type: none"> • Subsidy to crop premiums contracting • Advises Fondos FAPRACC <ul style="list-style-type: none"> • Only for small-scale farmers, administrated by the Ministry of Agriculture 	AGROASEMEX <ul style="list-style-type: none"> • For Fondos, • For Private companies 	FAPRACC <ul style="list-style-type: none"> • Only for small-scale farmers, administrated by the Ministry of Agriculture. 	STATE GOVERNS. FAPRACC (wage compensation payments)
Public	FOPREDEN	Private insurers and <i>Aseguradora Hidalgo</i> (public)	Through large Reinsurance Companies	FONDEN	N.A.

Figure 6. Public instruments for risk management financing to natural disasters in Mexico (2003, by type of asset at risk)

FONDEN

FONDEN is a fund to permit access to governmental agencies to financial resources after a disaster occurs, both at municipal, state and federal level. The fund is an attempt to give priority to rebuild public assets involving poor families. Only in that sense its actions might be considered as an attempt to reduce poverty.

Since its establishment in 1996, FONDEN's budget has varied widely because its payments have exceeded budget in most years (see Figure 6 below). Given the brevity of FONDEN's existence, it is still difficult to define with accuracy how much to set available for FONDEN from the federal budget, since all public resources are scarce and all federal agencies struggle for more resources, depending still on lobby capacity at a large extent. Also, resources allocation is based on the criterion of employed amount over the previous fiscal year. Some years, budget is under the level of final usage, and vice versa for years when expenditures are considerably below projected budget. For that reason, resources redirection from other programs and also from other ministries has been implemented to observe the commitment, as seen in Figure 6 below (SHCP 2000). The difference between budget and expenditures generates a gap, which has been closed by redirecting

resources from usually social programs⁶. FONDEN's annual average budget averages ca. US\$ 600 million. The table below selected the years from FONDEN establishment (1996) to 2001, and also 1982 and 1985, years of a volcanic eruption in the state of Chiapas, and of an earthquake in Mexico City, respectively, with considerable economic losses compared to GDP and as share of public expenditure.

However, given FONDEN's insufficiency to deal with both public and private assets financing for reconstruction over its first 6 years of existence, the Mexican government decentralized resources providing to federal ministries and further involved public entities. From year 2003, FONDEN is responsible for financing only public assets, whereas for private the respective ministry or public agency. Insurance contracting is responsibility of each public entity (Ministry, organism, state and municipal governments, public enterprises, etc.). They can choose the best way of insuring according to own needs.

⁶ Regarded to this kind of decision, see Reglas de Operación del FONDEN 2002.

	1982	1985	1996	1997	1998	1999	2000	2001
Losses	314	4,160	5	448	670	1,221	304	271
Losses/GDP	0.14%	2.25%	0.00%	0.10	0.14%	0.22%	0.05%	0.04%
FONDEN disbursements	--	--	195	431	463	427	531	73
FONDEN / Losses	--	--	3900%	96%	69%	35%	175%	27%
Losses / Pub. Exp.	1.16%	15.4%	0.00%	0.09%	0.12%	0.19%	0.04%	0.03%

Figure 7. Indicators on Natural Catastrophes Financing in Mexico, selected years(mill. US\$) With data from Ministry of Finance, Ministry of the Interior (CENAPRED and FONDEN), INEGI and WB

AGROASEMEX

From its part, AGROASEMEX is the state-owned crop insurance company, which currently manages and concedes subsidy for crop insurance premiums to farmers' mutual arrangements of insurance (*Fondos*) and is also responsible of advising FAPRACC, the crop insurance mechanism from the Ministry of Agriculture aimed at subsistence producers. Both individual farmers and *Fondos* get AGROASEMEX subsidy by contracting premiums from private insurers (see Appendix 3).

AGROASEMEX acts also as re-insurer for private companies and for *Fondos*. *Fondos* work mainly along low-income regions of the country. Covered risks include drought, excess moisture (due to floods, heavy rains, etc.), frost, hail, fire, wind, and also plant infestations, impossibility to cultivate, non-germination, and livestock diseases, accidents, incapacity, and forced sacrifices. The products offered by *Fondos* are described below in Figure 8. These products have multi-peril coverage, aimed to hedge of both yield and revenue-related risks.

Type	Coverage	Remarks
Insurance to investments	Amounts of investments on the crop	Technological equipment and infrastructure improvements.
Insurance to investments adjustable to living stock	Payable at the moment of the disaster certification	
Insurance by plant	Hedges plant value to climate risks	An agreed price is stipulated
Insurance to expected harvest at agreed price	Pays indemnity for yield loss, adjusted to commercial price,	i.e. per kilo
Insurance yield	Pays indemnity when realized yield is under trigger yield due to cost increment.	Insurance yield is an estimate of the long-run average yield based upon the actual production history for the insurance unit. ⁷

Figure 8. Types of insurances operated by Fondos. Source: AGROASEMEX 2002

⁷ In the USA, for instance, the Crop Insurance Reform Act of 1994 authorized the Federal Crop Insurance Corporation (FCIC) to enlarge coverage up to 85 percent in certain circumstance, but its coverage typically ranges from 50 to 75 percent of the expected yield in 5 percent increments (Skees 2000).

The scope of AGROASEMEX in terms of covered area and insured farmers is still modest compared to the 80s and 70s. In the 80s, ca. 7 million crop hectares were covered by the insurance subsidy of AGROASEMEX (that time ANAGSA), whereas in the first three years of the present decade it accounts for less than a half of that (see Figure 9, right graph).

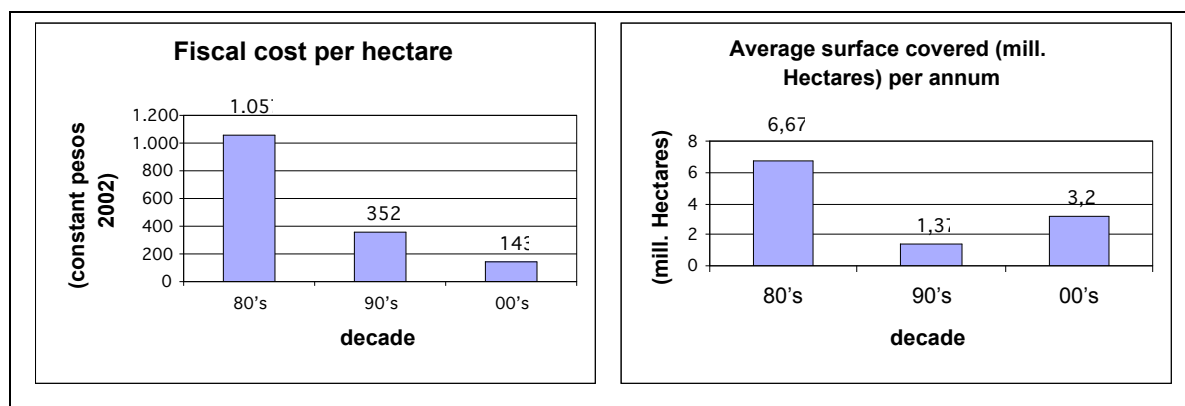


Figure 9. Agricultural coverage of the subsidy along decades(*) Source: AGROASEMEX 2003

(*) 00's are estimations corresponding the period 2000-2003

However, in the decades previous to the 90s, agricultural insurance was inefficient due to lack of surveillance, high moral hazard, and rent seeking from some economic agents. Lack of surveillance led to misestimating risk, and therefore made distortions in premia pricing (Wenner and Arias 2000). The allocation of subsidies for agricultural insurance in Mexico over the 80's showed signs of bad management (see Appendix 2 for details), which turned AGROASEMEX into a loss-making entity (Skees 2000). Though with the said less coverage, after its reform in the 90's, the company has now a financial surplus.

Compared to the crop insurance system of the past, *Fondos* works in a decentralized frame from the 90s, with also a risk of excessive atomization and exclusion. One of the main negative characteristics of that is the high figure of farmers that cannot get into a *Fondo*. Due to their lack of solvency, they are usually rejected by existing *Fondos*. So, support for agricultural insurance premia is unequally earmarked, since there are relatively more resources spent on medium and large-scale farmers than on small farmers, while most Mexican farmers belong to the latter category.

Also, government subsidies to crop insurance premia have only been relevant to farmers in 10% of Mexico's cultivated area during the 1990's, whereas during the 1980's the subsidy reached 40% of the area. In addition, only 25% of cultivated area gets access to some

financing. Thus, three-fourths of total crops in Mexico are currently out of institutional hedge and 90% uninsured.

FAPRACC

As discussed above, farmers without ability to contract insurance, and without solvency to be members of a *Fondo*, remain without insurance coverage and usually highly exposed to disasters, as currently happens to most of farmers in Mexico. If they had access to credit they could probably manage agricultural risk better, but when they do not have the means to afford nor credit as currently with 85% of producers (INEGI 2004), that risk has to necessarily be internalized. AGROASEMEX and the Ministry of Agriculture started in 2003 implementing a program to deal with that, hedging these farmers indirectly by two ways: ex-post, paying indemnities after disaster, and ex-ante, subsidizing crop insurance premiums. The program is known as FAPRACC, Spanish acronym of Fund to Attend Damaged Population due to Climatic Contingencies (*Fondo para Atender a la Población Afectada por Contingencias Climatológicas*). The program is based on a system aimed at reaching only the poorest farmers.

In the case of indemnities payment, the start point to determine a disaster occurrence is the definition of meteorological parameters. Exceeding certain weather threshold, e.g. mm of rain, temperature ranges, etc. a disaster state can be declared. Afterwards, all damaged

agricultural producers listed as low-income population are eligible to get the support (upon request). The authorities responsible for that initial selection are the states (provinces), which in turn request the resources to the Federal Ministry of Agriculture. The system is programmed to provide the resources to the state authorities at latest in three weeks. At state level is still unknown how long the support lasts to reach affected farmers. It also varies widely from state to state. This ex-post support is temporal, since only corresponds to one event. Also, resources disbursement is shared by the federal and state governments at 70-30%, respectively (DOF 2003: Art. 7). The program includes direct support to agriculture, livestock, and fisheries, granted (1) per crop hectare, livestock unit, or damaged boat, depending activity; (2) by wage in case of mitigation works; and (3) for catastrophic insurance contracting.

Conditions for insurance contracting are responsibility of state governments, who in turn can request support for catastrophic crop insurance to the federal government, based on research conducted together with AGROASEMEX, as well as complemented by information provided by the Water National Commission (*Comisión Nacional del Agua*), as well as by interested producers. Beneficiaries must accomplish all requirements stated in Operation Rules of FAPRACC (DOF 2003, Art. 4), which in general demand being small-scale producer (in accordance to defined ranges). Agreed parameters of climate risks rule the insurance contract, and the eventual beneficiary of catastrophic crop insurance (*Seguro Agrícola Catastrófico*) should renounce to additional benefits of FAPRACC in case a covered disaster occurs.

Despite its novel design, FAPRACC spent less than 1% on insurance in year 2003, whereas over 90% on indemnities for reconstruction. These indemnities were needed, but the penetration of insurance seems to still be low considering existing hazard exposure and individual economic vulnerability of subsistence farmers.

FOPREDEN

Currently, an initiative is being implemented in Mexico to establish the Fund for Disasters Prevention, FOPREDEN (*Fondo de Prevención de Desastres*), which is a federal fund to provide financing to mitigation works and research on mitigation, based on efficiency and feasibility analysis. Unlike FONDEN, FOPREDEN is designed to be an instrument for disaster avoidance through encouraging mitigation works of insurance. Projects should be proposed by state governments, federal ministries or federal organisms in form of application,

afterwards a scientific committee reviews each initiative (DOF 2003, ARFOPREDEN, Art. 9) to finally be passed by the Assessment Council for final approval (Art. 11). In case of state-proposed projects, FOPREDEN contributes with 70% of the project cost, and the state pays the remaining 30%, whereas the contributions accounts at 50-50% in case of projects projected by ministries and other public organisms (Art. 5). Projects are restricted to one per year for proposing entity and up to a defined financial roof determined by FOPREDEN attaining budget restrictions. However, FOPREDEN is still a practically unused instrument to reduce vulnerability to natural disasters.

In balance, despite its sophisticated design, governmental instruments to hedge from disasters concentrate on average over 90% resources in reconstruction, while ex-ante instruments still have a very modest implementation. It might be due to lack of risk assessments at municipal and state levels, and consequently it leads to underestimate prevailing vulnerability to disasters. So, even if the decentralization process initiated in the 90s (i.e. *Ramo 33*) has brought benefits concerning self-sufficiency and autonomy to local governments to manage resources, but it has also meant excessive atomization and unattended tasks.

Also, disbursements to deal with losses from natural disasters in Mexico have not brought clear contributions to vulnerability reduction of the poor over the past ten years. There is a widespread recognition among governmental officials responsible for social programs about the relevance of integrating a disaster reduction strategy to meet overall goals of poverty reduction strategies. However, there is as well limited optimism concerning the scope of governmental programs given the identification capacity to reach targeted poor population.

4. Conclusions

Lack of an integral vision on the risk exposure of Mexican agriculture and the respective to address it renders some financial instruments mere transitory instruments to deal with poverty, inequity, and vulnerability in the countryside. Even when Mexico can be considered as very advanced in terms of prevention and preparedness compared to other developing countries with similar conditions, its response is still insufficient given hazard exposure, prevailing levels of poverty, inequity and, in general, of high economic vulnerability to disasters in the agricultural sector.

The vulnerability to natural disasters in Mexico is only one indicator of structural economic failures in the country. These failures are linked to inequity and lack of long-term sustainability of some social programs and subsidies, as well as to the overall reduction of governmental support to agriculture along the past fifteen years. This work is useful in that it identifies economic vulnerability in the countryside and entitlement limitations, as well as its affectation on rural incomes, comparing among current governmental alternatives to deal with that vulnerability. In general, vulnerability assessments could greatly contribute to really achieve sustainable progresses if integrated into a broader policy of economic development.

One way to make a more efficient allocation of public resources on poverty and disaster reduction is to focus more in improving long-term assets of the rural poor, but without putting at risk immediate relief provision. In many cases, asset improvement does not a greatly increase the budget, but it does require a more coordinated and consolidated way of working of governmental agencies, both among federal ministries, and between federal, regional and local governments. A coordinated poverty reduction program, accompanied by an agricultural development strategy incorporating natural disaster risk planning, is crucial. The assessment of existing public mechanisms to deal with damages from disasters made by this research work reveals high concentration on aid to the poor and reconstruction, that is, on basically ex-post instruments. However, a more active promotion of ex-ante instruments might be a way to overcome the temporality that currently limits the scope of disaster reduction strategies in the country, as well as of improving assets of the poor in a long-term sustainable manner.

Resources allocation to help reduce the inequity gap among economic agents is also required. Instead, along the past twenty years, subsistence farmers in Mexico have got each time less overall support. The same trend has been observed in case of crop insurance subsidy, which tough helped to reduce deficits and turned into a more selected policy instrument, has reached fewer beneficiaries. Also, current public support to deal with agricultural vulnerability to disasters does not clearly reach the poorest areas.

From its part, increasing uncertainty in trade conditions given trade liberalization and productive vulnerability are factors that undermine rural economy and press out migration as adapting strategies of subsistence farmers over the past two decades. In this regard, public expenditure could be selectively expanded to strengthen trade conditions and to improve strategies guarantying

fair trade. Market conditions in Mexican agriculture are contributing to decrease real rural incomes of the poor. Support to reduce vulnerability to natural disasters in the countryside can revert part of the problem, and could improve performance by differentiating among economic agents. FAPRACC, the Fund to Attend Damaged Population due to Climatic Contingencies, has enormous potential in this way by means of agricultural insurance. Investments in mitigation could valuably contribute to reduce long-term vulnerability by promoting instruments like FOPREDEN, the Federal Fund for Disasters Prevention, which could thus become highly effective as development promoter by undertaking actively mitigation works in the countryside setting assets of the poor strengthening as priority.

REFERENCES

- Albalá-Bertrand, J.M. (1993). *The political economy of large natural disasters*. Clarendon Press Oxford. Oxford.
- Adams, R. H., and He, J. J. (1995). *Sources of Income Inequality and Poverty in Rural Pakistan*. International Food Policy Research Institute. Research Report 102. Washington, DC.
- AGROASEMEX (2003). *Informe de Cierre de las Operaciones del Sistema Nacional de Aseguramiento al Medio Rural en el Año Fiscal 2002; Migración al Segundo Piso; Consolidación como Reaseguradora; Fortalecimiento en actividades de fomento; Que son y como operan los fondos de aseguramiento, and; Portafolio de Servicios*. Working Papers. Mexico City.
- AGROASEMEX (2002). *Manual de Normas y Procedimientos para la Constitución de los Fondos de Aseguramiento*. Mexico City.
- Arriagada, Camilo (2000). *Pobreza en América Latina. Nuevos escenarios y desafíos de políticas para el hábitat urbano*. División de Medio Ambiente y Asentamientos Humanos. CEPAL. Santiago.
- Attanasio, O. & Szekely, M. (1999). *La pobreza en América Latina. La pobreza basada en los activos. El trimestre económico, pobreza y activos en América Latina, Vol. LXVI (3), No. 236*. Fondo de Cultura Económica (FCE). Mexico City.
- Benson, C. and Clay, E. *Disasters, Vulnerability and the Global Economy*. In: *The Future of Disaster Risk: Building Safer Cities*, Conference Papers. Edited by Kreimer, A., Arnold, M., and Carlin A..The World Bank. Washington, DC.

- Bitrán, D. (2001). Características del impacto socioeconómico de los principales desastres ocurridos en México en el periodo 1980-1999. Serie Impacto Socioeconómico de los desastres en México. Coordinación de Investigación, Centro Nacional de Prevención de Desastres, Sistema Nacional de Protección Civil (Secretaría de Gobernación). Mexico City.
- Briguglio, L. (2002). The Economic Vulnerability of Small Island Developing States. In: Sustainable Development for Island Societies: Taiwan and the World, Asia Pacific Research Program w/SARCS Secretariat Publication. Taiwan.
- Briguglio, L. (1992). Preliminary study on the construction of an Index for ranking countries according to their economic vulnerability. Report to UNCTAD, 1992.
- Butterfield, G. (1998). Workers World. Hurricane Georges: A tale of two systems. October
- Cannon, Terry (1994). Vulnerability Analysis and the Explanation of 'Natural' Disasters. In: Varley, Anne. Disasters, development and environment. Ed. John Willey & Sons. Chichester.
- Card, D., Krueger, A. (1996). Labor market effects of school quality.: theory and evidence. In: Gary Burtless (ed.), Does money matter?: the effect of school resource on student achievement and adult success. Brookings Institution. P. 97-140. Washington, DC:
- CENAPRED -Centro Nacional de Prevención de Desastres (2001). Diagnóstico de peligros e identificación de riesgos de desastres en México: Atlas Nacional de Riesgos de la República Mexicana. Ministry of the Interior of Mexico. Mexico City.
- Caballeros, R. and Zapata, R. (1995). The impacts of natural disasters on developing economies: implications for the international development and disaster community. Disaster Prevention for Sustainable development. ECLAC, Mexico City.
- Chambers, R. (1989) Vulnerability, Coping and Policy." IDS Bulletin 20:1-7.
- Colosio Murrieta, Luis Donaldo (1979). Urbanization and Economic Development in Mexico. International Institute for Applied Systems Analysis (IIASA). Working Paper. Laxenburg, Austria.
- DOF - Diario Oficial de la Federación (2003). Reglas de Operación del Programa del Fondo para atender a la Población Afectada por Contingencias Climatológicas (FAPRACC). Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación.. Mexico City.
- DOF - Diario Oficial de la Federación (2002). Reglas de Operación del Subsidio a la Prima del Seguro Agropecuario and Lineamientos para Aplicación de las Reglas de Operación del Programa de Subsidio a la Prima del Seguro Agropecuario. 15 de marzo. Mexico City.
- DOF – Diario Oficial de la Federación (2001). Reglas de Operación del FONDEN 2002.
- DOF - Diario Oficial de la Federación (2000) Reglas Generales para la Constitución, Operación y Funcionamiento de los Fondos de Aseguramiento Agropecuario, de vida campesino y Conexos de Actividad Agropecuaria. 8 de junio, Mexico City.
- Dilley, M. and Boudreau, T. E. (2001). Coming to terms with vulnerability: a critique of the food security definition. Food Policy 26.
- Cardenas, Enrique (1992). Historia Economica de México. México, Fondo de Cultura Economica. El Trimestre Economico, 3 Volumen. México City.
- Cannon, Terry (1994). Vulnerability Analysis and the Explanation of 'Natural' Disasters. In: Varley, Anne. Disasters, development and environment. Ed. John Willey & Sons. Chichester.
- CNA – Comisión Nacional del Agua (1998). Anuario Estadístico sobre Control y Manejo de Aguas en la República Mexicana 1997.
- COPA/COGECA (2002). Discussion Paper on Risk Management and Agricultural Insurance in the European Union. Madrid, May.
- De Janvry, A. & Sadoulet, E. (2000). Income strategies among rural households in Mexico. The role of Off-farm activities. World Development.
- Desinventar - LaRed (2003). Red de Estudios Sociales en Prevención de Desastres en Américas Latina. <http://www.desinventar.org/desinventar.html>
- Dilley, M. and Boudreau, T. E. (2001). Coming to terms with vulnerability: a critique of the food security definition. Food Policy 26.
- Economic Commission for Latin America and Caribbean Countries, ECLAC (2003). Panorama Social de América Latina 2002-2003. Pobreza y distribución del ingreso. Santiago de Chile.
- Economic Commission for Latin America and Caribbean Countries, ECLAC (2001a). Instituciones y pobreza rurales en México y Centroamérica. LC/MEX/L.482. P. 30.

- Economic Commission for Latin America and Caribbean Countries, ECLAC (2001b). *Economic Survey of Latin America and the Caribbean 1999-2000*. Santiago de Chile.
- Fein, J. C. H., Ranis, G. (1964). Development of the labor surplus economy: theory and policy.
- Fei, J. C. and Ranis, G. (1961). A theory of economic development. *American Economic Review* 51: 533-565.
- French-Davis, R., 1989. *Ajuste y Agricultura en la America Latina: un examen de algunos temas ECLAC. El Trimestre Economico Vol LVI*. Mexico, D.F.
- Figueroa, Adolfo (1991). Desarrollo agrícola en la America Latina. *El Desarrollo desde adentro*. In: *El Trimestre Económico* No. 71. CEPAL. Ed. Fondo de Cultura Económica. Mexico City.
- Freeman, P., Martin, L., Bayer, J., Mechler, R., Saldana-Zorrilla, S., Warner, K. (2002). National System for Comprehensive Disaster Management, Phase 2: Financing Reconstruction. *Inter-American Development Bank Regional Policy Dialogue*.
- Freeman, P., Bayer, J., Mechler, R. et al (2001). National System for Comprehensive Disaster Management, Phase 1. *Inter-American Development Bank Regional Policy Dialogue*.
- García, V. & De la Parra, M. (2002). Desinventar y los registros sobre escasez de agua en México. 1970-2000. In *Nueva época*. Año 7, septiembre-diciembre 2002. CIESA. Mexico City.
- Gordillo, Gustavo (1988). *Campesinos al asalto del cielo*. Ed. S. XXI. Pp. 130. Mexico.
- Guy Carpenter (2003). *The World Catastrophe Reinsurance Market: 2003*. September.
- Harwood, I., et al. (2000). From Risk Pooling to Safety Nets: Crop and Revenue Issues in the United States. In: *Income Risk Management in Agriculture. Agriculture and Food*. OECD. Paris.
- Hernández Trujillo, José Manuel (1997). Evaluación y perspectivas de los fondos de aseguramiento agropecuario (Assessment and perspectives about insurance crop Funds). Departamento de Economía. UAM-Azcapotzalco. Mexico City.
- INEGI (2003a) National Institute of Statistics, Geography, and Informatics. *Estadísticas del Comercio Exterior de México. Información preliminar enero-abril 2003*. Aguascalientes, Mexico, June 2003.
- INEGI (2003b) National Institute of Statistics, Geography, and Informatics. *Anuario de Estadísticas por entidad federativa*. Ed. 2003. Cap. Agricultura, ganadería, pesca y silvicultura. [http://www.inegi.gob.mx/difusion/espanol/bvinegi/aepef/AEPEF%202003%20\(parte%202\).pdf](http://www.inegi.gob.mx/difusion/espanol/bvinegi/aepef/AEPEF%202003%20(parte%202).pdf)
- INEGI (2003c) National Institute of Statistics, Geography, and Informatics (2003): <http://www.inegi.gob.mx/est/contenidos/espanol/tematicos/mediano/med.asp?t=agro01&c=4790>
- INEGI (2000) National Institute of Statistics, Geography, and Informatics (2000). *Anuario de Estadísticas por entidad federativa*. Ed. 2000. Aguascalientes <http://www.inegi.gob.mx/difusion/espanol/bvinegi/aef/indef.pdf>
- Kelly, P. M. and Adger, W.N. (2000). Theory and Practice in Assessing Vulnerability to Climate Change and Facilitating Adaptation. *Climate Change* 47.
- Kaminsky, G. and C.M. Reinhart (1996): "The twin crises: the causes of banking and balance-of-payments problems." *International Finance Discussion Paper No. 544* Washington, D.C.: Board of Governors of the Federal Reserve System (March).
- Kreimer, A., Arnold, M., Barham, C., Freeman, P., Gilbert, R., Krimgold, F., Lester, R., Pollner, J., Vogt, T. (1999). *Managing Disaster Risk in Mexico: Market Incentives for Mitigation Investment*. The World Bank Disaster Management Facility. Washington, D.C.
- Kunreuther, H. and Lineroth-Bayer, J. (2003). The Financial Management of Catastrophic Flood Risks in Emerging-Economy Countries. *Special Edition on Flood Risks in Europe. Risk Analysis*, 23.
- Lederman et al (2003). *Lessons learned from NAFTA*. The World Bank Group. Washington, DC.
- Lewis, W. A. (1954) Economic development with unlimited supplies of labor. *Manchester School* 22: 139-131. Manchester.
- Lineroth-Bayer, J. and Amendola, A. (2000). Global Change, Natural Disasters and Loss Sharing: Issues of Efficiency and Equity. *The Geneva Papers on Risk and Insurance*, 25.
- Lineroth-Bayer, J. (1999). Climate Change and Multiple Views of Fairness. In: Ferenc L. Toth (ed.) *Fair Weather? Equity Concerns in Climate Change*. Earthscan Publications Ltd. London.
- Mechler, R. (2003). *Natural Disaster Risk Management and Financing Disaster Losses in Developing Countries*. Fakultät für Wirtschaftswissenschaften,

- Universität Karlsruhe (TH), Ph.D. thesis (<http://www.ubka.uni-karlsruhe.de/cgi-bin/psview?document=2003/wiwi/2>).
- Milenio magazine. "Dificultades del agro mexicano de cara a la primera década de TLCAN. No. 277. January 2003. Mexico, D.F.
- Montserrat, H. and Chavez, M. (2003). Tres Modelos de Política Económica en México durante los últimos sesenta años. In: *Análisis Económico* No. 37., Vol. XVIII. Universidad Autónoma Metropolitana. Mexico City.
- OECD (2003). *Environmental Risks and Insurance: a comparative analysis of the role of insurance in the management of environment-related risks*. Policy Issues in Insurance No. 6. Paris.
- OECD (2000). *Income Risk Management in Agriculture*. Agriculture and Food. Paris.
- OECD (1997). "Twenty Guidelines For Insurance Regulation And Supervision In Emerging Economies...". Book 1. Insurance Committee Secretariat.
- OAS - Organization for American States (2002). *Unit for Sustainable Development and Environment. Natural hazard assessment*.
- Personal communication with personnel from the Secretaría de Gobernación of Mexico (Ministry of the Interior): Dirección General de Protección Civil, Centro Nacional de Prevención de Desastres, Fondo Nacional para Desastres, and Dirección de Investigación de CENAPRED.
- Prebisch, Raúl (1950). *The economic development of Latin America and its principal problems*. United Nations, New York.
- Prebisch, Raúl (1951). *Problemas teóricos y prácticos del crecimiento económico*. Santiago.
- Prebisch, Raúl (1973). *La cooperación internacional en la política de desarrollo latinoamericano*, Serie Conmemorativa del XXV Aniversario de la CEPAL, Santiago de Chile, CEPAL. Publicado originalmente en agosto de 1954.
- Ravillon M. and Datt, G. (1996). How important to India's poor is the Sectoral Composition of Economic Growth?. *World Bank. Economic Review*. Vol. 10 (1).
- Rizzuto, R., and Wachtel, P. (1980). Further evidence on the returns to school quality. *Journal of Human Resources*. P. 240-54
- Robinson, S., Burfisher, M., Thierfelder, K. (1995). *The impact of the Mexican crisis on trade, agriculture, and migration*. Trade and Macroeconomic Division. International Food Policy Research Institute. Washington, DC. <http://www.ifpri.org/divs/tmd/dp/papers/tmdp08.pdf>
- Rodriguez, Octavio (1980). *La teoría del subdesarrollo de la CEPAL*. Ed. Siglo XXI. Mexico, City.
- Saldaña-Zorrilla, Sergio O. (2003). *El Comercio México-Unión Europea*. In: *Análisis Económico* No. 37., Vol. XVIII. Universidad Autónoma Metropolitana-Azcapotzalco. Mexico City.
- Saldaña-Zorrilla, Sergio O. (2000). *Consideraciones de política agrícola en México*. Bachelor thesis. Departamento de Economía. Universidad Autónoma Metropolitana-Azcapotzalco. Mexico City.
- Sarris, Alexander (2001). *The Role of Agriculture in Economic Development and Poverty Reduction: an Empirical and Conceptual Foundation*. Rural Development Department. The World Bank Group. Rural Strategy Background Paper No. 2. Washington, DC.
- Skees, J., Varangis, P., Larson, D., Siegel, P. (2002). *Can financial markets be tapped to help poor people cope with weather risks?* The World Bank. Development Research Group Rural Development. Washington, D.C.
- Skees, J. R. (2000). *Agricultural Insurance Programs: Challenges and lessons learned*. Workshop on Income Risk Management. Session 4: from Risk Pooling to Safety Nets: Insurance Systems. OECD, Paris. 15-16 May.
- SAGAR (1998). *Situación actual y perspectiva del frijol en México 1990-1998*. Working papers. Centro de Estadística Agropecuaria SAGAR y SIC-M, SECOFI. Mexico City.
- Saldaña-Zorrilla, Sergio O. (2003). *El Comercio México-Unión Europea*. In: *Análisis Económico* No. 37., Vol. XVIII. Universidad Autónoma Metropolitana-Azcapotzalco. Mexico City.
- Saldaña-Zorrilla, Sergio O. (2000). *Consideraciones de política agrícola en México*. Bachelor thesis. Departamento de Economía. Universidad Autónoma Metropolitana-Azcapotzalco. Mexico City.
- SHCP – Secretaría de Hacienda y Crédito Público (2001). *Ley General de Instituciones y Sociedades mutualistas*, Art. 13; *Ley sobre el Contrato del Seguro*, Art. 40; *Reglas Generales para la Constitución*,

- Operacion y Funcionamiento del los Fondos de Aseguramiento, de vida campesino, y conexos a la actividad agropecuaria.
- SHCP – Secretaria de Hacienda y Credito Publico (2000). Exposicion de Motivos e Iniciativa de Decreto de Presupuesto Federal de Egresos 2000. Mexico
- Sen, Amartya (1981). Poverty and famines: An essay on entitlement and deprivation. Oxford University Press. Oxford.
- Singer, H. (1950). The distribution of gains between borrowing and investing countries. *American Economic Review* 40: 473-485.
- Skees, J., Varangis, P., Larson, D., Siegel, P. (2002). Can financial markets be tapped to help poor people cope with weather risks? The World Bank. Development Research Group Rural Development. Washington, D.C.
- Skees, J. R. (2000). Agricultural Insurance Programs: Challenges and lessons learned. Workshop on Income Risk Management. Session 4: from Risk Pooling to Safety Nets: Insurance Systems. OECD, Paris. 15-16 May.
- Skees, J. R. (1999). Conceptual and Practical Considerations of Sharing Catastrophic/Systemic Risks. *Review of Agricultural Economics*.
- Stiglitz, Joseph (2000). *Economics of the public sector*. Third edition. W.W. Norton. New York.
- Szekely, M., Lustig, N., Cumpa, M., Mejia, J.A. (2000). Do we know how much poverty there is? Inter-American Development Bank. Working paper #437. Washington, DC.
- Tejo, Pedro (2000). La pobreza rural. Una preocupación permanente en el pensamiento de la CEPAL. Red de Desarrollo Productivo. Unidad de Desarrollo Agrícola. División de Desarrollo Productivo y Empresarial. ECLAC. Santiago.
<http://www.eclac.cl/publicaciones/DesarrolloProductivo/4/lcl1454/LCL1454P.pdf>
- The Economist (2003). Can people learn to be as rational as economic theory supposes? In: *Economic focus*. August 30th 2003. Volume 368 Number 8339. London.
- The Economist, November 2002. London, U.K.
- Timmer, C. P. (1997). How well do the Poor connect to the Growth Process? CAER Discussion Paper No. 178. Harvard Institute for International Development. Cambridge, Massachusetts. The MIT Press.
- Todaro, M. P. (2000). Urbanization and Rural-Urban Migration: Theory and Practice. In: *Economic Development*. Seventh Edition. Ed. Addison Wesley Longman. Essex.
- Todaro, Michael P. (1982). *Economics for a Developing World*. Second edition. Ed. Longman Group Limited. Essex, UK.
- Turner, B. L. et al. (2003). A Framework for Vulnerability Analysis in Sustainability Science. 8074-8079 PNAS. July 8, 2003. Vol. 100. No. 14.
www.pnas.org/cgi/doi/10.1073/pnas.1231335100
- UNCTAD (2003). Economic Vulnerability: the UN approach to the economic vulnerability of Least Developing Countries: implications for Asian and Pacific LDCs. Economic and Social Commission for Asia and the Pacific. Pp. 2-7. October 2003, Bangkok.
- UNCTAD (2001). Third United Nations Conference on the Least Developed Countries, Brussels, Belgium, 14-20 May 2001. Programme of Action for the Least Developed Countries. Adopted by the Third United Nations Conference on the Least Developed Countries in Brussels on 20 May 2001. Pp. 43-46.
- United Nations Framework Convention on Climate Change (2002). Poverty and Climate Change: reducing the vulnerability of the poor. Consultation draft, a contribution to the eight conference on climate change. October 2002.
- UNDP (2003). Human Development Report 2003. In: Millennium Development Goals: A compact among nations to end human poverty Human Development Index. http://www.undp.org/hdr2003/pdf/hdr03_HDI.pdf
- US Census Bureau- CMS 2002. Web site.
- Vatsa, Krishna S. and Krimgold, Frederick (2000). In: *Managing Disaster Risk in Emerging Economies; "Financing Disaster Mitigation for the Poor"*. The World Bank.
- Wenner, M. and Arias, D. Agricultural Insurance in Latin America: Where Are We? Paving the way forward for rural finance. An international conference on best practices. Risk Management: Pricing, Insurance, Guarantees. Inter-American Development Bank. Washington, DC.
- Wenner, M., Proenza, F. (2000). Rural Finance in Latin America and the Caribbean: Challenges and Opportunities. Working Paper, Inter-American Development Bank. Department of Sustainable Development. Washington, DC.

Wodon, Quentin and Velez, Eduardo (2000). Poverty and Inequality (Chapter 3). In: Mexico: A Comprehensive Development Agenda for the New Era. The World Bank Group. Washington, DC.

World Resources Institute 1996-1997: The urban environmental (New York: Oxford University Press) tab. 1.1; United Nations, World Urbanization Prospects.

World Bank (2004a). Poverty in Mexico: an assessment of conditions, trends, and government strategy. Report No: 28612. Mexico City.

World Bank (2004b). Memorandum of the president of the IBRD and the IFC to the Executive Directors on a Country Assistance Strategy of the World Bank Group in partnership with the United Mexican States. Colombia and Mexico Country Management Unit. Latin America and the Caribbean Region.

World Bank (2002). Country assistance strategy of the World Bank Group for the Mexican United States, 2002. Washington, DC.

World Bank (2001). "World Bank Development Indicators." World Bank, Washington, DC.

World Bank, Guy Carpenter & Co. Inc., EQECAT, and IIASA (2000). Managing the financial impacts of natural disaster losses in Mexico. Report prepared for the Government of Mexico.

World Bank (1994) Staff Appraisal Report of Rainfed Areas Development Project http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/B/1994/06/15/000009265_3961005144507/Rendered/PDF/multi0page.pdf. June 1994. Agriculture Operation Division. Country Department II. Latin-America and the Caribbean Regional Office.

Yap, Josef T. (2002). Monitoring Economic Vulnerability and Performance: Applications to the Philippines. Philippine Institute for Development Studies. Thailand Development Research Institute. Manila.

APPENDIX 1. Summary of stakeholder consultation

The purpose of the visit was to establish contact with policymakers from the Mexican government and to enhance existing relation with key stakeholders concerned to natural disasters, poverty and rural development as part of the ProVention Consortium-World Bank Project. The opportunity to hold interviews with these people was prepared by means of sending a brief summary of the project before the visit, as well as some key questions about the interview's matter. The result of

the visit was very positive. There is a widespread concern in Mexico about natural disasters, but it is not well addressed to date. For that reason this project was considered highly valuable and interesting due to its linkage to poverty and rural areas. In general, Mexican authorities expressed willingness to cooperate by providing data and by further consultation. Interviews were recorded in four audiocassettes, and are briefly described as follows.

Also, I want to express my special acknowledgement to the Deputy Minister of Rural Development at the Ministry of Agriculture, Ing. Antonio Ruíz García; to the National Coordinator of Social Programs Recipients at the Ministry of Social Development, Lic. Luis Francisco Mejía Piña; and to the Director General of AGROASEMEX, Lic. Salvador Mayoral, due to the valuable orientation and insights they provided to the execution of this research.

My first visit was to Roberto Quaas, Director General of the National Center for Disasters Prevention (CENAPRED) at the Ministry of the Interior. I had contacted him two years ago in order to get elemental statistic on losses from natural disasters in Mexico for my research. I briefly discussed project's program, emphasizing the areas, which Quaas might be most involved in: reducing financial vulnerability, mitigation and risk transferring. From this interview it is relevant that (except for civil protection and identification of human settlements at risk), CENAPRED does not really deal with socioeconomic implications of natural disasters in a broader perspective.

The interview with the Under-minister of Rural Development at the Ministry of Agriculture (SAGARPA), Antonio Ruiz-Garcia, was very productive, since it explored all current issues and limits on natural disasters in the countryside. Under-minister Ruiz-Garcia took advantage of the interview, which lasted two hours, to involve the Director General of Planning in the discussion, who contributed by explaining crop insurance mechanisms developed by the Ministry, as well as by providing me access to data basis on natural disasters. On the same day, I held an interview with the Director General of International Affairs at this Ministry, who attended the interview in representation of the Minister of Agriculture.

The visit to the Ministry of Social Development (SEDESOL) consisted of an interview with the National Coordinator of Social Programs Recipients, Lic. Luis Francisco Mejía Piña, in presence of the Director of Research for Development, Lic. Miguel Limon. This

meeting provided with many highlights about current needs of the Mexican government about disasters and poverty, as well as of valuable data for this project. After the meeting, Mr. Mejia offered support for our project. He is very interested to contribute to such a project even beyond this first phase. He also expressed willingness to contribute to any event related to natural disasters, poverty and/or economic development from the ProVenton Consortium and the World Bank.

I met Lic. Salvador Mayoral, Director General of AGROASEMEX, the public crop insurance company, which depends on the Ministry of Finance. He had shown much enthusiasm since the first contact, what was corroborated during this interview. Mr. Mayoral's team is assessing several countries (governments and private companies) worldwide on catastrophic insurance, where AGROASEMEX is considered one of the major programs globally. He offered cooperation with this project, and also provided me with valuable technical documents, basically working papers and normative rules regarding AGROASEMEX. In general, he expressed to be pleased with this project, since consider it an integrating and innovative work, from which decision taking might be better supported when planning public policies in Mexico.

APPENDIX 2. International comparison of financial performance of crop insurance

The experience of ANAGSA -AGROASEMEX's predecessor- compared to other selected countries, evidences negative financial results during the 80s, as presented in Table 2.1 below. Average payouts (indemnities plus administration costs) greater than average premiums paid means net loss for the scheme (Hazell 1992). In the case of Brazil, the ratio is extreme high (4.29), but the most remarkable fact is that indemnities explain most of the deficit, whereas, on the other extreme, Japan 85-89 has high relative administrative cost as component of the (high too) deficit (3.57 of 4.56!). Mexico's performance looks more similar to the Brazil tendency, since the ratio indemnities/premiums are extremely high (3.18). To achieve a ratio under 1 (see Canada), some authors (like Skees 2000, OECD 2000) affirm that it requires a very high investment in obtaining the needed information.

ANAGSA had to face an extremely high number of claims for indemnification. The situation turned so financially unsustainable, that ANAGASA was closed in 1988. Under such circumstances was implemented a reform to the Mexican system. The reform incorporated a very useful self-initiative into the system to reduce public burden: mutual funds to hedge crops.

Country	Period	Indemnities/ Premiums	Administration costs/Premium	(Indemnities + Administration costs) / Premiums
Brazil	75-81	4.29	0.28	4.57
Costa Rica	70-89	2.26	0.54	2.80
Japan	47-77	1.48	1.17	2.60
Japan	85-89	0.99	3.57	4.56
Mexico	80-89	3.18	0.47	3.65
USA	80-89	1.87	0.55	2.42
USA*	1999	0.96	0.96	3.68
Canada**	98-99	0.48	0.07	0.56

Table 2.1 Financial performance of Crop Insurance Schemes in selected countries
Sources: Hazell 1992, (*) Skees 2000, (**) Saldana-Zorrilla 2003

APPENDIX 3. Governmental disbursed subsidy to agricultural insurance

Governmental disbursed subsidy to agricultural insurance, 2002 (thousand of pesos)

By means of...	TOTAL		Crop insurance		Livestock insurance	
Fondos	123,060.5	35%	117,744.8	48%	5,315.7	5%
Private Companies	226,223.2	65%	126,390.6	52%	104,832.6	95%
ACE Seguros	549.9	0%	549.9	0%	0.0	0%
Com. America	123,515.2	35%	54,819.6	22%	68,695.6	62%
Gen. De Seguros	32,524.8	9%	19,561.7	8%	12,963.1	12%
Proagro	63,330.4	18%	49,012.6	20%	19,317.8	18%
Inbursa	0.0	0%	0.0	0%	0.0	0%
Tepeyac	2,391.2	1%	2,337.7	1%	53.5	0%
Mutualidad Torreon	3,911.7	1%	109.1	0%	3,802.6	3%
TOTAL	349,283.7	100%	244,135.4	100%	110,148.3	100%

Source: AGROASEMEX 2003

When operated directly as insurer, AGROASEMEX was concerned to practically only profitable crops. In 2002, after AGROASEMEX migrated to the second floor as exclusively re insurer, only 8.8 of 21.9 million hectares are considered profitable, and only 5.0 of that is related to some financial scheme, i.e. insurance (1.9 mill. ha.). AGROASEMEX provides Non-proportional Re-insurance, which covers catastrophic events to private insurers at 50% up to exceed 120%. Re-insurance for Fondos covers loss exceeding, but by mean of analyzing each Fondo, to offer the optimal re-insurance scheme according to its particular needs, as current rules are not still modified.⁸

Appendix 4. Agricultural prices, credit granting and support to agricultural productivity

	1994	1995	1996	1997	1998	1999	2000	2001	2002
Maize real prices 1995	N.A.	815	967	796	700	616	640	607	574
Wheat real prices 1995	N.A.	850	1331	792	745	630	599	651	616
Sorghum real prices 1995	N.A.	712	1005	540	511	438	438	423	408
Credit to agriculture (mill. pesos, constant prices base 1993)	47.98	34.12	31.6	29.32	25.24	18.45	15.3	13.15	N.A.
PROCAMPO payments per ha.	1256	1127	923	842	834	805	832	859	866

Source: ASERCA, II Informe de Gobierno Vicente Fox Q., and Banco de Mexico. (*) Prices at farm gate plus marketing assistance. Maize in Sinaloa, Wheat in Sonora, Sorghum in Tamaulipas. N.A.= No available

⁸ In 2002, AGROASEMEX accumulated 12 reclamations at the National Commission for the Protection and Defense of Financial Services Users (Comisión Nacional para la Protección y Defensa de los Usuarios de Servicios Financieros) ("CONDUSEF"), which is a Public Decentralized Agency, whose purpose is to promote, advise, protect and defend rights and interest of persons utilizing or hiring financial products or services offered by financial institutions operating within the Mexican territory. 12 of 159 disasters have produced complains, what situates AGROASEMEX as number 3 in the index of reclamations per 1,000 disasters. The index includes 45 financial institutions. Source: Revista Actualidad en Seguros, No. 46. December, 2002, CNSF.

Appendix 5. Losses from disasters and GDP

There are a number of valuable papers about macroeconomic impacts from natural disasters (i.e. Albala-Bertrand 1993). However, macroeconomic impacts from natural disasters are not really clear in the case of Mexico. It is so due to the fact that average losses (1980-2002) represent 0.002% of GDP in 2002. Also, there is no correlation between loss from natural disasters and GDP level, as Figure 5.1 below shows, and also because inflation, interest rates, and further key macroeconomic variables in the Mexican economy do not apparently respond in cause-effect relation to assets diminishing due to natural disasters. In its place, this work considers relevant a microeconomic analysis, since the nature of losses from disasters, as discussed along this work, damages structural productivity in the countryside, as well as increase poverty directly by reduction of rural income flows and assets.

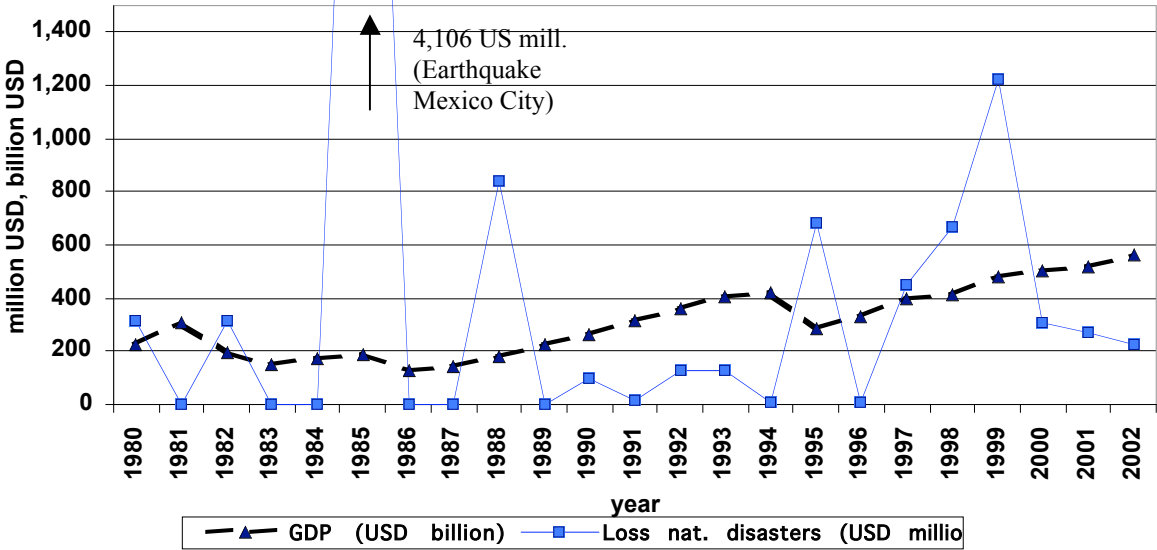


Figure 5.1 GDP compared to losses from natural disasters in Mexico