THE EFFECT OF DISASTERS ON DEVELOPMENT: VAN AND BINGOL CASE STUDIES

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ABSTRACT

THE EFFECT OF DISASTERS ON DEVELOPMENT:
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The increase of the number of natural, technological and man-made disasters and economic losses due to disasters caused an increase in significance of the studies that investigate the relationship between disaster and development. Turkey has actualized many studies after the 1999 Marmara Earthquake, however, the focus of disaster policies are still concentrated on response and reconstruction/recovery stages of disaster. 2003 Bingöl and 2011 Van earthquakes showed that disasters still cause economic burden on the economy. This study discusses disaster and development relationship within the frame of vulnerability. It explores countries at different development level to observe whether disasters are obstacles of development or disasters are opportunity for development. In this study, economic losses caused by disasters, disaster legislation and development plans of Turkey are discussed. Reasons of high economic losses in Turkey due to disasters are explored. This thesis aims to contribute to show how disasters affect the economy of different cities for the development of efficient policies on disaster risk reduction. Therefore, 2011 Van and 2003 Bingöl earthquakes, the significant disasters in terms of the number of affected people since 2000, are chosen as case studies. The change in macroeconomic variables due to earthquakes in these two provinces is investigated.

Key Words: Development, Disaster, Disaster Economy Policies, Risk Reduction,

ÖZ

AFETLERİN KALKINMAYA ETKİSİ
VAN VE BİNGÖL ÖRNEKLERİ

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Son yıllarda doğal, teknolojik ve insan kökenli afetlerin sayısının ve bunlardan kaynaklanan ekonomik kayıpların artması afetlerin ekonomik etkilerini ve kalkınma ile olan ilişkisini inceleyen çalışmaların önemini artırmıştır. Ülkemiz afetlerin ekonomik etkilerini azaltma konusunda özellikle 1999 Marmara Depremi'nden sonra birçok çalışmayı gerçekleştirmiş olsa da; afet politikaları hala müdahale ve iyileştirme odaklıdır. 2003 Bingöl ve 2011 Van Depremleri afetlerin kent ekonomisi için hala bir yük olduğunu kanıtlar niteliktedir. Bu çalışma, afet-kalkınma ilişkisini, afetlerin kalkınmaya engel olduğu veya kalkınmayı desteklediğini, gelişmişlik düzeyi farklı ülkeler üstünde yapılan çalışmalar ve zarar görebilirlik kavramı çerçevesinde incelemektedir. Türkiye'de afet ekonomisi için yapılan çalışmalar; yaşanan afet kayıpları, nedenleri, afet mevzuat çalışmaları ve kalkınma planları üzerinden tartışılmış ve ülkemizde afetlerin ekonomik kayıplarının neden fazla olduğu sorusuna yanıt aranmıştır. Bu tez, Türkiye'nin afetlerin ekonomik risklerini azaltma konusunda etkin politikalar üretmesi için afetlerin kent ekonomisini nasıl etkilediğini göstermesi amacına da katkı sağlamayı hedeflemektedir. Bu nedenle, 2000'li yıllarda çok sayıda insanı etkileyen depremlerden 2011 yılında gerçekleşen Van, ve 2003 yılında gerçekleşen Bingöl, depremleri örnek olarak seçilmiş ve depremlerin kentlerin makroekonomik değişkenleri üstündeki etkileri yorumlanmıştır.

Anahtar Kelimeler: Afet, Afet Ekonomi Politikaları, Kalkınma, Risk Azaltma.

To my family,

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LIST OF ABBREVIATIONS

CEI: Compulsory Earthquake Insurance

CGE: Computable General Equilibrium

CRED Centre for Research on the Epidemiology of Disasters

DEMP: The Prime Ministry Disaster and Emergency Management Presidency.

ECLAC: Economic Commission for Latin America and the Caribbean

EM-DAT: Emergency Events Data Base/The International Disaster Data Base

FEMA: Federal Emergency Management Agency

GDP: Gross Domestic Product

GFDRR: Global Facility for Disaster Reduction and Recovery

HFA: Hyogo Framework for Action

IMF: International Monetary Fund

IO: Input Output

JICA: Japan International Cooperation Agency

MDG: Millennium Development Goals

Mw: Moment Magnitude

NUTS: Nomenclature of Units for Territorial Statistics

OECD: Organization for Economic Co-operation and Development

SAM: Social Accounting Matrix

TCIP: Turkish Catastrophe Insurance Pool

TTB: Turkish Doctors' Union

TURKSTAT: Turkish Statistical Institute

UNDP: United Nations Development Programme

UNISDR: United Nations International Strategy for Disaster Reduction

WB: World Bank

CHAPTER 1

INTRODUCTION

1.1.Introduction

"*Disasters are primarily a problem of development, but essentially not a problem for development"* (Albala-Bertrand, 1993, p. 202).

Disasters cause social, economic, environmental, cultural and other kinds of losses. The report published in 2012 by the World Bank (hereafter WB), Global Facility for Disaster Risk Reduction (hereafter GFDRR) and Japan Policy and Human Resources Development shows that the incidence of disasters and losses has increased in number. Parallel to this increase, the number of people affected by natural disasters and economic losses shifted. The earthquakes are one of the most destructive natural disasters and have important share in economic losses of disasters. According to Lall and Deichmann (2009), there are 370 million residents in seismic areas and it might increase to 870 million by 2050. According to EM-DAT database, between 2002 and 2011, estimated damage due to earthquakes is so high that it is equal to one third of the overall damage in the world caused by all other natural disasters.

There are different factors that change the level of economic losses caused by disasters. The economic growth of country and the type of disaster are the most critical ones. Small and medium sized economies have been widely affected by disasters due to high social and economic vulnerability. It is observed that 11% of disaster prone population lives in low-level development countries and more than 53% of deaths resulting from disasters recorded in these countries (United Nations Development Programme, hereafter UNDP, 2004).

Turkey, is exposed to different types of hazards due to geomorphologic, topographic and climatic conditions and conditions of country such as planning decisions,

unplanned urbanization and construction quality turn hazards into disasters in years. However, these hazards turn to disasters such as earthquakes, rock falls, avalanches, flash floods in urban areas. According to Turkey Earthquake Hazard Zone Map, 92% of population of Turkey, 90% of city centers and 40% of dams are located on seismically active zones (Ozerdem and Barakat, 2000). Since seismic risk is high, most of the losses increased in years are caused by earthquake. During the twentieth century, 80.000 people have lost their lives and 586.000 housing units have been destroyed (Akyel, 2007). Therefore, Turkish economy has been affected significantly and sustainable development has been obstructed. As far the total cost of the disaster is equal to 1 % of GNP of Turkey is on the average (Akyel, 2007).

Turkey has experienced many disasters so far and many studies about disaster management have been conducted in years. However, there are few studies about the effects of the disasters on economic development and the contribution of the disaster risk reduction policies on economic development. Therefore, this thesis aims to reflect how economic situation of earthquake prone provinces in Turkey changes after earthquakes, by analyzing 2003 Bingöl and 2011 Van earthquakes.

This thesis includes five chapters. Following the first chapter that gives brief introduction, about the problem definition and aim of the thesis, the second chapter begins with the categorization of impact of disasters. Then, economic losses caused by disasters worldwide are analyzed. Then, the literature that describes disasters and development relations are reviewed. Especially the difference between developed and developing countries in terms of economic effect of disaster is explored. Moreover, existing models that are in use in the literature on the economic effects of disasters on various countries are examined.

The third chapter starts with country earthquake profile and economic losses of earthquakes in Turkey. 1999 Marmara earthquake is the most destructive earthquake in terms of losses and the effect to macroeconomic indicators of Turkish economy that was recorded in history of the country and it is analyzed in detail. Moreover, the reasons of significant economic losses in Turkey are mentioned.

In the fourth chapter, 2011 Van, and 2003 Bingöl earthquakes as case studies will be investigated. The economic effects of earthquakes on Van and Bingöl provinces will be tried to measure by the variables that have significant effect on Gross Value Added (GVA) of cities.

In the final chapter, the findings of the thesis will be analyzed. Some mitigation strategies that may help to lessen the economic losses caused by disasters will be investigated in order to contribute on existing policies of decision makers.

1.2.Problem Definition

Disasters have become serious concern due to their increasing worldwide effects on the community, economy and environment. It is said that between 1970 and 2012, the number of natural disasters and their costs reached to an alarming level (Rasmussen, 2004). Countries under disaster risks tries to lessen such economic impacts by implementing mitigation policies and investing on mitigation activities that needs to be realized before a disaster event. If successful mitigation is implemented, disasters may create less economic loss on these countries and recovery activities last for less time.

Each disaster has a unique characteristic and different impacts can be observed in different countries. In developed countries, disasters started to become one of the most important part of development issue although the statistics show that number of affected people and cost of disasters in developing countries are higher than that of developed countries (Ranger and Surminski, 2013). Turkey, as an emerging economy, has suffered from disaster losses, especially of earthquakes in years. There occurs a strong earthquake in every two years and very destructive earthquake in every three years in Turkey (Karagöz, n.d.). The average cost of disasters in each year is equal to 1% of GDP of Turkey (Akyel, 2007).

After a disaster occurrence, usually the economic development slows down and central government spends a large amount of the budget for recovery and reconstruction activities. The idea of “father state” still holds in Turkey and government is the main source of trust for the community. The central government is responsible to compensate the economic losses. For example, the government is responsible to provide new housing units for disaster survivors who lost their property due to earthquake. 1999 Marmara and Düzce Earthquakes became a milestone for Turkey; it has tried to be developed policies and to be invested for risk reduction. However, Turkey has not developed strong and efficient economic recovery policies on disaster and development link. Policies that integrate disaster strategies into development policies do not seem to be enough in Turkey.

Economic policies should be developed to show the effect of economies by disasters. This thesis will use simple regression analysis as a brief example to determine how economies of earthquake prone provinces have been affected by earthquakes in cases of Van and Bingöl. The modeling results could be used as a scientific back up to observe the change in the economy after an earthquake occurrence. These results might be used to develop effective mitigation policies.

1.3. The Aim and Scope of the Study

"*An economic analysis of ex ante mitigation can only take place after a good accounting of the ex post is available"* (Cavallo and Noy, 2010, p.7).

Disasters have become popular subjects through researchers in recent years since the increasing effects of disasters on human life and property. Although phases of disaster management have been covered by natural and social scientists, economic aspects of disasters have still required attention from researchers.

As Cavallo and Noy (2010) indicate in the quotation above, the knowledge about the effects of earthquakes is critical tool for mitigation process. Many countries have started to work on mitigation activities and policies particularly after catastrophes. 1999 Marmara Earthquake occurred in the industrial heart of the country and the most destructive earthquake in last century by cost of 9-13 $ billion (World Bank, 1999). Afterwards, Turkey has started to invest for better disaster management by changing legislation and institutions. These implements are not enough to develop effective mitigation strategies for economic policies of disasters. Van and Bingöl Earthquakes substantiated that earthquakes are still cause economic burden for cities. There is necessity for assessment of ex post economic effects of disasters to produce ex-ante policies to lessen disaster impact in Turkey.

This thesis also aims to show how socio- economic situations of provinces changed after Van and Bingöl earthquakes to contribute to production of new mitigation policies. Van and Bingöl were chosen as case studies as being the most destructive earthquakes in terms of loss of life after 2000s. Also Van and Bingöl are located in comparatively less developed parts of Turkey. So it will be interesting to observe the economic profile of these cities with high seismic risk.

This thesis will include the analyses conducted by researchers on worldwide and a simple statistical analysis in case of two cities as research method. The economic conditions of cities can be investigated by the change of Gross Value Added (GVA) and the variables that affect the GVA. The regression analyses will be useful to find variables that affect the GVA. Then, the change in economic variables will be interpreted for before and after earthquake occurence.

CHAPTER 2

DISASTER AND DEVELOPMENT

This chapter starts with an explanation and categorization of disaster impacts. Then general disaster profile and economic losses caused by disasters around the world will be reviewed. The literature on the disaster and development relationship and trends will be explored in detail. For example, a relationship can be defined as the effect of development level of a country on economic losses caused by disasters. It can also be defined as the impacts of disaster losses on the economic growth of a country. The disaster and development link will be examined in short run and long-run by providing examples from literature that investigates economic situation of the disaster vulnerable countries.

2.1. Impact of Natural Disasters

Disasters have social, economic and environmental impacts. Although structural damage is more visible and significant, non-structural damages like loss of trade relations can affect the region more dramatically and lasts longer. The occurrence of an earthquake may not cause any damage to people's life or property in one country, however it may become a catastrophe in another country according to the conditions such as physical force, location, the vulnerability of population and infrastructure, the level of preparedness. (Rasmussen, 2004).

Disaster damage is classified according to expression in financial terms namely tangible and intangible damage (Table 1). Tangible damage is used for damage that can be assigned a monetary value ($). Intangible damage defines damage that cannot be assigned a financial value. For example, replacement and repair cost is tangible while cultural losses are intangible (Table 1). Mechler (2004) separated the impact of disaster into three parts: economic cost, humanitarian effects and ecological effects (Figure 1). Economic cost also includes three parts: direct, indirect and

macroeconomic. “Direct damages include damage to all assets to fixed assets, capital and inventories of finished and semi-finished goods, raw materials and spare parts that occur simultaneously as direct consequences of the natural phenomenon causing a disaster” (UNDP, 2004. p. 286). Life losses, building damages, energy and communication disruption are some examples of direct damages. (Basbug, 2006) Indirect damages, on the other hand, means disruption of production of goods and service after a disaster that effects on flows of goods (Skidmore and Toya, 2006). Interruption of business continuity, decrease in labor force and work opportunities can be listed as the examples of indirect damages. Lastly, macroeconomic effects, which are also considered as secondary effects, can be described as the change in macroeconomic variables due to any of disasters. It can be seen in GDP, export-import rates, consumption and inflation as well as government resources allocated for relief and reconstruction efforts. As Mechler (2004) indicates that macroeconomic effects include cost of indirect damages and spending on relief and restoration efforts where duplication is inevitable.

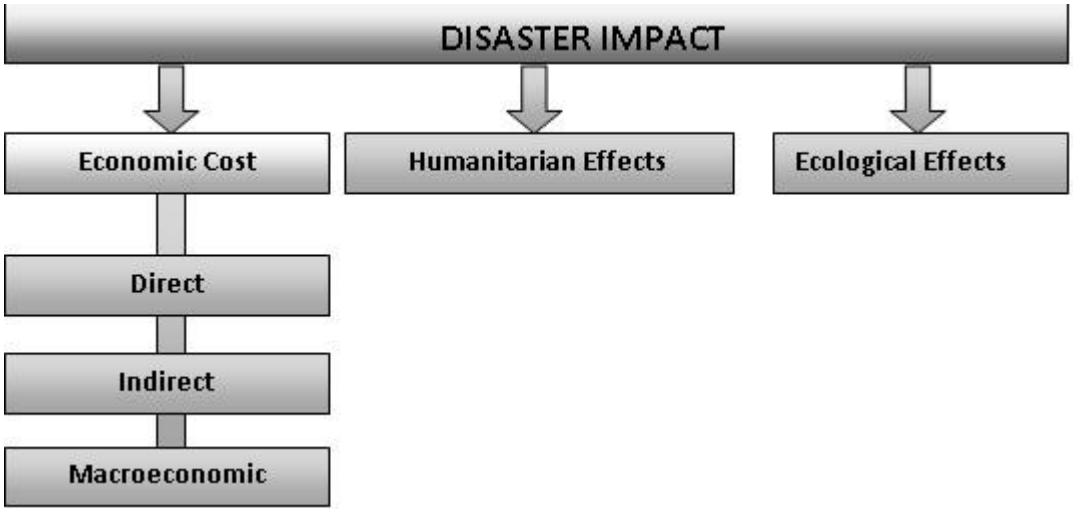

Figure 1: Impact of Natural Disasters
(Source: Mechler, 2004)

Table 1: Tangible vs. Intangible Impacts of Disasters
(Source: Coburn et al, 1994.)

		Losses	
Consequences	**Measure**	**Tangible**	**Intangible**
Deaths	Number of People	Loss of economically active individuals	Social and psychological effects on remaining community
Injuries	Number and injury severity	Medical treatment needs, temporary loss of economic activity by productive individuals	Social and psychological pain and recovery
Physical damage	Inventory of damaged elements by number and damage level	Replacement and repair cost	Cultural losses
Emergency operations	Volume of manpower, man-days employed, equipment and resources expended to relief	Mobilization cost, investment in preparedness capability	Stress and overwork in relief participants
Disruption to economy	Number of working days lost, volume of production lost	Value of lost production	Opportunities, competitiveness, reputation
Social disruption	Number of displaced persons, homeless	Temporary housing, relief, economic production	Psychological, social contacts, cohesion, community morale
Environmental impact	Scale and severity	Clean-up costs, repair cost	Consequences of poorer environment, health risks, risk of future disaster

Xie et al (2012) shows that direct losses are not adequate for analyzing total impact of disasters although direct losses of disasters usually are more common to government institutions, insurance markets, and the media after catastrophes. For example; the physical damage in energy facilities or transportation lines is calculated as direct damage but destruction of energy facilities or transportation lines affect the all sectors in supply chain. Therefore, the calculation of indirect losses should be also one part of total loss estimation of a disaster for an efficient disaster risk reduction.

Moreover, it is said that the direct losses of disaster cannot be reduced however; indirect losses could be reduced by increasing in government investment and improvement in disaster management. In Xie et al (2012), the hypothetical catastrophes occurred in two cities in China, Shanghai (developed city) and Sichuan (less developed) are compared for general evaluation of the indirect economic loss (hereafter IEL). The disruption of production process (hereafter IEL I) and the disturbance of industrial lines (hereafter IEL II) are evaluated as two parts of IEL. The input-output model is used for the assessment of effects two types of IEL.

The first result of their model suggests that the developed regions are more vulnerable than less developed regions with respect to IEL. The second one states that total IEL is contributed by IEL II primarily. Another result is both of IEL II and IEL may be focus point of decision makers. Lastly, the achievement of regional sustainable development is possible on the condition the need of transaction between economic growth and disaster prevention.

Categorization of economic impacts of disasters has basically two main challenges. The first challenge is in which perspective the damage is calculated. It is important that while calculating economic losses, the spatial borders and temporal scale should be defined clearly (Kousky, 2012). For example, the critical point in calculation of the economic cost of a heavily damaged house by an earthquake in Turkey is whether the government aid to households is calculated or not. Another point is the time boundaries. For example, the change of economic indicators of the construction sector is time-dependent. They rise in following years of a disaster event; however, it lasts only for three years then starts to decrease. The second challenge of the calculation of economic losses is the double counting of same losses. For example, if a machine is damaged because of a flood, the value of machine and damage on production should not be counted as loss to avoid double calculation.

The impact of disasters on economy of countries is composite, so assessment and evaluation of this impact is a challenging issue. Some methodologies have been improved for disaster impact analysis (Okuyama, 2009). There are various economic modeling frameworks have been employed to estimate the effects of a disaster. Perhaps, the most widely used modeling framework is the Input Output (hereafter IO) model that was applied to natural and man-made disasters since World War II (Rose, as cited in Okuyama, 2009). The other researchers who use this method are

Cochrane, 1974, 1997; Wilson, 1982; Kawashima *et al*. 1991; Boisvert, 1992; Gordon and Richardson, 1996; Rose *et al*. 1997; Rose and Benavides, 1998; and Okuyama *et al*., 1999.

IO model analysis has basis of production theory and involves inputs and output in production processes. The first reason why this model is so popular is because it gives detailed information about inter-industry interdependency of economy. Secondly, the model can originate and separate higher-order effects with established methods. Last, the integration of model with other models is easy.

In addition to IO model, the social accounting matrix (hereafter SAM), general equilibrium model (hereafter CGE) and econometric models are used to estimate impact of disasters. SAM is used for the calculation of higher order effects between socio-economic agents and activities. CGE models are more successful for including input and import exchange. Econometric models need wide range data. The positive and negative aspects of model are shown in Table 2.

Table 2: Model Comparison

(Source: Okuyama, 2009)

	Strengths	Weaknesses
IO	- simple structure - detailed inter-industry linkages - wide range of analytical techniques available - easily modified and integrated with other models	- linear structure - rigid coefficients - no supply capacity constraint - no response to price change - overestimation of impact
SAM	- more detailed interdependency among activities, factors, and institutions - wide range of analytical techniques available - used widely for development studies	- linear structure - rigid coefficients - no supply capacity constraint - no response to price change - data requirement - overestimation of impact
CGE	- non-linear structure - able to respond to price change - able to cooperate with substitution - able to handle supply capacity constraint	- too flexible to handle changes - data requirement and calibration - optimization behavior under disaster - underestimation of impact
Econo metric	- statistically rigorous - stochastic estimate - able to forecast over time	- data requirement (time series and cross section) - total impact rather than direct and higher-order impacts distinguished

2.2. Earthquake Economic Losses Around the World

In 2050, it is estimated that 100.000 people may lost their lives because of natural hazards and global cost of disasters would reach to $300 billion annually if risk reduction measures work out for decreasing effect of climate change (UNISDR, 2006). Lall and Deichmann (2009) note that 370 million of people live in earthquake prone areas and it is expected to shift to 870 million by 2050. These estimations based on the disaster statistics of recent years. The economic cost of the disasters is $138 billion in 2012 and it is expected to increase to $431 billion (UNDP, UNICEF, OXCAM and GFDRR, 2014). As shown in the Figure 2, the number of disasters, the number of people affected from these and cost of these have increased in years.

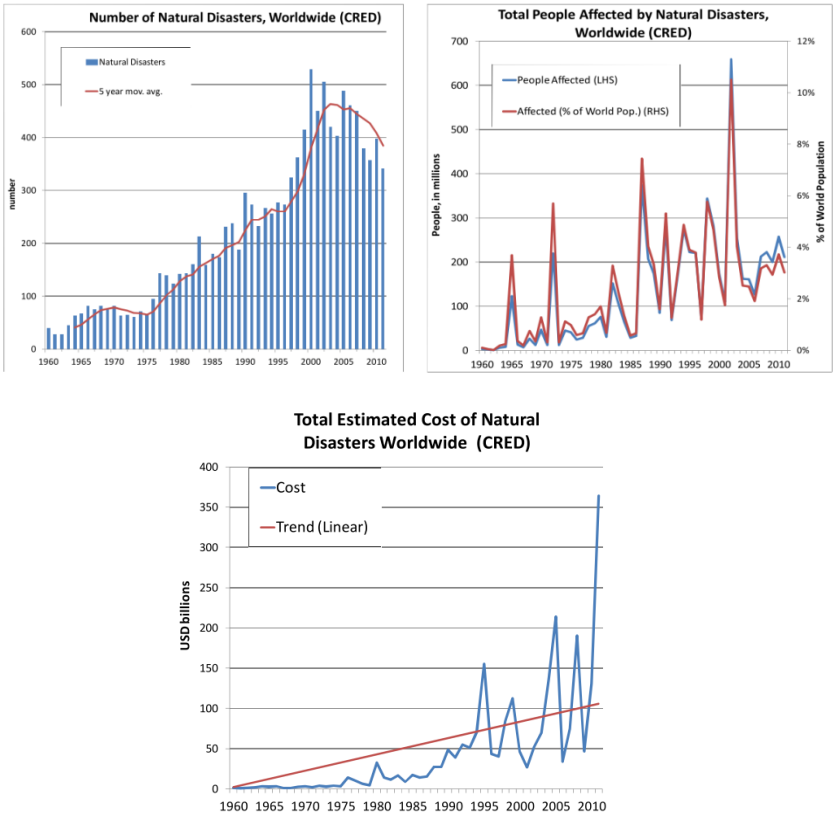

Figure 2: Number of Disasters and Total People Affected by Natural Disasters and Total Estimated Cost of Natural Disasters in Between 1960-2012
(Source: Laframboise and Loko, 2012)

Freeman et al (2002) highlights that number, intensity, and economic cost of the disasters have increased due to shift in density of population in disaster-prone areas and climate change. Estimated damage caused by reported natural disasters has heightened since 1900s (Figure 2). Economic losses of disasters aggregated to $ 3,800 worldwide in 2012 (World Bank, 2013). 1995 Kobe earthquake in Japan, 2005 Hurricane Katrina in U.S.A., 2008 Wenchuan earthquake in China, 2011 Honshu Tsunami in Japan caused by Tohoku earthquake exhibit so significant disaster losses (Figure 3). The common point of these four disasters is that they occurred in developed countries except the Wenchuan Earthquake. Hurricane Katrina occurred in U.S.A., a developed country. However it hit the Mississippi, Louisiana, and Alabama states, which are the first, second and eighth poorest states of the country respectively. The rate of insurance is low in these states due to low income,

compensating the economic loss of disaster became more difficult. (Masozera et al, 2007)

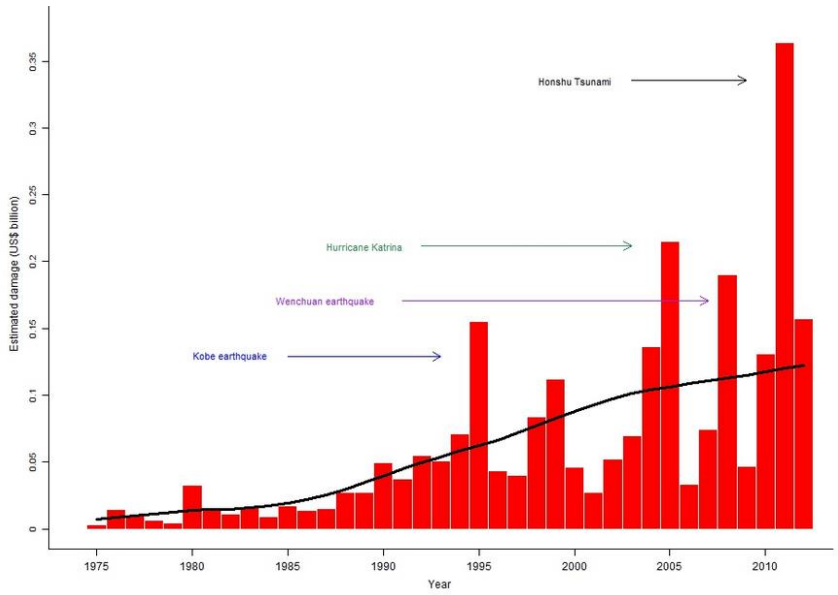

Figure 3: Estimated Damage (US $ billion) caused by reported natural disasters 1975-2012

(Source: EM-DAT:The OHDA CRED International Disaster Database)

Earthquakes have considerable share in total disaster-related losses. The Office of Foreign Disaster Assistance (hereafter OFDA) Centre for Research on the Epidemiology of Disasters (hereafter CRED) International Disaster Database shows that between 2002 and 2011, estimated damage due to earthquakes is so high that it is equal to one of third of all damage of natural disasters (Table 3).

Table 3: Total Amount of disasters estimated damage, by type of phenomenon and year (2002-2011) in millions of US dollars
(Source: EM-DAT: The OFDA/CRED International Disaster Database)

DISASTER TYPE	TOTAL AMOUNT (Millions of US Dollars)[1]
Earthquakes/ tsunamis	461,532
Natural Disasters	1,424,903
Technological Disasters	38,112
TOTAL	**1,463,014**

Rasmussen (2004) claims that 75% of 6000 natural disasters occurred in the period of 1970-2002 were recorded in developing countries. The rise in urban population concentration and the increase in frequency and intensity of extreme weather events have resulted in significant increase of the economic losses in the last 30 years. These figures may indicate that most of the disasters occurred in developing countries but developed countries may have higher disaster-related economic loss. The GDP change resulting from disaster is also high in developing countries as seen in figure 4.

[1] 2011 Prices

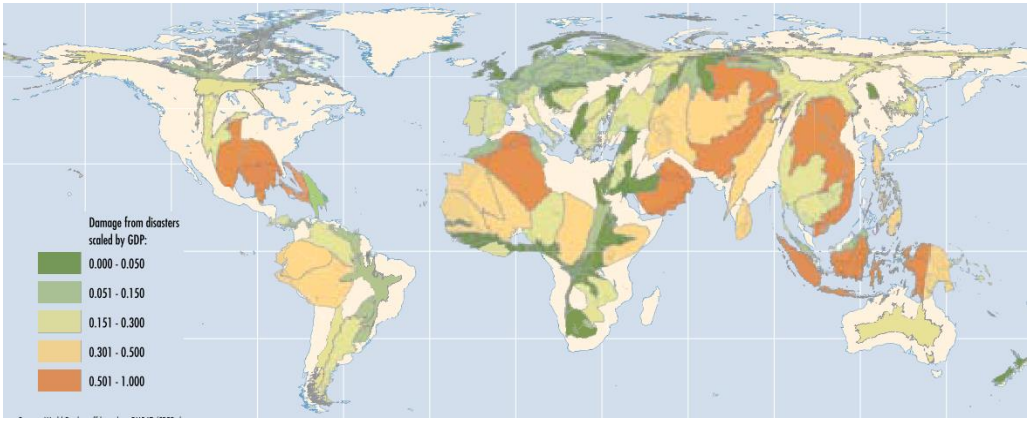

Figure 4: Areas reflect cumulative damage from disasters scaled by GDP for 1970 to 2008.

(Source: United Nations (hereafter UN) and World Bank (hereafter WB), 2010)

More than 2% of population of developing countries has exposed to disasters every year and their loss is equal to 0.05% of their GDPs each year. Figure 5 shows that the developing countries like Chile, Cambodia, China and Turkey have lost a large percentage of their GDP due to disaster losses. Turkey is the fourth country in G20 countries[2] in terms of disaster losses average percentage in % GDP between 1980 and 2011 (OECD, 2012)

[2] The Group of Twenty Finance Ministers and Central Bank Governors (also known as the G-20, G20, and Group of Twenty) It is a group of finance ministers and central bank governors from 20 major economies

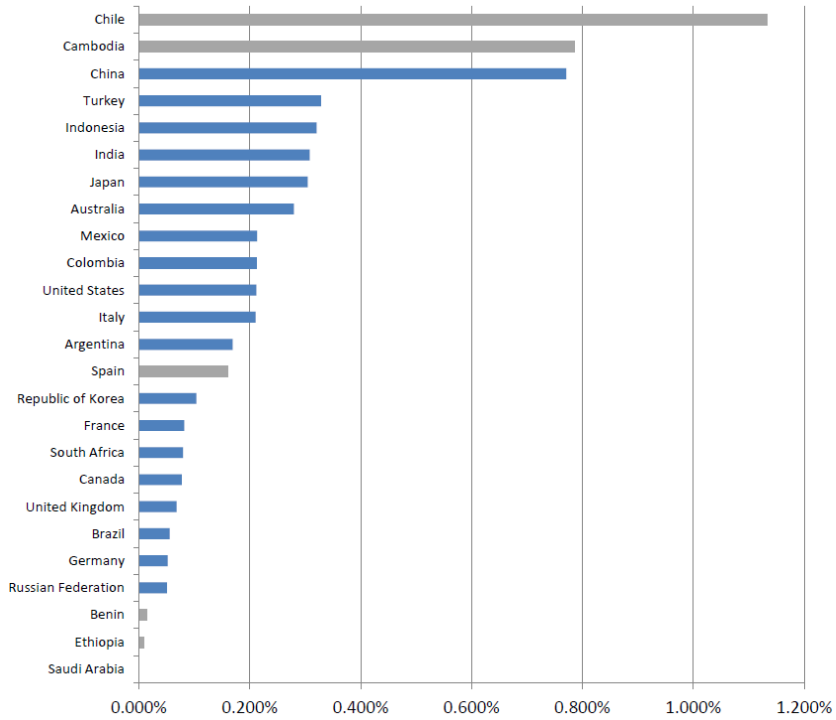

Figure 5: Disaster Losses Average Percentage in GDP in G20 and selected countries between 1980-2011

(Source: Organization for Economic Co-operation and Development (hereafter OECD), 2012)

Loayza et al (2012) remarks that disaster type and economy of countries change the impact of natural disasters on development. The dynamic generalized method of moment's was implied to cross-country panel dataset between 1961 and 2005 and it has three results. First, disaster losses affect the growth in economic sectors of countries distinctly and also disaster type is another significant factor on the growth of economic sector. For example, droughts have a negative impact on agricultural growth while the impact of floods is positive. Another example is storms and earthquakes cause higher industrial growth in developing countries; however, agricultural growth and other sectors of the economy affect positively by moderate floods (though not severe). Second result is that moderate disasters like floods can affect some sectors positively but there is not this type of relation for severe disaster. For example, the medium size storm affects the economy positively while severe

storms tend to have negative effect on industrial growth. Lastly, vulnerability to natural disasters is much higher in developing countries than developed countries because more sectors are affected by disaster in those countries.

As mentioned before, human settlement are more prone to natural disasters that have been observed frequently in recent years. Therefore, there are some attempts to decrease disaster losses in international area. Firstly, in 1987 United Nations general assembly declared the 1990-2000 International Decade of Natural Disaster Reduction (IDNDR) to determine objectives that will be realized by countries following ten years of 1990. Preparation of Yokohama Strategy and Plan of Action for a Safer World (1994), the Millennium Declaration (2000), International Strategy for Disaster Reduction (ISDR), the United Nations Development Programme (UNDP) "Disaster Risk Reduction" Global Report (2004), Conference on Disaster Risk Reduction and the Hyogo Declaration (2005), the Hyogo Framework Action Plan (hereafter HFA) (2005-2015) and Nations and Communities to the Global Platform for Disaster Risk Mitigation and Enhancement Resistors (2007) are major steps to activate disaster mitigation strategies in countries.

In addition to all these attempts, the UN Conference on Environment and Development (Rio Summit) organized in 1992. In Rio Summit, it is explained that adequate precautions and measures should be taken to reduce the losses caused by disasters to reach sustainable economic growth and sustainable development objectives. Also it is emphasized that there is a strong relationship between disaster losses and environmental degradation. It is declared in the UN World Summits on Sustainable Development which held in 2002 and 2012 (Rio +10, Rio +20). The summits focus on the settlements that are under risk of the disaster and measures that should be taken to reduce the risks highlighted prior to the disaster in order to reduce losses in turn.

The first evaluation report of the HFA Plan (2005-2015) published in 2008 emphasizes that many of the countries that improved their institutional and legal arrangements in terms of preparedness and response phase of disasters, establishment of an early warning and disaster information systems have succeeded to slight decrease in death rate caused by hurricanes, floods. However, the problems with the development of the technical infrastructure and human resources and financial problems should be overcome. On the other hand, the governments of the countries

involved in this action plan (although given the political commitment for integration of risk reduction applications to development plans and projects) do not reached to the desired level in terms of risk reduction efforts.

In disaster and development relationship, Millennium Development Goals (hereafter MDGs) and the HFA are critical documents in international area. Both of them aim to achieve sustainable development. In 2000, 189 countries have agreed to agree on under the framework of the United Nations Millennium Development Goals that covers the years 2000 to 2015. The results of natural and technological disasters pose a significant threat towards the achievement of the eight basic goals of Millennium Development. For this reason, countries succeeded in reducing disaster risk are a better chance of achieving those goals.

Economic loss of disasters was seen as a challenge for countries to meet UNDP Meeting the MDGs. The visible loss of disasters are seen as direct outcomes however disasters also cause financial, political, health and environmental problems. MDGs aim to plan for development with decreasing human vulnerability to hazard. MDG section IV "Protecting Our Common Future" mentions to focus on diminishing the number and effects of natural and man-made disasters. Each of the goals of MDG aims to minimize human vulnerability to disasters. Moreover, it is important to determine the framework of risk reduction. For example construction of earthquake resistant schools is not enough to meet sustainable and long-term development but school building should not be damaged by disasters and also students and other employees should be ready for disasters (UNDP, 2004) (Figure 6).

The World Summit on Sustainable Development, held in Johannesburg in South Africa in 2002, has contributed to discuss new frameworks for environmental sustainability.

> An integrated, multi-hazard, inclusive approach to address vulnerability, risk assessment and disaster management, including prevention, mitigation, preparedness, response and recovery, is an essential element of a safer world in the twenty-first century. (UNISDR, 2005, p.4)

Necessary actions are the strengthen of the International Strategy for Disaster Reduction , increase of institutional capacity, improvement of the early warning systems, community based disaster management.

HFA (2005-2015) under the leadership of the United Nations World Conference on Disaster Reduction held in Kobe, Japan in 2005. It was prepared and adopted by 168 countries, which are the members of the United Nations. To minimize the disaster risk around the world, HFA Plan, which serves as a road map, is composed of the three strategic objectives, five priority actions and their sub-actions (Ministry of Development, 2012).

These strategic objectives are:

1-Composition disaster risk reduction for sustainable development planning and policies,

2- Strengthening existing institutions and mechanism and capacity development for increasing conscious and awareness to disasters,

3- Including of emergency preparedness, response and reconstruction disaster risk reduction approaches systematically.

Primary actions are:

1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.
2. Identify, assess and monitor disaster risks and enhance early warning.
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
4. Reduce the underlying risk factors.
5. Strengthen disaster preparedness for effective response at all levels.(UNISDR, 2005, p:5-6)

Another study is conducted by Basbug and Özden in 2012 to denote the inseperable link between MDGs and HFA by providing a bicycle model (Figure 6). The model suggests that the strategic goals of MDGs and HFA may be in same direction like wheels of bicycle.

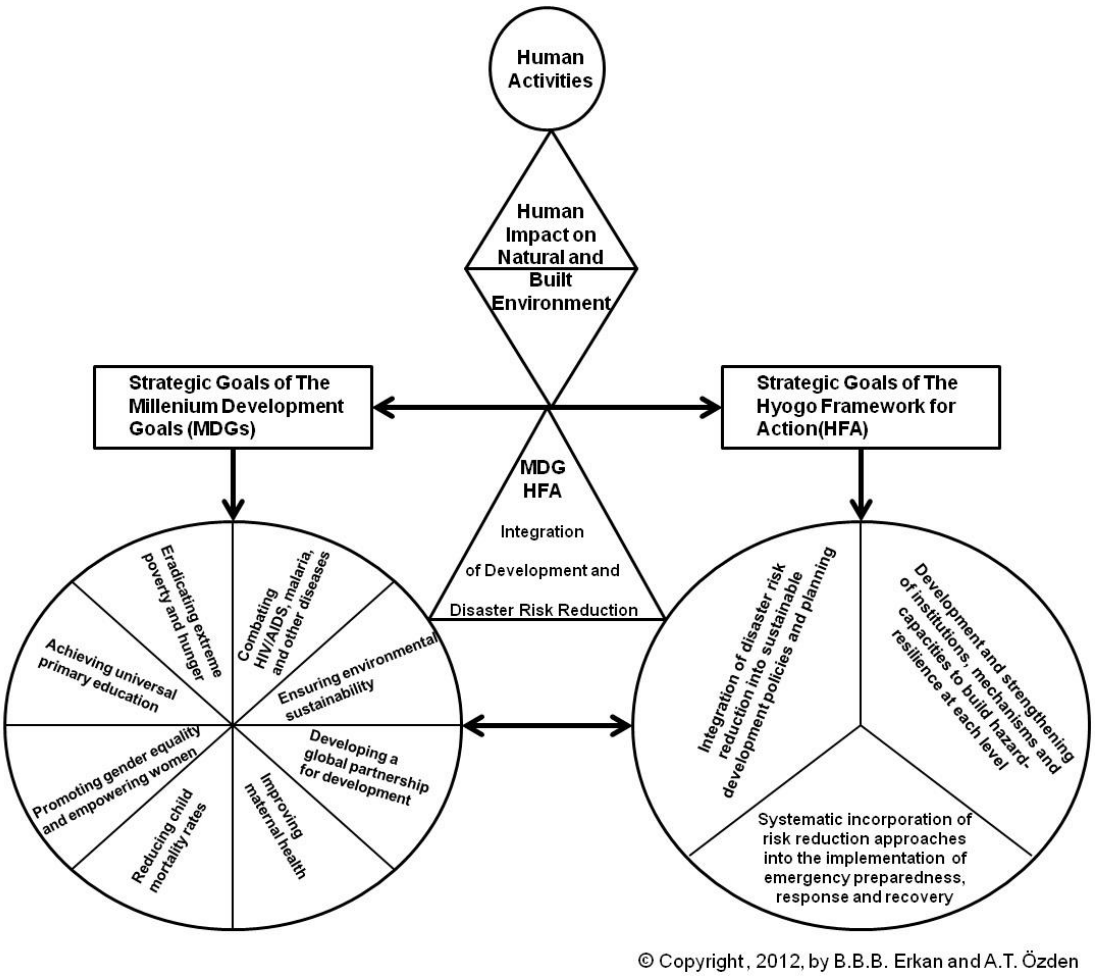

Figure 6: Bicycle Model
(Source: Erkan and. Özden, 2012)

2.3. Disaster and Development

Any large-scale natural disaster in any country causes high direct damages such as mortality, loss of capital and destruction of infrastructure moreover; it increases vulnerability of the country to future disasters. These direct damages affect the country's economy so disasters put development at risk (UNDP, 2004). Disasters may stop or diminish economic growth of the country on following years since economic growth, poverty and economic resilience to natural hazards are strongly connected to each other (Mitchell et al, 2013). To define the relationship between disaster and development, firstly, impacts of disasters on macroeconomic variables of the economy will be explained, and then the differences of disaster effects on

developing and developed countries will be pointed out. Lastly, the two opinions that disaster diminishes development level or disaster is opportunity for development will be investigated.

To begin with, the irreparable destruction of natural disasters also affects the macroeconomic variables of countries like GDP growth, trade, public deficit and indebtedness in short-run and long run. Usually the most significant change in macroeconomic variables is observed on GDP, internal trade links, fiscal balance and poverty. Firstly, GDP usually diminish in following year of disaster, the GDP change can be so small however it can be more than 20 % in some cases. Different studies have been implied in various countries to find the extent of the decrease in GDP is observed. One of these studies was performed for 35 disaster events occurred in Latin America and the Caribbean. It is found that the disasters caused the decrease of GDP by 3% (Rasmussen, 2004).

Secondly, natural disasters affect the trade relations between countries. Generally, some production activities decrease, the demand for some materials needed for reconstruction increase, while lost materials exceeds the supply after disaster, consequently import transactions increase and export transactions tend to decrease. Charveriat (2000) claims that the exports diminished in the rate of 9% and imports rates raised by 8.2% after hurricane in Saint Lucia in 1998. Since hurricanes are effective on agricultural product and export transactions, Barbados and St. Kitts had to cut down sugar export to St Lucia.

Thirdly, fiscal balances changes in negatively. Government expenditure increases after climatic and geological disasters because an important part of government budget is usually transferred to emergency assistance and reconstruction efforts in rehabilitation process. Therefore average budget deficit increases by 17% after a climatic disaster and 60% after a geological disaster. On the revenue side, there is decline by 18% and 30% after a climatic and geological disaster. The change in expenditure and revenue sides cause to increase budget deficit about 30% after climatic and geological disaster (Melecky and Raddatz, 2011). If the budget deficit reaches a large amount, tax revenues are increased to keep balance of the government budget. Especially developing countries like Turkey allocate more amount of money for reconstruction efforts and government tries to find new solutions for increasing revenues. For example, the government imposed new tax,

called as special communication tax to balance the government budget after the Marmara Earthquake occurred in 1999. Lastly, the population having low level of income more affected by natural disasters and poverty rate increases. Since low-income households usually settle down in relatively more vulnerable areas of cities like river basins, valley bottoms and construction quality accordance with proper building codes are also missing in these regions (Rasmussen 2004).

Disaster and development relation changes with respect to development level of countries. UNISDR (2006, p:3) report claims that "While no country in the world is entirely safe, lack of capacity to limit the impact of hazards remains a major burden for developing countries". The less developed countries are exposed to more disaster losses and more vulnerable to hazards than developed countries (Figure 7).

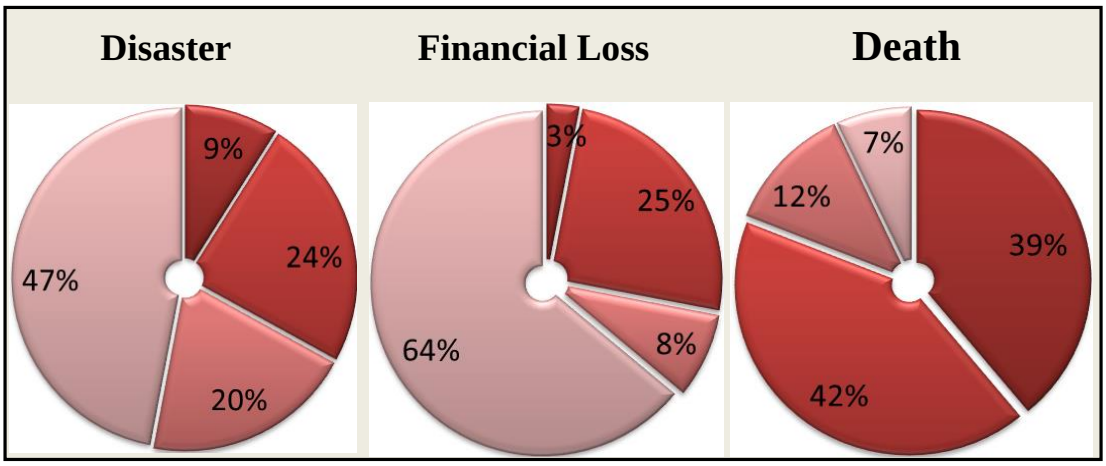

Figure 7: The Distribution of Number of Disaster, Financial Loss and Number of Deaths Caused by Disasters According to Income Level of Countries

(Source: UNDP, UNICEF, OXCAM and GFDRR, 2014)

Moreover, these countries experience the effects of disaster for longer time. Recovery activities lead to allocate necessary resources of the countries, then it prevents the investment on prevailing production activities (UNISDR, 2004). While economic recovery mechanisms like insurance can rehabilitate the economy quickly in the developed countries, every part of community from government to households

should spend money to compensate the effects of disaster in developing countries (Hoeppe and Gurenko, 2006 and Hallegatte et al. 2007 as cited in Mitchell, T. et al 2013). For example, the government should invest in public services and infrastructure, when a household should invest in new equipment. So all these expenditure leads to diminish production activities and development in long term (Mitchell et al 2013).

The UNISDR report (2004) mentions that developing countries have limited capacity to cope with disasters. 97% of disasters that caused deaths, has occurred in developing countries and economic loss in terms of GNP in these countries is so high that it is not possible to compare with developed countries. Ranger and Surminski (2013) indicate that the initial impact of disaster is deeper in low-income countries than high-income countries (Figure 8). Since high income countries have more effective disaster risk reduction policies, the damage is less and the economic indicators can reach the values before disaster in short time. In low-income countries, any disaster may cause shocks in economy and GDP falls fast. Figure 8 shows that during the period of 1980 to 2011 developing countries experience the direct damages of disasters 14 times higher than developed countries in terms of GDP loss. It is also claimed that 1% of GDP (or 2% for droughts) of developing countries is equal to total cost of disaster while in developed countries it is only 0.25% (Raddatz ,2009) .

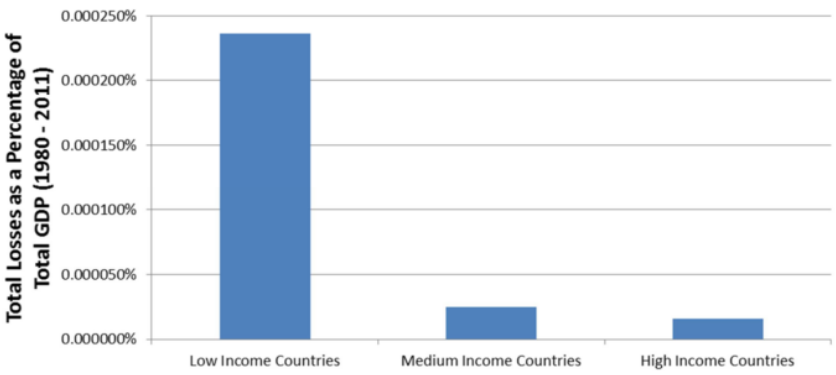

Figure 8: Total Losses as a Percentage of Total GDP (1980-2011)
(Source: Ranger and Surminski, 2013)

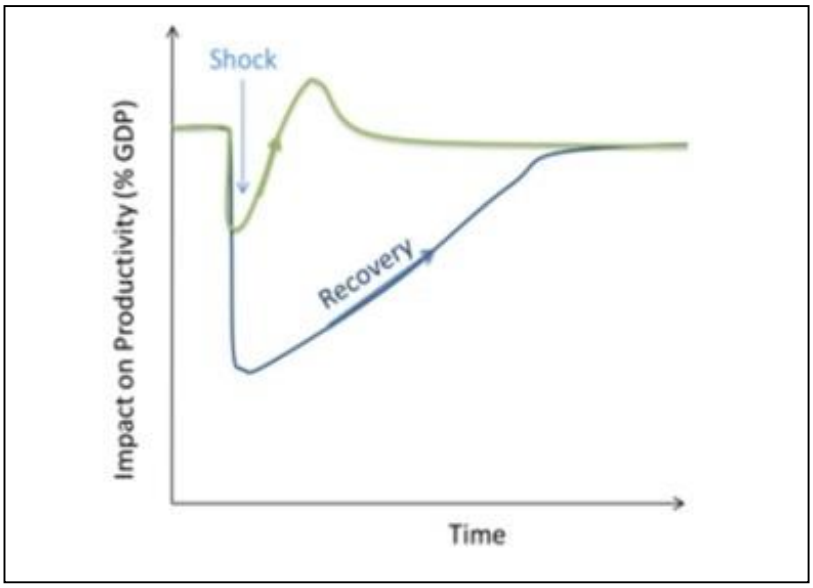

Figure 9: Disaster effect on GDP on less developed countries (blue line) and developed countries (green line)

(Source: Ranger and Surminski, 2013 (adopted by Hallegatte et al. (2007))

Figure 9 shows that every year, natural disasters cost $125 billion and every decade this number increases by $30 billion on average. These results indicates the increasing exposure to disasters (Handmer et al. 2012 as cited in Ranger N and Surminski N. 2013) (Figure 10) and the rise of the level of welfare and population of the countries will also increase the losses. It is said that the higher income level causes the increase in average annual losses from disasters. If a country is low-level development country, average annual losses grow faster than income. If country is high-level development country is, the situation is vice versa (Hallegatte, 2012*)*.

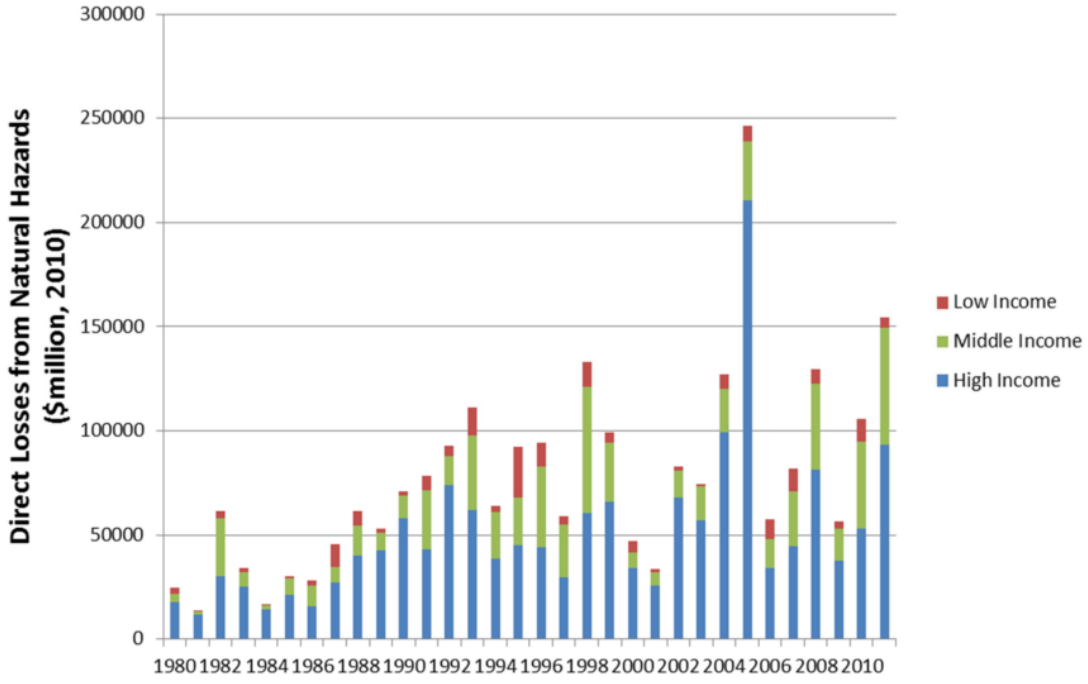

Figure 10: Economic losses grouped by the World Bank income class
(Source: Ranger and Surminski, 2013)

Okuyama (2009) also supports the idea that there is a relationship between economy of country and impact of the disaster on that country. He claims that there is an inverted-U relationship between impact on GDP and GDP per capita (Figure 11). He separates the countries into three categories: low-income, middle-income and high-income countries. The disaster impacts do not affect the whole system in low-income countries due to simple structure of the economy of the country. Therefore, the effect of disaster in economy is not so much. High-income countries have financial and technologic resource management. They are successful to absorb negative effects of disaster by taking preventive measures. On the other hand, middle-income countries have exposed to greater higher-order effects that expand total impacts of disasters. Therefore, these countries are more exposed the impact of disaster although they seem more secure than least developed countries. GFDRR report published in 2012 also supports this idea and claims that the effect of disaster intensifies in medium sized economies that develop fast. The years from 2001 to 2006, the 1% of GDP was lost because of the disasters in these countries, while high-income countries lost only

one of ten of this percentage (WB, GFDRR and Japan Policy and Human Resources Development, 2012).

The share of economic loss of low income countries seems low. However these countries do not develop resilient economy after disasters and according to report of UNISDR (2013), the capacity on decrease in vulnerability to disasters are not improved by low income countries after disasters. This cause to recurrence and continuity of economic losses in each disaster.

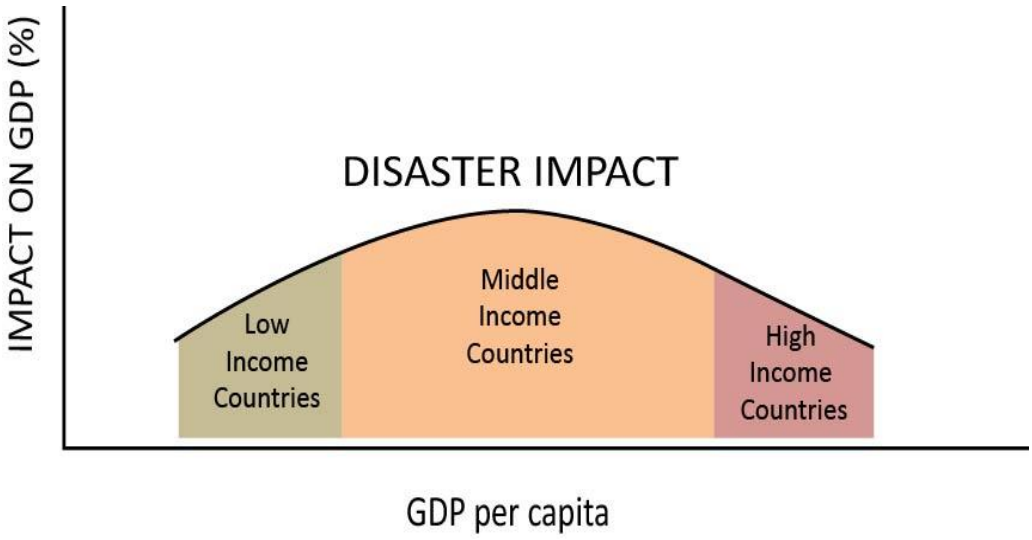

Figure 11: The relationship between disaster impact and level of income of countries. (Source: Okuyama, 2009.)

Developing countries are more vulnerable to economic damages caused by disasters. Cavallo and Noy (2009) illustrates that poor countries having per capita GDP is less than $2000 has lost 9.4 deaths per million per year in 1990, however rich countries having per capita GDP more than $14,000 had only 1.8 deaths. Moreover, larger developed economies are more successful to absorb economic effects of disaster because of sizeable foreign currency reserves, high proportions of insured assets, comprehensive social services and diversification in economy. In addition, they have experience in engineering, inter-sectorial economy and inter-regional economic relations. All these factors absorb output shocks and cause the decrease on indirect damages. As Cavallo and Noy (2009) say that these countries have experience large

amount of direct damages whereas Skidmore and Toya (2002) point out that those countries decrease the probability of occurrence of indirect damages and secondary effects. For example, an earthquake occurred in 2011 near to El Salvador and Seattle causing $2 Billion economic loss. This economic loss is equal to the 15% of GDP of El Salvador. The country had difficulties in compensation for the losses. However, Seattle in U.S.A had not difficulties as much as El Salvador. Having only one dominant sector in economy is also critical factor that determines absorbing capacity (UNDP, 2004).

Dayton-Johnson (2006) indicates that poor countries are more vulnerable to disasters when compared to rich countries and the most vulnerable of them is the poorest people. Since poor people usually live poor quality housing conditions and they do not escape disaster zones as in the example of Hurricane Katrina in New Orleans in 2005. The low level of education and health conditions make the poor people more fragile. The vulnerability of poor countries continue after disasters since the policies are not produced for decrease of vulnerability and they do not have economic recovery mechanism like insurance.

Padli et al (2009) support the idea that development level of countries and economic losses of disasters are connected substantially and meaningfully. They search the relationship between disaster fatalities and the level of economic development, government consumption, length of education, land area and population by using data for 73 non-OECD and OECD countries in the years of 1985-1995-2005. The results of the empirical studies on those countries show that the most obvious factor is income that determines economic losses caused by disasters because the increase of income level contributes to preparation for disasters. In the model, this common argument was shown that the citizens in same countries with high-level income are prepared better for natural disasters. This may lead to diminish the effect of natural disasters successfully. Also, in their suggested model it is observed that the government budget have also clear and inverse relationship with disaster losses due to the high level of budget allocation lead to reduce in economic losses. However, the effect of education level on economic losses was not investigated in this study.

Kahn as cited in Padli et al (2009) says that even though high income countries are exposed to natural disasters as much as low income countries, the number of deaths caused by disaster is less than that of low income countries. Since high income

countries have high institutional capacity, lower income inequality and high level of democracy while others do not have.

According to UNDP (2004), Table 4 shows three major assumptions to define the disaster and development relationship. Firstly, development is limited by disasters due to loss of production capacity, market access or material inputs. Integration of disaster risk management as main focus into development policies is highly necessary for generating development without revealing new risks. In the second assumption, it is assumed that development can increase disaster risk. As in the example of 1999 Marmara Earthquake, the industrialization of region increased the agglomeration of assets and so did earthquake risk. Moreover development could cause to increase disaster possibilities especially for man-made disasters. For example; Chernobyl Disaster (Ukraine) in 1986 , The Bhopal Disaster (India) in 1984 and Fukushima Daiichi Nuclear Disaster (Japan) in 2011.In the last assumption, development can decrease disaster risk. Because the decrease of poverty by increasing trade relationship or technological development can help disaster risk reduction.

Table 4: Disaster-Development Relationship

(Source: UNDP, 2004)

	ECONOMIC DEVELOPMENT
Disaster limits development	Destruction of fixed assets. Loss of production capacity, market access or material inputs. Damage to transport, communications or energy infrastructure. Erosion of livelihoods, savings and physical capital.
Development causes disaster risk	Unsustainable development practices that create wealth for some at the expense of unsafe working or living conditions for others or degrade the environment
Development reduces disaster risk	Access to adequate drinking water, food, waste management and a secure dwelling increases people's resiliency. Trade and technology can reduce poverty. Investing in financial mechanisms and social security can cushion against vulnerability.

Research on disaster effects on macroeconomic variables became popular subject in the last decades. To understand how disasters affect development, researches usually compare the conditions in developing and developed countries. There are two main opinions how disasters affect macroeconomic variables. The first opinion is that disasters obstruct the growth of macroeconomic variables of economy while the second one is that disaster is not a problem for development (Hochrainer, 2009).

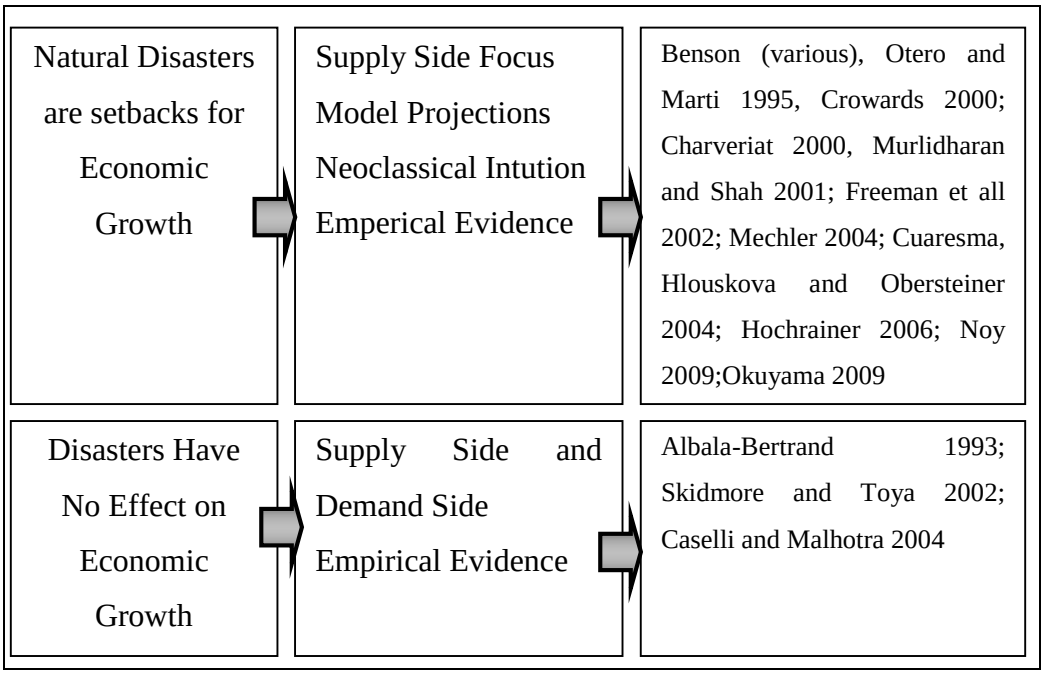

Figure 12: Synopsis of macroeconomic perspectives on natural disasters (Source: Hochrainer,2009 adopted from Zenklusen 2007)

Otero and Marti (1995), one of the supporters of the idea that natural disasters are setbacks for economic growth, studied disaster impact on highly disaster prone developing countries in Latin America and Caribbean for last twenty years by using Economic Comission for Latin America and The Caribbean (hereafter ECLAC) disaster assessment methodology[3]. According to results, development is affected negatively; the development plans cancelled and production process was disturbed in case of driver of economic sectors like productive sectors. The GDP and per capita income decrease and balance of external sector changes after disasters. Moreover, the emergency needs of survivors are paid from fiscal budget and balance of budget

[3]. The methodology makes it possible to estimate the effects of natural disasters; it was also applicable to man-made ones, as in the case of certain armed conflicts in Central America. In the original ECLAC Handbook, disaster effects are measured at the sectoral and global levels, thus allowing for an assessment of the reconstruction capacity of the affected country or region and the scope of the necessary international cooperation. The ECLAC methodology pays due consideration to the prevailing insufficiency of reliable quantitative information for the region, the availability of which is even more limited after a disaster. The ECLAC Handbook did not include methods for estimating damage and losses in certain social and economic sectors, to the environment or to specific population groups (ECLAC, 2003, p. 8).

changes. Inflation also tends to increase because of the reconstruction efforts and market disorders.

Crowards as cited in Charveriat (2000) claims that after disaster GDP growth decreases by 3% when compared to the rates in normal days. The GDP growth increases by 3% in successive years. Charveriat (2000) states that GDP growth and other flow indicators are not sufficient to understand disaster effect in short term. However, losses in human and physical capital would be more useful to do this. Charveriat selected 35 disasters that occurred in 20 countries in the Latin America and the Caribbean in the years between 1970 and 1999. The results of analysis show that GDP growth is affected in the year of disaster then increase in following two years. On the other hand, agriculture production, manufacturing and capacity of export sector diminish. Inflation increases due to decrease in production rates and increase in transportation costs. Public finances are also highly affected where revenues decrease and expenditures increase. Trade balance changes and deficit increases. (Table 5).

Table 5: Effects of Disasters on Macroeconomic Indicator
(Source: Charveriat (2000) Adapted from Albala-Betrand (1993a) and Downing Holstoorn and Tol (1999).)

Macroeconomic Indicator	**Expected change after disaster occurence**
Growth rate of GDP	Decrease or negative rate in year of disaster and subsequent increase during 1 to 2 years.
• *Agricultural Sector*	Significant fall in production (if hurricane, flood or drought)
• *Manufacture Sector*	Decrease in activity due to disruption of transportation, reduced production capacities.
• *Export sector*	Poor performance due to the effects described above
Gross Formation of Fixed Capital	Sharp increase in the year following the disaster.
Inflation rate	Increase caused by the disruption of production and distribution and increasing transportation costs.
Public finances	Worsening of deficit due to a shortfall in tax revenues and increase in public expenditures.
Trade balance	Deficit due to decrease in exports and increase in imports, associated with the decline in production capacities and strong public and private investment for reconstruction.
Current Account	Increase in deficit due to trade imbalance, partially offset by capital inflows generated by official and private donations.

Some Model Examples

Noy (2009) analyzed 507 disasters that killed at least ten people, 466 events that at least 100 people are affected and 428 destructive events occurred in 1970- 2003 years by using EM-DAT database collected by the CRED.

Noy (2009) start the analysis by using the following linear equation:

$$y_{i,t}=\alpha_i+\beta\, y_{i,t-1}+\Upsilon DMS_{i,t}+\phi x_{i,}+\varepsilon_{it}$$

where $y_{i,t}$ is the annual GDP growth rate, $DMS_{i,t}$ is measure for disaster magnitude, and $X_{i,t}$ are control variables commonly used in the short-run growth literature . Noy (2009) changed the equation in analysis process and the final equation is represented as:

$$y_{i,t}=\alpha_i+\beta\, y_{i,t-1}+\Upsilon DMS_{i,t}+\gamma(DMS_{i,t}-z_{i,t})+t\, z_{i,t}+\phi x_{i,t-1}+\varepsilon_{it}$$

The analysis resulted that high rate of literacy, institutional strength, high income per capita, high level of international trade, high allocation of government expenditures on disaster have powerful effect on decreasing the primary effect of disaster and avoid the snowball effect in macroeconomic level. Noy (2009) concluded that emerging economies are deprived of these factors and more vulnerable to disasters than developed ones. Furthermore, small economies felt more densely the effects of disaster when compared the large economies and primary cost of disaster besides indirect effects are also higher in developing countries.

Albala-Bertrand as cited in Noy (2009) is one of the supporters of the idea that disaster has positive effect on development. He developed a model for 28 disasters in 26 countries the years between 1960 and 1979. According to results of analytical model, after a disaster GDP increases, inflation stays unchanged, the production of agriculture and construction sector rises and reserves rises while there is no evaluable effect on exchange rate.

Skidmore and Toya (2002) say that the disaster risk could be one of the drivers of higher rates of growth according to an endogenous growth framework. Accurate determination of growth control variables such as initial income, initial secondary schooling, fertility rate, investment GDP ratio, trade openness, population and latitude implies the robustness of the statistical relationship between disasters and economic growth. The statistical results significantly show that all control variables mentioned above affect growth. For example, countries with low level of income and high level of human capital grow at faster rates. Also low rate of fertility, low level

of government consumptions, higher investment and increase in import-export relations also are effective in increase in economic growth. Therefore, improvements in technology and increased human capital investment cause the positive relationship between hydro-meteorological disasters and economic growth. According to findings, the frequency of disasters is positively correlated with the 30-year average of the growth rate of per capita GDP in the case countries. The physical damage after a disaster causes higher total factor productivity[4] caused by technological development and forced capital formation. However, it is claimed that the relationship between geological disasters and economic growth is negative because of loss of life (human capital destruction) along with physical capital. These results shows that total factor productivity is primary significant factor to determine the relationship between disaster and growth.

Toya and Skidmore (2005 and 2007) use total deaths and economic loss data for 43 years in their study to examine how social and economic development level can affect the natural disaster losses of countries. They use two sets of regression to reach these results; the first one measures the relationship between total number of death and development, the second one measures the relationship between GDP and development. One of the regression to determine the relationship between the level of development and disaster impacts is :

$$deathsj_{it}=\beta1(pcgdp_{it})+ \beta2(hc_{it})+ \beta3(open_{it})+ \beta4(fin_{it})+ \beta5(gov_{it})+ \beta n(y_{it})+ \varepsilon_{it}$$

In this equation, $deathsj_{it}$ refers to the natural logarithm of the total number of deaths caused by natural disaster event j in country i during period t, $pcgdp_{it}$ is the natural logarithm of real per capita gross domestic product, hc_{it} is total years of schooling attainment in the population aged 15 and over, $open_{it}$ is (exports+imports)/GDP, fin_{it} represents M3/GDP[5], govit is government consumption/GDP, y_{it} is a vector of additional variables that determine deaths from natural disasters (e.g., population, land area, disaster type) and ε_{it} is the error term. They found that high level of

[4] The total factor productivity of a firm, industry or group of industries is defined as the real output produced by the firm or industry over a period of time divided by the real input used by the same set of production units over the same time period" (Diewert, 2010, p. 45).

[5] Liquid liabilities are also known as M3. They are the sum of currency and deposits in the central bank (M0), plus transferable deposits and electronic currency (M1), plus time and savings deposits, foreign currency transferable deposits, certificates of deposit, and securities repurchase agreements (M2), plus travelers checks, foreign currency time deposits, commercial paper, and shares of mutual funds or market funds held by residents (Worldbank, 2014).

income per capita cause less number of deaths and less economic losses. According to findings countries that have higher income, higher educational attainment, greater openness, complex financial systems and small government size experience fewer losses in disaster. It might be high level of education changes behavior of citizens and orientate them to implement safe construction practices as preventive measures after evaluating potential risk of disaster. The high level of import-export relations provides increase of knowledge and technological transfer. Moreover, strength of financial system brings increase of awareness about information and risk assessment making them to avoid to project development in hazard prone areas. The size of government may also determine the high allocation of budget for disaster risk and management issues. All of these reasons show that income is not only measurement for disaster risk reduction. Therefore, improvement of education quality, increase in openness and development of financial markets could be long-run disaster reduction policies.

Padli et al. as cited in Raschky (2008) support the idea of high level of income does not always result in protection for natural disasters. Raschky claims that high level of income causes high level of disaster losses.

Parallel to Raschky, Padli et al (2009) claim that people having high level of income take their self-protection to natural hazards and high-income countries allocate more budget to response activities. Therefore, the economic development increases protection to natural hazards with decreasing rate.

Mechler (2004) also noted some general statements about disaster and development relationship. One of them is that macroeconomic variables of developed countries directly are not affected by disasters. The GDP of developing countries fluctuate with the effect of earthquake; it decreases in disaster year or after one year from disaster then increase with effect of shift in capital flow and investment to disaster region. After a disaster hit, government-spends a lot in disaster prone region. Tax revenues decreases. These cause the rise in the public deficit. As a result of disruption of production process, goods and capital stock decrease and demand for goods rise. Import increases, export decreases, so trade relations are affected negatively, and imbalance of trade rises. In developing countries, effects of disasters may be observed in longer term depending on extension of a disaster, economic cost and socio-economic conditions of the country.

Disaster, Development and Vulnerability

Vulnerability is the most important input that shapes the relationship between disaster and development. The reason why some countries are more vulnerable to disasters and why the economic losses are higher than other countries has been analyzed in the literature by scientists. In this section, the relationship between disaster and development will be tried to analyze in terms of vulnerability.

Manyena (2012) explains brief history of development and disaster paradigms. Manyena claims that since the introduction of the vulnerability paradigm during the late 1970s into 1980s, the link between disasters and development has become familiar. Disaster and development are very close paradigms that unsolved development problems or failure in development increase the vulnerability of people to natural disasters. Moreover, disasters are the indicators of development problems (Wijkman and Timberlake, 1984).

In the history of disaster and development paradigm, it is common that hazard paradigm is a focal point. Disasters are seen as natural events from 1930s to 1960s. The years from 1950s to 1960s, there are attempts for bringing together disaster and development in terms of scientific and technical knowledge. The distance between disaster and development paradigms decreased; however, the parallel relations in these two paradigms were not determined clearly in 1980s.

Whilst Sen's (1981) entitlement theory, the pressure and release model, the sustainable livelihoods framework and the resilience paradigm were developed for gathering disaster and development paradigms. The Entitlement Theory was introduced in 1981 in relation with famine in Asia and Africa. It still affects development and disaster scholars. The theory indicates that famine is not only caused by food deficiency, but it also caused by the inequalities in food distribution system. In other words, socio-economic vulnerability is more critical than natural factors. The idea of environmental determinism that nature is blamed as reason of disaster was rejected. Another attempt that contributed to bring together the disaster and development paradigms is the pressure and release model. The model was developed in 1994 by Blaikie. It describes three root causes which progress vulnerability in one side and hazard exposure in another side to describe the risk (Figure 13). The reduction of vulnerability becomes the fundamental part of development and necessary for relieving the pressure and decrease of disaster risk.

Sustainable livelihood framework brought an ecologic approach in 1990s. It became popular after international conferences especially Agenda 21 that agreed after 1992 Rio Earth Summit on Environment and Development. This approach focuses on establishing vulnerability context that people's assets and capitals and people's livelihood activities by emphasizing on livelihood issues. Resilience paradigm was another attempt related with disaster and development issues. The World Conference on Disaster Risk Reduction of 2005 has contributed to increase popularity of resilience paradigm. Before then, the lessons from implementation of International Decade for Natural Disaster Reduction and HFA were also important milestones for definition of the resilience concept. Resilience concept has been positive pole of disaster risk while vulnerability is seen negative pole of it. This means that as resilience increases, the vulnerability decreases. Today, the resilience is one of the most important understanding of disaster management (Manyena, 2012).

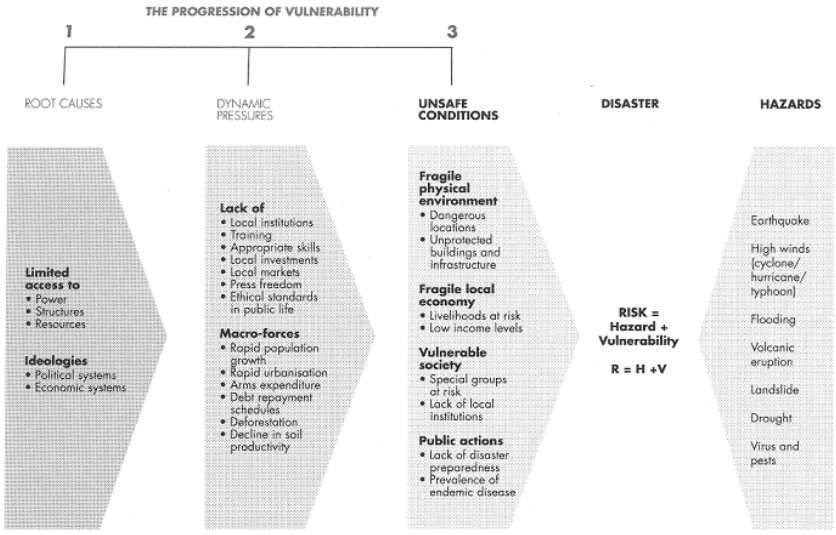

Figure 13: Blaikie Pressure and Release Model

Source: Blaikie et al. (1994)

The effect of development on vulnerability and the effect of disaster on development are shown in Figure 14. It includes four quarters. The first block indicates that development can increase vulnerability especially in developing countries. For example, increase of livestock lead to overgrazing and vulnerability to famine

increases. On the contrary, development leads to the rise the level of education and more investment on disaster risk reduction. Therefore, development opportunities could decrease vulnerability as shown in the second block. Third block implies that disaster can set back the development. 1999 Marmara earthquake is highly affected Turkish economy and caused 6.1 % losses in GDP(Turkey Country Office The World Bank, 2013). However, disasters may be considered as a chance for development because of the activities in the reconstruction phase. Disasters may increase the public awareness and encourage people to learn new skills to cope with disasters.

Figure 14: The relationship between disaster, development and vulnerability (Source: Stephenson, 1994)

It is usual that emerging economies experience more economic losses than developed countries due to high-level of vulnerability (Figure 15). From 1980 to 2012, only 9% of disasters occurred in low income countries and 48% of disaster related death was observed in these countries worldwide (World Bank, GFDRR & Japan Policy and Human Resources Development Report, 2012). Moreover, Laframboise and Loko (2012) indicate that 87% of world population affected by disasters live in middle-income countries and 12% them live in low-income countries and 64% of deaths

caused by disasters was in middle income and 32% of them was in low-income. Moreover the disasters cause the increase of vulnerability of countries of developing countries. Since developed countries take lessons after disasters and improve their systems. For example; Kobe earthquake is important milestone for Japan disaster system. USA also improved their legislation after Hurricane Katrina. However Turkey has not developed efficient economic mitigation policies after 1999 Marmara Earthquake.

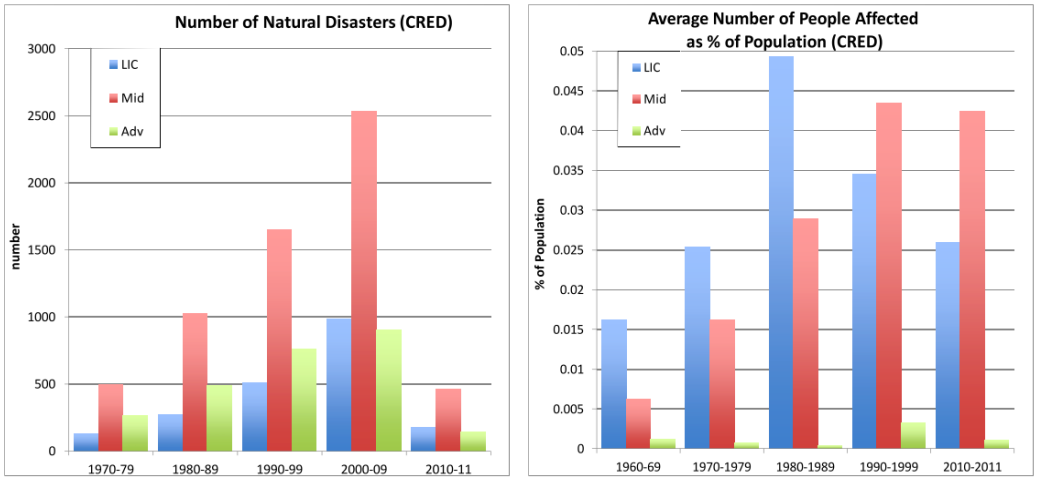

Figure 15: The Distribution of Number of disasters and Average Number of People Affected as % of Population According to Income Level of Countries

(Source: Laframboise and Loko, 2012)

Researchers use vulnerability indicators to estimate potential economic losses and risk (Table 6). The vulnerability concept is separated into four parts; physical, social, environmental and economic. The loss of life, damage of engineered structures and the loss of capital stock determine physical vulnerability. Countries' financial abilities that assimilate the effects of disasters, relay on property losses and restore the economic growth refer the economic vulnerability. The researchers use some vulnerability variables to predict change in macroeconomic variables (Table 6).

Table 6: Macroeconomic consequences and economic vulnerability to natural hazards

(Source: Hochrainer, 2009 extended from Barrito, 2008)

Researchers	**Vulnerability variables for predicting economic impacts and risk**	**Response variables**
Charveriat, 2000	•Size of the economy, degree of diversification and size of the informal and agricultural sectors.	•GDP
ECLAC and IDB 2000; Freeman et al. 2002; Mechler,2004; Hochrainer, 2006	•Ability to refinance losses and provide relief to the affected population (financial vulnerability) •Availability of implicit (aid) and explicit (insurance) risk sharing arrangements	•GDP, fiscal variables
Burton et al.,1993; Kahn, 2005.	• Income	• Deaths due to natural disasters
Benson and Clay, 2004	•Structure of the economy • Size •Income level and stage of development •Prevailing socioeconomic conditions	• Total GDP annual change •Agricultural GDP annual change • Non-Agric. GDP annual change
Toya and Skidmore, 2007	•Educational attainment in population aged 15 and over •Economic openness (exports+imports)/GDP • Financial sector level of development (M3/GDP) • Government consumption • Additional variables that determine the deaths caused by disasters (Population, land area, disaster type).	• Disaster-related deaths • Damages/GDP
Noy, 2009	• Literacy rate • Quality of institutions • Per capita income • Openness to trade • Levels of government spending • Foreign exchange reserves • Levels of domestic credit • Openness of capital accounts	• GDP
Raschky, 2008	• Availability of financial risk sharing institutions	• GDP

Benson and Clay (2003) claims that basically there are five factors that affect macroeconomic vulnerability to natural hazards:

- the type of natural hazard
- the overall structure of an economy, including natural resource endowments;
- the geographical size of a country;
- income level and stage of development
- prevailing socio-economic conditions, including the policy environment and state of an economy. (Benson and Clay, 2003, p. 17)

Pertiwi as cited in Kahn (2005) mentions that vulnerability is affected by economic development of country. Developed countries experience low number of deaths that equals to disaster level. More developed countries having GDP more than $14,000, only 1.8 people lost their lives per million per year, while low income countries having GDP per capita less than $2,000, 9.4 people lost their lives. In further research of Kahn, if a country with 100 million population could increase the GDP by $12,000, the death toll could be decreased to 764. under the condition that budget allocation for prevention and mitigation efforts increases parallel to increase in GDP.

Different literature find different factors to explain high vulnerability of developing countries. According to study of Pops in 2006, the countries with economy depending on single industry are more vulnerable to disasters. In the large-scale countries, disasters affect severely the local area but the effect of disaster decrease when the economic scale increases. However, undiversified economies usually experience shock in disasters and cannot easily absorb the effects. Since diversification of structural composition of a country's GDP brings resilience to disasters. Albala Bertrand (2009) exemplifies that droughts in Latin America affect agricultural sector in Latin America. The macroeconomic conditions in longer term is affected as a result. The report published by ESCAP and UNISDR in 2012 indicate that Maldives lost 60% of GDP due to 2004 Indian Ocean Tsunami.

The effect of disaster on development is usually examined in two terms: the short-run and the long-run. Short run continues for three years following the disaster while the long run continues more than five years (Pertiwi, 2013).

The GDP, which is significant variable to measure economic development of country is directly affected by disasters. For this reason, nearly all studies investigating the relationship between disaster and development concentrate on GDP. The disaster

effect at GDP at macroeconomic level is examined in two terms: short (1-5 years) and long (more than 5 years). The GDP change could be positive, negative or neutral as can be seen figure 16.

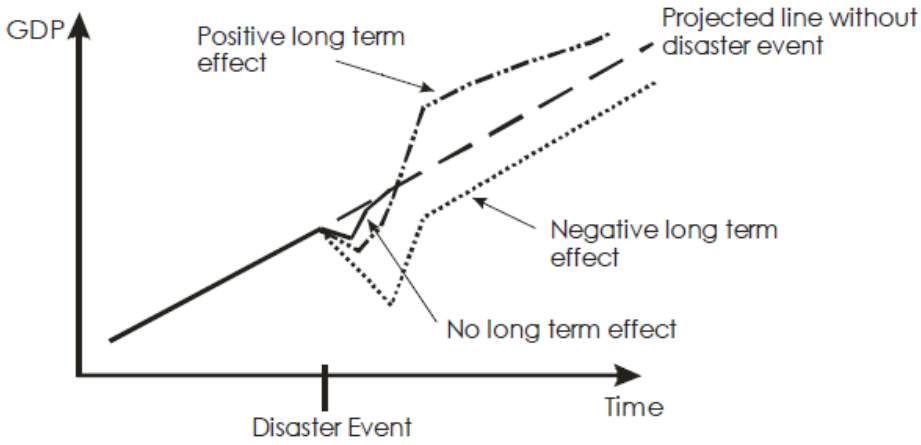

Figure 16: Possible Trajectories of GDP After a Disaster
(Source: Hochrainer, 2006)

2.3.1. Disaster and the Long Run Effects

There is no consensus among economists about natural disasters that affect the long run growth of the economy positively or negatively. Usually scientists favor the idea that disasters decrease or does not affect the long run growth except for Skidmore and Toya. They claim that disasters lead to positive growth although the effects of climatic disasters and geologic disasters on economic growth are different. This idea was based on the effects of human capital accumulation and technology. Climatic disasters have positive effect on the long run economic growth since they positively affect human capital accumulation and technological development. On the other hand, geological disasters have negative effect on the long run economic growth.

Natural disasters' effects on macroeconomic variables may determine the long run growth. Although the effects of disaster on long run growth are not clear, some macroeconomic variables have been analyzed. Natural resources, physical capital accumulation, human capital accumulation and technological development are the

four key macroeconomic variables that affect the long run growth after disaster in a positive way.

Firstly, natural disasters like hurricanes and floods can damage natural resources of countries like soil quality and forests. For example, Hurricane Isabel that occurred in North California in 2003 damaged the timber stocks that costed 550 million dollars. Since it damaged soil fertility, the agriculture production was affected for a long time. Another point is that natural beauties that attract tourists can be damaged by disasters. Some natural disasters like volcanic eruptions can affect the long run growth on positively. Moreover, floods may increase agricultural fertility by providing sediments on floodplain. These examples show that disasters and the conditions of countries may vary regarding the effects of disasters on the long run growth. There is no accurate rule that indicates the effect on the long run growth as being positive.

Secondly, physical capital could lead to increase in the high level of income and economic growth. Infact high physical capital increases productivity of workers, which helps economic growth. Physical capital accumulation is highly vulnerable due to destruction by disasters.

In most cases, human capital accumulation positively supports economic growth. More educated and specialized workers can increase productivity by learning and applying new concepts. However, there are some exceptions. For example, human capital accumulation cannot support economic development due to insufficient conditions. It is difficult to define natural disasters' effect on human capital accumulation since it can occur in several ways. To begin with, a disaster causes decrease in substantial human capital in case life losses. Next, the effect of a disaster is the interruption of education. The education facilities (the universities, schools) may be damaged by disasters and students might be forced to leave schools. Therefore, quality and quantity of human capital decreases. Moreover, schools are not necessarily affected by disasters physically but the poor families could cut off the education life of their children because of limited financial opportunities. For example, it is usual that after economic crises the rates of the primary and secondary school attendance decrease. On the other hand, researchers usually say that natural disasters increase human capital accumulation. Skidmore and Toya (2002) indicate that when the relationship between geological disasters and economic growth may be

found negative because of the losses of life. Since it cause human capital destruction along with physical capital.

Lastly, disasters generate opportunities to develop new technologies due to the destruction of capital and infrastructure. Moreover, the technology may increase the productivity of human capital in case they are able to use new technology. By Domino Effect, increase in efficiency of human capital reflects to efficiency of workers so this tends to increase in efficiency resulted in the rise of economic variables.

Skidmore and Toya (2002) examine how total factor productivity is affected after a natural disaster in order to estimate the long run economic effects of disaster. The technological development indirectly affects the total factor productivity, while labor and physical capital is directly affected. They found that hydro-meteorological disasters cause a rise in total factor productivity while seismic disasters have not significantly effect.

Cavallo and Noy (2010) show the long run economic effects of natural disasters in Table 7. As shown in the table, Skidmore and Toya (2002) support the idea that there is a positive relationship with the long run growth and climatic events; whereas there is negative relationship or neutral effects between geological events and the long run growth.

However, Noy and Nualsri (2007) claim that there is not statistically observable effect of disasters on the long run growth.

Table 7: The Long-Term Effect of Disasters

(Source: Cavallo and Noy, 2010)

Authors	Conclusion	Estimated effect
Skidmore and Toya (2002)	Climatic events have a positive relationship with the long run growth. Geological events have a negative or neutral effect	Climatic Events: 0.42 percent of GDP (2)
		Geological Events: -0.32 percent of GDP
Noy and Nualsri (2007)	A shock to the killed variable results in a decrease in growth rate while a shock to the damages variable does not seem to have much statistically observable effect on the long run growth.	Estimated coefficient, killed as ratio of population: -6.58
		Estimated coefficient, damages as ratio of GDP: Not significant
Cuaresma et al. (2008)	Natural disasters are negatively correlated to the technological transfer between developing and developed countries.	Natural disaster frequency coefficient: - 0.69
		Natural disaster loss coefficient: -0.28
Raddatz (2009)	Climatic disasters have a negative impact on per capita GDP. Geological events do not have a significant impact. This effect is greater for smaller economies.	Climatic. -0.6 percent of GDP per capita
		Geological. Not significant

Cuaresma et al (2008) investigates the extent of the effect of development, research and catastrophic risk. They found that developed countries experience more economic loss when compared the developed ones, since the low per capita income countries have less knowledge spillover and new technologies. Hallegate and Dumas as cited in Pertiwi (2013) remarks that after disasters, large amount of money is used for reconstruction processes especially in significant disasters, so there is no possibility that disaster could affect economic growth process, positively.

Raddatz's, research in 2009 shows that when a disaster hit country, the GDP diminishes at least 0.6% in the long run although nearly all of output costs is compensated in the year of disaster.

All studies show that there are unconvincing results that investigates the relationship between disaster and the long run growth. However, the usual claim is that the long run economic growth is affected negatively by disasters. The level of effects of disaster shows differences in terms of the countries' stage of development. High income countries are more successful to activate 'creative destruction' dynamic to lessen the indirect damages of disasters by spending a lot of money when compared to low income countries (Pertiwi 2013).

2.3.2. Disaster and the Short Run Effects

There are plenty of studies that try to explain the relationship between disaster and development considering long term effects of disasters. However, it is hardly to observe significant and direct results when investigating such relationship based on short term effects of disasters. Table 8 gives the summary of the research on short term disaster effect.

Table 8: Short-Term Effect of Disasters

Source: Cavallo and Noy, 2010

Author	Conclusion	Estimated effect
Albala-Bertrand (1993)	Disasters have a neutral or positive effect on economic growth.	Difference between averages: 0.4 %
Raddatz (2007)	Climatic and humanitarian events reduce real per-capita GDP. Geological events do not have a significant impact.	Climatic: About -2 % of GDP per capita
		Humanitarian: About -4 % of GDP per capita
		Geological: Not significant
Strobl (2009)	Hurricanes have a negative impact on country growth, although countries show a smaller recovery the following year.	Immediate impact: -0.8 % of per capita income
		Impact one year after: 0.2 % of per capita income
Loayza et al. (2009)	Disasters have differential effects on economic growth. They are more adverse for developing countries.	Droughts: -0.606 % of GDP
		Floods: 0.996 % of GDP
		Earthquakes and storms: Not significant
Noy (2009)	Disasters have a negative impact on economic growth when measured by the property damaged, but not when measured by population. Effect is larger for developing and smaller economies.	For OECD countries: Short run effect: 1.33 % of GDP; Cumulative effect 1.99 % of GDP
		For developing countries: Short run effect: -9.7 % of GDP; cumulative effect -11.7 % of GDP
Rodriguez-Oreggia et al. (2009)	There is a significant impact from natural disasters on reducing the Human Development Index (HDI) and also on increasing poverty levels.	HDI: Going back about 2 years of development
		Severe poverty: 0.036 %
		Capacities poverty: 0.03 %
		Assets poverty: 0.015 %
Leiter et al. (2009)	Companies in regions hit by floods show higher growth of total assets and employment than firms in unaffected regions. The positive effect prevails for companies with larger shares of intangible assets.	Marginal effect of a flood on total assets (3rd quartile of share of intangible assets): 2.6 % of total assets
		Marginal effect of a flood on employment (3rd quartile of share of intangible assets): 4.7 % of employment
Mechler (2009)	Losses caused by natural disasters do not explain changes in consumption. However, adjusting savings for disaster effects helps in better explaining post-disaster changes in consumption, especially for low-income countries.	Not significant coefficients
Hochrainer (2009)	Natural disasters have a negative impact on GDP.	-0.5 % of GDP after the first year, -4 % of GDP after 5 years

Albala-Bertrand was one the researchers that define macroeconomic dynamics of disasters by collecting data for 28 disasters in 26 countries between 1960 and 1979 years. Based on the analysis about the situations before and after disaster, it is found that the effect of disaster on economy of the countries is positive. For example, GDP increased by 0.4%, while outputs of agricultural and construction sector rise. However, he claims that the boost in fiscal and trade deficit are the negative effects of disaster(Cavallo and Noy, 2010)

Benson and Clay (2003) claim that GDP of country that is hit by disaster decreases fluctuations in short term. Charveriat (2000) proved this statement in his study on disaster events in Latin America and the Caribbean between 1980 and 1996. The real growth rate declined in the year disaster hits and increased following two years in 28 of 35 disaster events.

Noy (2009) claims that there are some factors which can be helpful to cope with primary disaster shock and to decrease the effects on long run. These factors are the high level of literacy, strong institutions, higher per capita income, high level of import-export activities, high allocation of budget of government for disaster and high level of exchange reserves. Raddatz (2009) mentions that the vulnerability to disasters increases oppositely to the size and development of government. Moreover, large amount of the production cost of climatic disasters can be observed in the years of disaster hits.

Hochrainer (2009) uses a model to predict the change in GDP 5 years after a disaster. He compared the results of real GDP after the disaster so the predicted GDP if the disaster did not occur for 5 years. The result showed that natural disasters have negative effect on the economy of a country in the case of large disaster.

Rodriguez-Oreggia et al as cited in Pertiwi (2013) investigates the poverty and human development level after a disaster by using Mexico municipal data and Human Development Index by the World Bank. It is found that the disaster causes an increase in poverty in percentage of 1.5–3.6 and human development level diminishes. Parallel to these results Mechler as cited in Pertiwi (2013) claims that a disaster may cause to diminish household consumption in low-income countries.

Schumacher and Strobl (2011) used following model to predict the relationship between level of economic development and disaster losses.

$$\log\left(\frac{LOSSES\ it-1}{POPit-1}+1\right)=\alpha+\beta_1\log\left(\frac{GDP\ it-1}{POPit-1}\right)+\beta_2\log\left(\frac{GDP\ it-1}{POPit-1}\right)^2+\Lambda_j\sum_{j=1}^{m}X_{it-1}+\varepsilon_{i,t}$$

Where i is indicator of a country and t shows time period. LOSSES it-1/POPit-1 are a (per capita) measure of economic losses due to natural disasters as taken from the EM-DAT database, log GDPi;t−1 POPi;t−1 is a measure of economic development (wealth) as taken from the World Penn Tables and included both in levels and in quadratic form to capture its arguably nonlinear relationship to losses, X $\sum_{j=1}^{m} X$it-1 is a set of other possibly time and/or cross country varying control variables, and εi,t is an error term. In terms of other control variables we include the logged value of national population density and the logged value of the total geographical area of a country, as well as a set of year dummies (Schumacher and Strobl , 2011, p.100).

Schumacher and Strobl (2011) found that the economic impact of earthquakes varies from developing countries to developed countries. It is common to claim that the poorer countries have more human and economic losses in case of disasters than countries with strong economy. Moreover, increase in income leads to increase in demand for safety and could promote to take disaster precautions. There are two conditions for that. The first one is that if two countries have same level of hazard situation, the country with more income may have fewer losses after a disaster perhaps because of more investment in mitigation. The second one is if two countries have same level of income, the one with less hazard may have greater losses, since the country under high level of hazard situation will invest more on disaster risk reduction than the other. So, the relationship between economic losses due to disasters and wealth is determined by hazard exposure. If countries are under low hazard exposure, they have bell-shaped relationship between economic losses and wealth. Moreover if countries has under high hazard exposure, live U shaped relationship between economic losses and wealth. Figure 17 shows the relationship between losses and wealth. The line of HZ_00 shows the condition of countries under low hazard and it shows the bell-shaped relationship. The line of HZ_60 shows the those under high hazard and it shows the U shaped relationship.

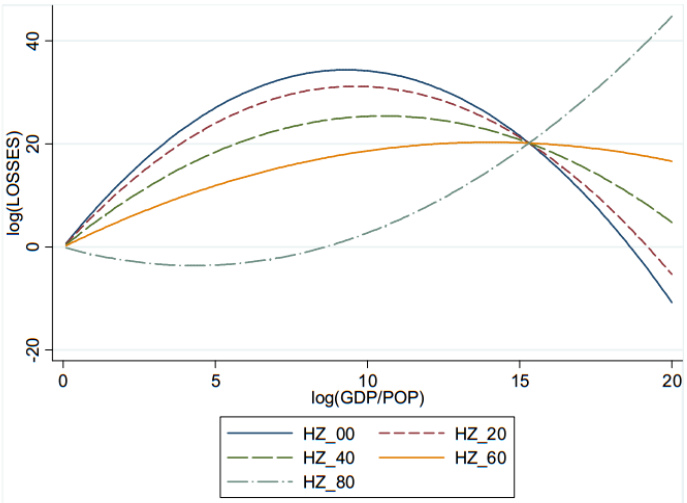

Figure 17: Losses-wealth relationship by natural disaster hazard level
(Source: Schumacher and Strobl, 2011)

Loayza et al (2012) applied a model to cross-country panel dataset for 1961-2005. Results of this model show that industrial growth rises in the case of earthquake and storm about 1% point because of increasing construction efforts after disasters. Droughts cause decrease in agricultural and industrial growth rate in developing countries by about 1% point (Table 8). They remark three results. Firstly, disasters do not always cause negative effects on development since different type of disasters affect countries in different ways. Effects of disaster on economic development differ based on country specific conditions. Second result is that disasters having median effect on countries like floods could cause positive supplements on the growth of economy while highly effective disasters do not. Third result is that developed countries are more resilient than emerging economies since the number of sectors affected by disaster is less.

Last studies aiming for estimating disaster impacts, usually uses a regression framework (Cavallo and Noy, 2010);

$$Y_{it} = \alpha + \beta X_{it} + \gamma DIS_{it} + \varepsilon_{it}$$

In this formula Y_{it} is the measurement of last effect of disaster like per capita GDP). DIS_{it} is a variable quantifies disaster's immediate impact on country *i* at time *t;* this indicator may be a criterias that shows the magnitude of disaster like wind speed or earthquake magnitude or it could be main variable of measure of damage such as mortality, morbidity, or capital losses. X_{it} is a vector of control variables that potentially affect Y_{it} and ε_{it} is an error term.

To conclude, the studies showed that economic indicators are affected in negative direction in short run. However, the reasons behind negative effects in economies was not clearly defined (Cavallo and Noy, 2010).

The long run and short run effects of disaster on development and models were analyzed by giving examples of literature in this part of thesis In following part of the thesis, the model implementation with data of Van will be presented.

CHAPTER 3

DISASTER RELATED LOSSES IN TURKEY

This chapter introduces earthquake hazard profile of Turkey and provides information about disaster losses. The chapter starts with an explanation of Turkish disaster management system. Then, it continues with the earthquake history of Turkey and earthquake damage share in overall disaster damage. In next title, the effect of earthquakes on the Turkish economy will be summarized. 1999 Marmara Earthquake was important milestone that affect the macroeconomic variables of the economy of the whole country. This devastating earthquake will be explained in detail. Urbanization history of Turkey will also be discussed in terms of earthquake effects in the country. Lastly, the development plans of Turkey will be analyzed in terms of disaster policies.

3.1. Disaster Management

Disaster management system of countries is critical in terms of economic losses. The direction and efficiency of investment on phases of disaster management system could contribute the increase or decrease the economic losses. The investment on mitigation phase decreases the economic loss caused by disasters. Moreover the allocation of resources on reconstruction and rehabilitation process instead of mitigation phase may increase the economic losses. Therefore, it is necessary to analyze disaster management system of Turkey.

To begin with, main aims of disaster management are the reduction or prevention of potential losses from hazards, assurance of assistance to survivors of disaster and success of rapid and efficient recovery. Conventional disaster management cycle consists of four processes: Mitigation, Preparation, Response and Recovery. Firstly, mitigation is described to eliminate or decrease the loss of life and property caused by disasters (natural, man-made and technological) and more resilient communities

by providing a critical foundation. Mitigation efforts help to decrease disaster damage and reconstruction effort. In some references, mitigation process is incorporated with prevention process. Prevention includes all countermeasures; the three of which are increasing control surveillance and security operations, searching about nature and source of threat, taking legal measures to protect life and property. Preparedness is a process in which operational capabilities are built and improved by planning, resources, training, exercising, and organizing. Response is defined as a process that includes short-term recovery to protect people's life, property and environment. Lastly, recovery is a long-term treatment of affected people that includes social, political, environmental and economic rehabilitation. Moreover, in this phase; service and site restoration plans are developed, government operations are reestablished, disaster effect is measured and initiatives are put in function to lessen impact (Baird, 2010). Major phases of disaster management is given in Figure 18.

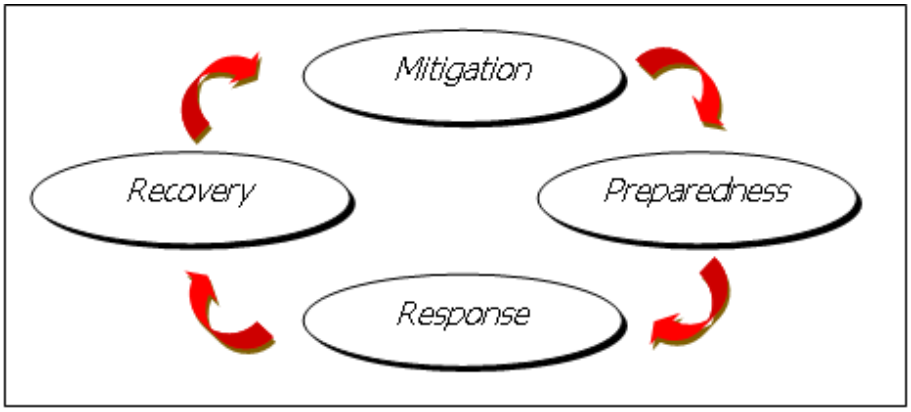

Figure 18:Disaster Management Cycle
(Source: Baird, 2010 adopted by FEMA EMI Course IS-10)

The disaster management is a multidimensional process. The Figure 19 indicates that major phases of disaster management need to multi disciplinary studies from land use regulation to evacuation beside the four process of disaster management.

Figure 19: Disaster Management Continuum
(Source: Disaster Management Center at the University of Wisconsin, 1991)

The success of each step of disaster management affects the other steps. However, the success of mitigation phase affects the whole cycle. The main aim of mitigation is to diminish the impact of disaster and get prepared for disasters. All steps of disaster management cycle is supported by development. Disaster management aims to promote sustainable livelihoods and to protect and rehabilitate them during disasters, which bridge it with development strongly. If this aim is succeeded, the recovery is more rapid and long-lasting due to higher capacity of people. The decreases of hazards, prevention from disasters and preparation to disasters are the main aims of a development oriented disaster management. Therefore, the mitigation and preparedness phases in disaster management cycle represent the development considerations. The increase of vulnerability and lack of preparedness are seen reflections of unsuited development process (Warfield, access time:10.11.2013).

Political choices, economic growth level and culture of countries determine disaster management process (Övgün 2013). In Turkey, recovery phase usually is considered as the most important part of disaster management and legislations, plans and programs are usually relates with recovery phase.

Legislations affecting the disaster management system of Turkey can be examined in four stages. In the 1923-1944 period, there was no effective policy for disaster management. However, in 1944 a bill, in which local government was assigned with responsibility of forbidding the housing construction permit without geological surveys was enacted. This bill contributed to preparation the first earthquake zone map of Turkey. The 1944-1959 period, the Law No. 4623 was declared in 1944 to organize disaster management activities. This was the first law that determines the local and central organization to decrease the hazard and risk of disasters and damage caused by disasters and control of settlement and buildings. This law is also important that it started to mitigation efforts firstly. The disaster occurred in that years showed that the law was not enough (Özmen and Erkan, 2012, p:226). Therefore, the Development Law No: 6785 and Civil Defense Law No: 7126 were declared in 1959-1999 period, Law on Precautions for Disaster Affecting Everyday Life No. 7269 was enacted. This law is still in use. It defines the prevention and response phases of disaster, however the focus of the law is the authorities, activities and responsibilities of actors of recovery stage of disaster. Lastly, in the post 1999 period, the Marmara Earthquakes forced policymakers to change regulations. Therefore, 7 new laws and 32 decrees were enacted and the institutions that are responsible for disaster management restructured (Baris, 2009). One of the decrees promoted to establish the search and rescue district directorates in the eleven cities[6]. Moreover another important development caused by these decrees was Compulsory Insurance for Earthquakes (Övgün, 2013).

The Turkish Disaster Management system is based on the top-down approach and central authority manages the disaster. Inefficient disaster management in the Marmara Earthquake and Düzce Earthquakes of 1999 and experiences in periods that mentioned above showed that there is need to change disaster management organizational structure. Before 2009, three institutions were responsible for disaster and emergency management; General Directorate of Civil Defense under Ministry of Interior, General Directorate of Disaster Affairs (hereafter GDDA) under the Ministry of Public Work and Settlement and General Directorate of Turkey Emergency Management (hereafter TAY) under the Prime Ministry. TAY

[6] Adana, Afyon, Ankara, Bursa, Diyarbakır, Erzurum, İstanbul, İzmir, Sakarya, Samsun, Van

coordinated response phase of disasters while GDDA was responsible for reconstruction phase. In the time of these institutions, crisis management was the focus of the disaster management. In 2009, these three institutions were combined to focus more on risk management, effective coordination of disaster management and localization of disaster management. At the central level, AFAD (Disaster and Emergency Management Presidency) and at local level, Provincial Disaster and Emergency Directorates were established by the Law No. 5902 in 2009. DEMP is responsible for coordination of disaster management. The main aim is to strengthen the localization of the disaster management and local actors. Governor was the head of the Provincial Disaster and Emergency Directorates and was responsible for disaster management.

In 2014, the law on the Organization and Duties of Disaster and Emergency Management Presidency numbered 5902 was changed. The Special Provincial Administrations were repealed and the Provincial Disaster and Emergency Directorates was assigned as provincial organization of DEMP in terms of duties and organization. The question of whether this organization change in Law No. 5902 means to return centralized disaster management or as rises and to be answered in time.

3.2. Earthquake Profile of Turkey

Turkey has always been a disaster-prone country because of its geological, topographical, and meteorological conditions. Disasters have caused 87.000 losses of life and damaged 651.000 dwelling units since 1900s (Övgün, 2009). Turkey has experienced many earthquakes as a result of being located on seismically active region dominated by three major fault lines[7] and lots of minor fault lines. 3 % of worldwide earthquakes occurred in Turkey. Turkey has experienced devastating earthquakes having a magnitude of 7.5-7.9 in every 30-60 years , a magnitude of 7,0-7,4 twice or three times in every 10 years, a magnitude 6,5-6,9 three or five times in every 10 years, a magnitude of 6,0-6,4 occurred five or seven times in every 10 years ("Türkiye'de Depremler Durdu mu?," 2009). Between 1902 and 2003, 137 earthquakes occurred in Turkey. They caused 83.908 life losses, 493.824 dwelling

[7] North Anatolian Fault (NAF), East Anatolian Fault (EAF), West Hellenic Arc (WHA).

units were damaged and costed $18 million (Ergünay, 2007). Figure 20 shows the Turkey Earthquake Zone Map and figure 21 show the earthquakes having bigger magnitude than 5 after 1900s. These earthquakes are usually caused by North Anatolian Fault, East Anatolian Fault and West Hellenic Arc.

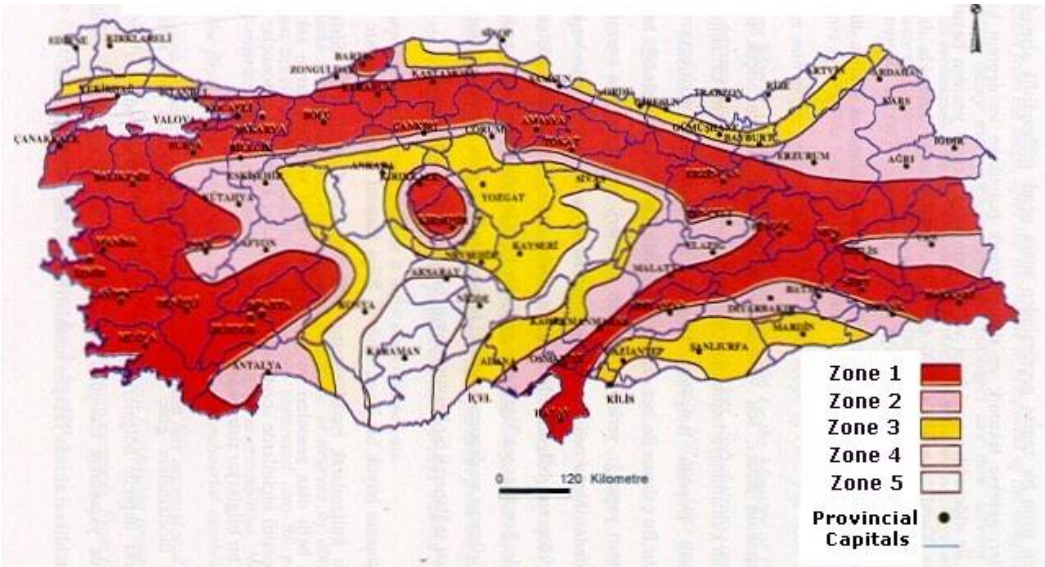

Figure 20: Turkey Earthquake Zone Map
(Source: Disaster and Emergency Management Presidency, Earthquake Department)

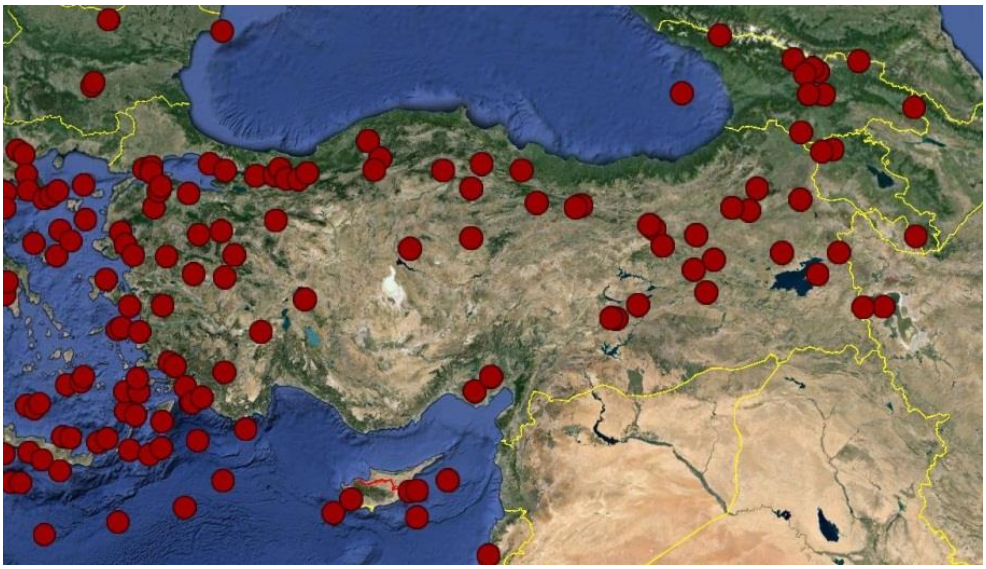

Figure 21:The epicenter of earthquakes having higher magnitude than 5 in 1900-2013

(Source: Disaster and Emergency Management Presidency, Earthquake Department)

The seismicity should be examined to understand the earthquake potential of Turkey. The primary fault lines of Turkey: North Anatolian Fault Line (hereafter NAF), East Anatolian Fault Line (EAF), Cyprus-Hellenic Arc, Aegean Graben System, East Anatolian Contractional Province and Central Anatolian Ova Province are six active tectonic belts as shown in the figure (Çorbacıoğlu, 2006).

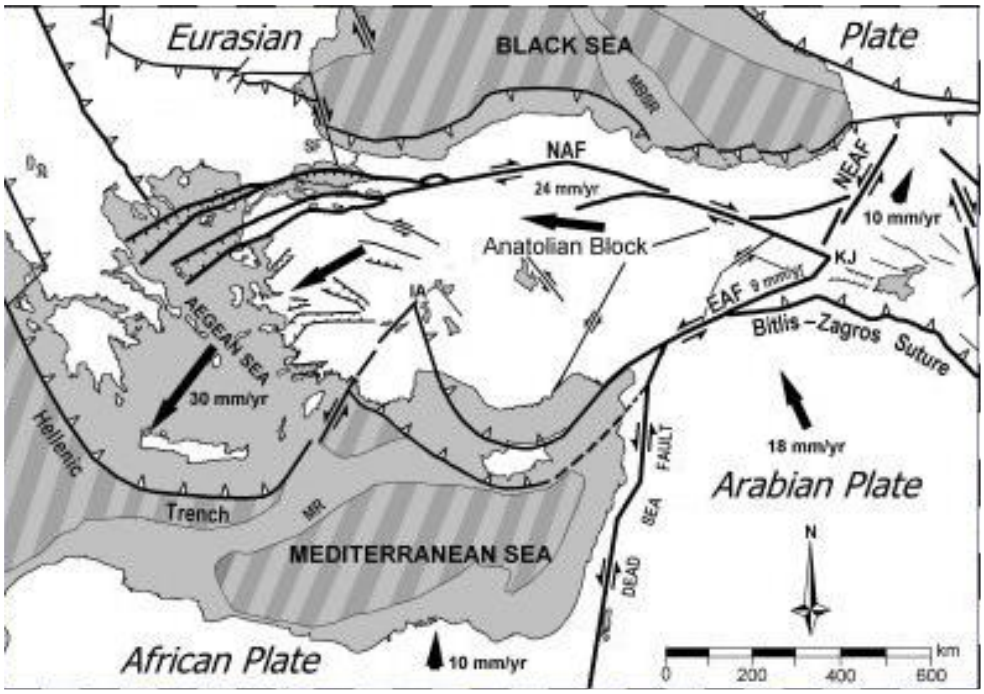

Figure 22: The Major Fault Lines and Plates of Turkey
(Source: Karagöz Lecture Notes, n.d.)

Asian, African and Arabian plates, and Aegean, Anatolian and East Anatolian plate tectonics that take place between these three plates determine the seismicity of Turkey. The movement of Arabian Plates toward Eurasian plates in the direction of north-north east with a speed of 24mm/year causes the movement of Anatolian and East Anatolian plates toward west and east respectively. This movement causes strike slip movements of faults of the NAF toward north and EAF toward southeast. The most critical strike slip fault lines of Turkey are the NAF and the region, where it intersects with the EAF. All these faults have caused earthquakes in Turkey since ancient times.

NAF, which is right-lateral strike-slip fault, has a 1,200 km long. It has produced 36 devastating earthquakes while EAF produced 11 (Çorbacıoğlu,2006). Table 9 shows the most devastating earthquakes of Turkey the years between 1900 to current date. It is clear that most of them occurred on NAF. 17 August 1999 Marmara Earthquake was the most disastrous one in terms of economic loss, which this fault produced in

the last century. 1 May 2003 Bingöl Earthquake and 23 September 2011 Van Earthquake also occurred on this fault.

Table 9: The Devastating Earthquakes since 1990s in Turkey
(Source: Ergunay, 2007, adopted by Akar 2013, redrawn by author)

Location	Date	Number of Death	Affected Population	Economic Losses (Million Dollars)
Erzincan	13.03.1992	653	250.000	750
Dinar	01.10.1995	94	120.000	100
Çorum-Amasya	14.08.1996	0	17.000	30
Ceyhan-Adana	27.06.1998	145	1.500.000	500
İzmit Gulf	17.08.1999	17480	15.000.000	13000
Düzce	12.11.1999	763	600.000	750
Sultandağı- Afyon	03.02.2002	42	222.000	95
Bingöl	01.05.2003	177	245.000	135
Simav- Kütahya,	19.05.2011	2	-	-
Van	11.10.2011	644	700.000	1.500

.

The Earthquake Zone Map (Figure 20) is also important tool to show seismicity of Turkey. Ozmen and Nurlu (2009) say that first-degree earthquake hazard zone consist of 42% of Turkey land area and second degree earthquake hazard zone consist of 24% of Turkey land area. Moreover, the big percentage of population, industry and dams also are in first and second degree hazard zone (Table 10). In 1935, 7.1 million people were living the first degree earthquake hazard zone, while in 2010 this increased to 32.3 million. In 2010, 43-45% of Turkish population lived in first degree earthquake hazard zone and 20.5 million people lived in second degree earthquake hazard zone. Thus, according to 2010 figures, 65% of Turkish population lives on earthquake hazard zone (Avcı, 2011).

Table 10: The Distribution of Land Area, Population, Industry and Dam on Hazard Zones of Turkey

(Source: Ergünay, 2007)

Hazard Zone	Land Area	Population	Industry	Dam
1	42	45	51	46
2	24	26	25	23
3	18	14	11	14
4	12	13	11	11
5	4	2	2	6

It is clear that a large percentage of population lives on potential earthquake areas. Moreover, concentration of population on earthquake zone also increase the risk. Therefore, the integration of disaster concern and development plans gain more importance. However, every disaster proves that it is not realized (Turan, 2012).

3.3. Economic Effect of Earthquakes in Turkey

Turkish economy is one of the biggest economy in the world ranking 16th in terms of purchasing power parity and ranking 6th in terms of GDP in Europe in 2012 (MFA, access time 14.05.2014). The GDP of Turkey is $ 18,348 in 2012 and annual average GDP growth rate peaked in with the increase of 7.2 % since 1980s as shown in the figure 23. The 9.2% expansion of Turkish economy in financial recession, which affected the whole world in 2010, showed that Turkish economy is one of the fastest growing economy in the Europe.

Figure 23: The GDP of Turkey since 1960s
(Source: Trading Economics, 2012)

The GDP of Turkey in 2012 has tripled in the last 10 years by increasing from $ 3.492 to $10.497. The GNP per person increased to $15 according to purchasing power parity.

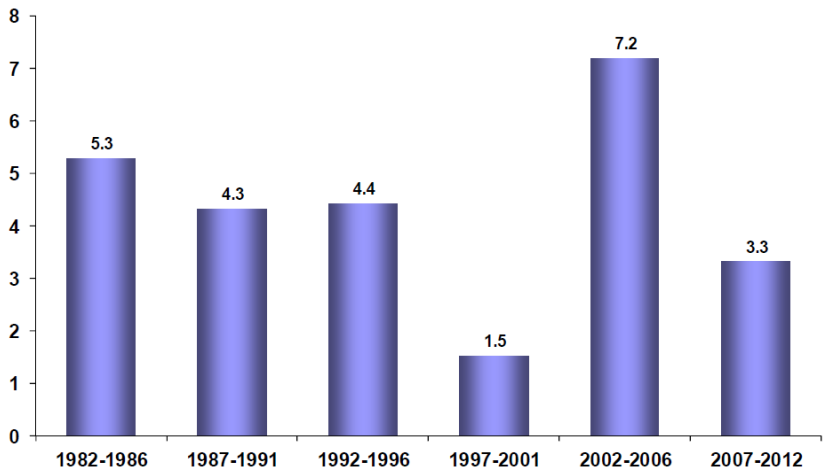

Figure 24: GDP Growth Rate (Annual Average, %)
(Source: Turkish Statistical Institute (hereafter TURKSTAT))

Agriculture, industry and service sector is dominant sector of country. The GDP's of sectors are 8.9%, 28.1% and 63% respectively in 2012. The total labor force is 27.3 million and employment distribution by sectors is the service sector is 49.4%, agriculture 24.6%, industry 19.1% and construction 6.9%.

After giving brief information about Turkish economy in the last decades, the economic effect of earthquakes will be explained. Natural disasters cause the decrease of GDP of Turkey, direct losses decrease GDP 3% in every year, and direct and indirect losses decrease nearly 4-5% of GDP of Turkey (Ministry of Development, 2012). According to statistics of CRED, earthquakes take place on the top in all types of disasters in terms of affected people, killed people and cost of disaster from 1900 to 2013 in Turkey (Table 11). Every earthquake caused 1174 loss of life and $325 million economic damage on the average from in this period. In this period, the share of earthquakes in total is 89236 from whole loss of life and $ 25 million.

Table 11: Summary of Natural Disasters in Turkey from 1900 to 2013
(Source: EM-DAT, 2013)

Disaster Type	**Number of Events**	**Loss Of Life**	**Total Affected**	**Damage (000 US$)**
Earthquake	76	89236	6924005	24.685.400
Average per event		1174.2	91105.3	324807.9
Epidemic	8	613	204855.0	-
Extreme temperature	7	100	8450	1000
Flood	39	1342	1778520	2195500
Mass movement dry	1	261	1069	-
Mass movement wet (Avalanche+Landslide)	11	432	13487	26000
Storm	9	100	13639	2200.0
Wildfire	5	15	1150	-
TOTAL	**156**	**91497**	**8945175**	**26.910.100**

Ergünay (2007) also indicates that the cost of earthquakes between 1994 and 2007 is $ 18 million. The most destructive earthquakes and their effects are shown in Table 12. It shows that the cost of Erzincan earthquake $ 0.75 billion and the cost of 1999 Marmara Earthquakes is more than $ 20 billion.

Table 12: The summary of most destructive earthquakes since 1900s
(Source: Çorbacıoğlu, adopted from Gülkan (2002))

Earthquakes	**Deaths**	**Housing Units Damaged**	**Housing Units Collapsed**	**Estimated Cost ($ Billion)**
1992 Erzincan	645	8000	1450	0.75
1995 Dinar	100	6500	2043	0.25
1998 Ceyhan	150	21000	2000	0.5
1999 Marmara	>18000	32000	26000	>20
1999 Düzce	812	10100	800	1
2011 Van	644	56315		

Figure 25 shows the interception of GDP changing of Turkey since 1960s and the earthquakes having magnitude higher than 7. It is clear from this Figure and Table 13 that the other earthquakes did not affect the GDP of county except 1999 Marmara earthquake. The GDP continued to increase in the following years of the earthquakes even if after the Marmara Earthquake. It is clear that where earthquakes occurred affect the damage to GDP country. Since the Marmara Earthquake occurred in the industrial heart of the country, the GDP of country was highly affected.

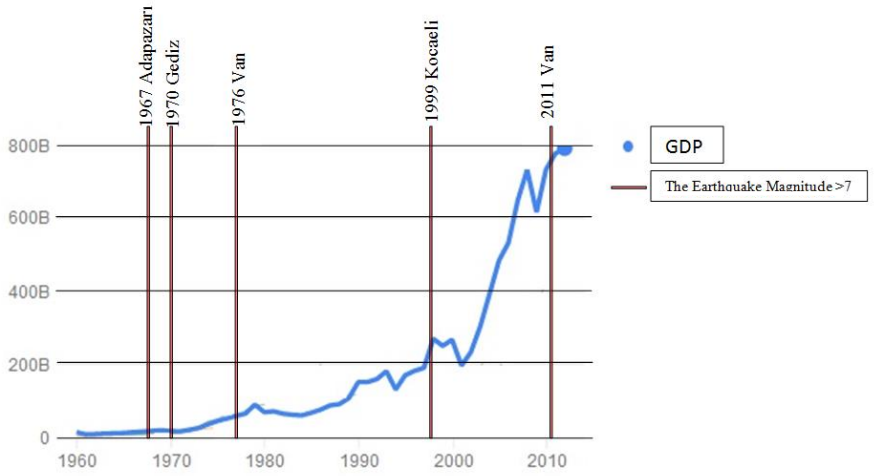

Figure 25: The GDP Change in Earthquakes (Mw≥7) in Turkey

(Source: Trading Economics, 2012)

Table 13: The GDP Change in Year Since 1967 for Earthquakes of Magnitude 7 or Higher in Turkey

(Source: Ergünay (2009) redrawn by author)

Year	Earthquake	Mw	Damaged building	Number of death	Gdp, billion dollars 2012 prices		
1967	Mudurnu	7.2		89	**1966**	**1967**	**1968**
					14,12	15,66	17,5
1970	Gediz	7.2	10500	800	**1969**	**1970**	**1971**
					1	17,09	16,26
1976	Muradiye	7.5		3840	**1975**	**1976**	**1977**
					44,63	51,28	58,68
1999	Marmara	7.4	86441	17480	**1998**	**1999**	**2000**
					269,3	249,8	266
2011	Van	7.2	2262	601	**2010**	**2011**	**2010**
					731,1	774,8	789,3

Turkey is more vulnerable to earthquakes when compared to other countries. There has been an earthquake of magnitude of 8.1 in 1985 in Mexico and an earthquake of magnitude 7.2 in Japan. The report has probably chose these countries that the fault lines that caused the earthquakes in Mexico and Turkey has similar characteristics and the socio-economic conditions of both are alike. Moreover Japan and Turkey has

close collaboration in terms of disaster management. The magnitude of the earthquakes are not so different, however, the losses of countries are highly different from each other. In Table 14, the comparison of earthquakes that were experienced by these countries is shown. The loss of life caused by earthquakes is the highest in Turkey. This table shows that Turkish macroeconomic indicators of Turkey are more sensitive to earthquakes than the other two example countries.

Table 14: The Comparison of Earthquakes in Mexico, Japan, Turkey
(Source: Turkey County Office, 1999)

	Mexico	**Japan**	**Turkey**
Date	Sep. 1985	Jan. 1995	Aug. 1999
Severity (Richter Scale)	8.1	7.2	7.5
Loss of lifes	9,500	6,430	15,135
Buildings destroyed (dwellings in the case of Mexico)	40,000	180,000	46,039
Material Damage (% of GDP)	2.7 - 3.5	1.5 - 2.0	1.5 - 3.3
Earthquake related fiscal burden (% of GDP)	…	1.0	1.8 - 2.3

3.3.1. 17 August 1999 Marmara Earthquake

1999 Marmara Earthquake is the most destructive earthquake in terms of life losses and economic loss in the history of the country. It occurred at 3:01 a.m. local time on 17 August 1999.The magnitude of earthquake in richter scale was 7.5 and the epicenter was about 11 kilometers southeast of the city of Izmit. The disaster affected the 23 % of the population of Turkey and the people in Kocaeli, Sakarya, Düzce, Bolu, Yalova, Eskişehir, Bursa, and Istanbul felt the earthquake. More than 18000 people lost their lives and more than 50.000 dwelling units collapsed. The economy of the region has important share in Turkish economy especially in the industrial

sector. The share of eight affected cities on Turkey GDP is 34.7 %, the share of Kocaeli, Yalova and Sakarya on Turkey GDP is 6.3% and the share of industrial value added is 46.7. Therefore, the macroeconomic indicators of the country like economic growth, GDP and inflation were affected negatively (OECD, 2003).

Economic growth decreased one and a half points above baseline. Moreover it is estimated that the earthquake caused a decline of GDP in proportion of 6,1. The following year of the earthquake, inflation is expected increase because of high expenses in reconstruction. The earthquake affected the trade balance by a decline of import activities by 6 % and export activities 11%. After the disaster, Production Index[8] dropped from 12.1% to 9% and consumption expenses decreased by 2.1%. Small and medium sized businesses were more severely affected from earthquake. The construction permits in the earthquake prone region were cancelled until 2000. The decrease in construction activity in the region not only affected the construction sector of the region but also caused a decline in construction sector at national level. Moreover in 1999-2000 years, reconstruction efforts caused on increase in the current account deficit by a total of some US$3 billion, equivalent of 1.5% GNP of Turkey. Long-term credits and concessional funds provided by international financial organizations and Turkey's bilateral partners are expected to provide this additional current account deficit (Turkey Country Office The World Bank, 2013)

The reserves of Central Bank decreased by $1.3 billion (Karagöz, K. 2007). The earthquake also caused decrease of tax revenues of government. Cancellation of taxes cost 270.2 billion dollars to budget. The share of income tax in $270.2 billion is $67 million, the share of company tax is $ 38.5 million and the share of motor vehicles tax is $ 758 million. Moreover, the government payment for emergency need, rehabilitation and reconstruction efforts caused to a heavy burden on budget. The total cost of the Marmara earthquake to public finance is calculated as $2.796 billion (Akar, 2013)

Calculating total cost of catastrophe was a hard work and different institutions explained different numbers from $ 5 billion to $13 billion. The State Planning

[8] "Production index means measures the volume of production at base year prices for the manufacturing, mining and quarrying and energy supply industries" (UK National Statistics, 2014).

Organization (hereafter SPO)[9], the World Bank and Turkish Industrialists' and Businessmen's Association (TUSIAD) calculated the cost of the earthquake as shown in Table 15. The World Bank estimated total cost as 9-13 million dollars, Turkish Industrialists and Businessmen Association (TUSIAD) declared the total cost as 5-9 million dollars, and SPO announced as 9-13 million dollars.

Table 15: Estimated Costs of 17 August 1999 Marmara Earthquake
(Source: JICA (2004) as cited in Akar, 2013)

COST (BILLION $)	SPO	WB	TUSIAD
Direct Cost	10	6.6-10.6	3.1-6.5
Housing	4	3.5-5	1.1-3
Management	4.5	2.5-4.5	1.1-2.6
Infrastructure	1.5	0.5-1	0.9
Indirect Cost	2.8	2-2.5	1.8-2.6
Loss of Value Added	2	2-2.5	1.2-2
Emergency Rescue	0.8		0.6
TOTAL COST	13	9-13	5-9
Secondary Cost	-	-	-
Financial Cost[10]	2	5.9	3.6-4.6

Kotil, Konur and Ozgur (2007) have studied in Marmara Earthquake in the example of Kocaeli City to show the macroeconomic effect of 1999 earthquake on Turkey economy. In their model, they chose industry, production industry, wholesale and retail trade, communication and transportation sub-sectors and tourism sector since these sectors have higher percentage in GDP than others. Time was not affected by

[9] The State Planning Organization (SPO) was reorganized as Ministry Of Development with a statutory decree in 2011.Therefore the institutional name has changed.

[10] "Financial cost incorporate expenses that a company incurs through operations, from factory costs to surcharges down the supply chain" (Codjia)

other variables so time is chosen as explanatory variable and sub-sectors are chosen as dependent variables. The least square method was used and estimation was evaluated according to statistic and econometric criterias. The results of model implementation showed that wholesale and retail trade sector trend rate is most affected sector in the condition that the decrease of the average annual growth rate is 4,6 and the reducing effect of earthquake is 5% level.

3.4. Why Earthquakes Cause Significant Economic Losses in Turkey?

Freeman et al (2003) remarks that there are two reasons for increasing cost of disasters in worldwide. First reason is the increase in the intensity of climatic effects because of climate change. The second reason is the increase in urban density in disaster vulnerable areas. For example, many of the megacities of the world, where the urban density is high, are located on disaster prone areas. Forbes (2007) explains the most earthquake vulnerable 20 cities[11] of world in terms of estimation of life losses in case of occurrence of an earthquake with magnitude 6 or higher. The first city is Katmandu, Nepal with estimation of the 69,000 loss of life. Istanbul takes second place with 55.000 loss of life. The most vulnerable 10 cities of world are megacities of developing countries like Delhi and Mexico city.

Economic vulnerability is a dynamic notion that the expansion and content of this concept change for different countries. Hazard type, all variables of the economy of the country, the size of the country, the welfare of country and socio-economic background are the basic parameters affecting the extent of effect of the disaster on the economy of the country. There are also different parameters like global warming and climate change (Benson and Clay, 2004). Developing countries are more vulnerable to disasters because of these parameters. The basic factors that affect the vulnerability of Turkey as a developing country can be listed as poverty, urban management and insufficient planning and preparedness. Urban management is analyzed in detail in the next section.

[11] Kathmandu (Nepal), Istanbul (Turkey), Delhi (India), Quito (Ecuador), Manila (Philippines), Islambad (Pakistan), San Salvador (El Salvador), Mexico City (Mexico), Izmir (Turkey), Jakarta (Indonesia), Tokyo (Japan), Mumbai (India), Guayaquil (Ecuador), Bandung (Indonesia), Santiago (Chile), Tashkent (Uzbekistan), Tijuana (Mexico), Nagoya (Japan), Antofagasta (Chile), Kobe (Japan)

3.4.1. Urban Management

Successful urban management is done under the condition that hazard management is achieved. Potential hazards of cities must be determined and hazard information must be disseminate to the public. Deichmann and Lall (2009) determines that the reasons of increasing density of natural disaster risk in urban areas are the rapidly urbanizing developing world, population increase and economic properties.

Natural disaster risk is composed of vulnerability and exposure. The risk and vulnerability are defined as;

> a compound function of the natural hazard and the number of people, characterised by their varying degrees of vulnerability to that specific hazard, who occupy the space and time of exposure to the hazard event (Wisner, B 1994, p.49)
> Vulnerability is a function of exposure to climate factors, sensitivity to change and capacity to adapt to that change". Systems that are highly exposed, sensitive and less able to adapt are vulnerable. Adaptation strategies therefore involve the identification of sectors/systems/regions vulnerable to change and an examination of the scope to increase the coping capacity of those systems — their resilience — which in turn will decrease that vulnerability. Prioritization will also depend on identifying vulnerable systems or regions whose failure or reduction is likely to carry the most significant consequences." (Australian Greenhouse Office, 2005, p.9)

and equate this definition as: Risk= Hazard x Vulnerability

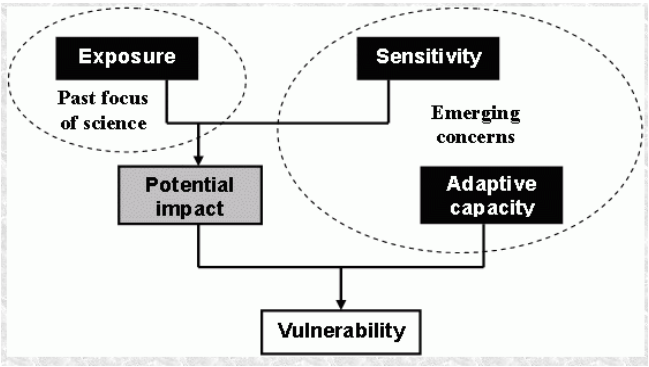

Figure 26: A framework for understanding vulnerability

Source: Australian Greenhouse Office, 2005.

The rise in exposure and vulnerability increases the urban risk. The number of people living in hazard prone areas is increased due to natural increase by fertility, urban expansion and migration. Growth in slum populations in sub-standard housing also became widespread due to rapid urbanization (Lall and Deichmann, 2009). Therefore, the high-level urbanization bring the increase of the exposure of people

and economic activity in hazard prone areas in case of disasters (as cited in ISDR 2009 and World Bank 2010).

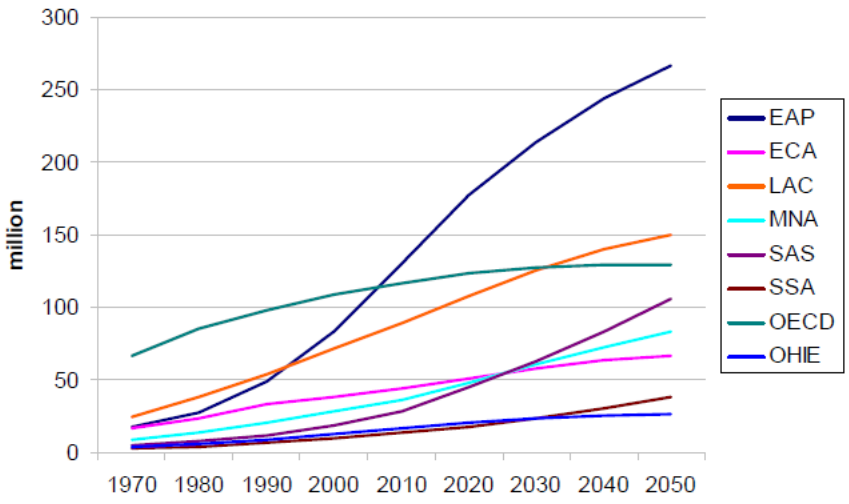

Figure 27: Population in large cities exposed to earthquakes increases from 370 million to 870 million between 2000 and 2050

(Source: Lall and Deichmann (2009) as cited in the World Bank 2009)

Many parts of the world suffer from increasing vulnerability to natural hazards because of rapid urban growth supported by huge amount of migration from rural areas that lives in poverty. Unfortunately, rapid urban growth causes uncontrolled and low quality settlement in urban areas. For example, ecology usually changes because of deforestation or infrastructure like drainage system usually are performed insufficiently for these settlements. All these factors cause the increase of the vulnerability to flash floods by raising the amount and speed of rainfall (Lall and Deichmann, 2009).

Rapid urbanization and high physical exposure usually increase earthquake risk. High urban growth rate, which is one of the factors that lead to increase in development level, socio-economic conditions and originates disaster risk. The migration from rural areas to urban areas generates squatter housing or city slums and housings settled down inappropriate places in disaster risk areas like steep

slopes, flood plains and neighboring to industrial and transport facilities. The low-income level groups sometimes are forced to live in hazardous areas for example due to being near to workplace (UNDP, 2004).In last years, the number and the complexity of disasters increase and the effects of multi-disasters are also critical. Therefore, the preparation of cities to these disasters and make them more resilient is critical.

The World Bank report published in 2010 also remarks the relationship between population increase and disaster damage. In developing countries, the households migrated to urban areas because of inevitability in rural areas and the urban areas witnessed the overgrowth population, which brought the unplanned urbanization. Therefore, the regions under high risk of disasters like high seismicity or flood plains are populated. The report says that the unplanned urbanization rate reached from 60% to 70% in the 1990s. Moreover, techniques and habits of building constructors is another factor that cause increase in damage after disasters. The construction quality including material and design is so effective on building damages in case of any disaster.

Disaster risk is usually determined by three factors in cities. The first factor is the history of city that where the city settled down and the growth direction of cities to hazard prone areas. The second driver is that urbanization process, where large amount of population located on risk prone areas. This factor is especially valid in medium and small sized urban centers and mega centers that capacity is not enough to satisfy the demand for housing and infrastructure of population. The third factor is that social and economic structures were destroyed due to newcomers of cities. This situation causes the disruption of accessibility to resources by newcomers and raise of vulnerability level (UNDP, 2004).

A large portion of earthquake losses in Turkey usually caused by damage to buildings and infrastructure. The construction quality is very important concerning damage to houses. Urbanization problems such as illegal houses in parallel to dramatic increase of population in the cities and disintegration of disaster risk to planning increased the risk of cities.

> It is needed to be added that the problem is not only the building quality, building stability and uncontrolled buildings but also urbanization nature, format, excessive population density in big cities, the imbalance in the population distribution, not taking into account the factors related to earthquake-resilience in making and applying the city plans and illegal

> construction and squatters and indicating that it is related to the human and natural disaster lost its naturalness in this condition (Keleş, as cited in Turan, 2012 p.49).

The population of Turkey has increased since 1927 and the urbanization rate shifted constantly due to flows from rural areas to urban areas. The percentage of population of cities and rural areas equaled in 1980s and the rise in urbanization rate from %50 to % 77 in 2012 dramatically (TURKSTAT, 2013) The numbers show that the urbanization process of Turkey occured rapidly and without planning, parallel to development of industry after the World War II. The urbanization realized in only meaning of numbers namely population of cities increased by migration from villages to cities, however cities were not ready to settle newcomers and housing production turned to a main problem. The problem brought illegal housing and city growth on the high risk areas. Especially the Marmara Region having potential of labor force is overpopulated and with unplanned city growth the vulnerability to disasters increased.

The period of rapid urbanization process of Turkey in relation to industrialization is explained in the next paragraphs.

In 1923-1945, the İzmir Economy Congress initialized economic policies of Turkey. National production gained importance and industry was promoted. Sümerbank and Etibank were established in this period. The main aim of the establishment of Emlak Bank was to give credits for housing production The responsibility of production of housing was given to municipalities in this period. The central government controlled the plans of cities and the city plans were designed for planned growth of cities like Ankara. In this period, the settlement plans were designed according to the places of industry for stable development between regions.

After the World War II, the International Monetary Fund (hereafter IMF) was seen as solution of economic problems. The machines took place of human power and this caused an increase in unemployed households. Moreover, the changing property relations and the changing distribution of agriculture credits caused a decrease of property. All these conditions started migration to cities. The newcomers in big cities usually constructed their housing on public land in periphery of the cities.

In 1960s, the industrialization especially in automotive sector developed and needed cheap labor force. These situations increased the migration to cities, which increased

the squatter housing in the periphery of cities and industrial areas. The old city center's down town was destructed. After 1970s, the characteristics of squatter housing changed. The number of floors increased and they had not for supplying the housing need of low-income groups anymore. In these years, the build-and-sell housing model was developed in these years for middle income groups.

In 1980s, specialization began in agricultural sector and it was opened to international area. However, developing technology increased fertileness and decreased the need to labor force in agriculture. Therefore, the migration to cities accelerated. Migration from cities with fewer opportunities to cities with more opportunities increased. These conditions also increased the illegal housing. Development amnesties that enacted in four times in this period promoted to construction of these type of housing. In this period, squatter housings are transformed to multistorey buildings by changing development plans, which means that the increase of population density in the region and vulnerability.

In 1990s, rapid urbanization continued to increase and public managers took responsibilities to construct qualified housing for low and middle-income groups. In some metropolitan cities like İstanbul, Ankara, İzmir, Adana, Mersin, Kocaeli and Diyarbakır, the rate of illegal housing reached to 70%. The share of population living in irregular housing increased five times between the years between 1950 and 1960. In 1991, the number of illegal housing was 1.585.455 and most of them settled in big cities İstanbul, Ankara and İzmir (Kabadayı, 2004).

Another problem is that disaster risk was not integrated into planning process. Although disaster risk is so high and known in Turkey, neither city nor the regional plans were designed to decrease disaster risk in urban areas. For example, the NAF is known for so many years but no regional policy was adopted to prevent or decrease the dense industrial and settlement corridor in the Marmara Region. Urban transformations that turns squatter housing to legal housing is another problem, which increases disaster risk.

Urban areas are also host to multi-hazard and multi-disaster. Earthquakes trigger secondary disasters like fires, avalanches and tsunamis.1999 Marmara Earthquake caused to disastrous fire at TUPRAS petroleum .rafinery.

In summary, the urbanization process is one of the main reasons to increase disaster risk in Turkey. Overpopulation of disaster prone areas and unplanned and

uncontrolled growth of cities increased vulnerability and risk in the cities. The experience of disasters have not orientate policy makers to find new solutions for risk reduction in cities. For example, cities are continuously growing without defining their risks. It is clear that Turkey may experience a lot disaster with high losses in the future, if mitigation efforts do not include urban planning adequate.

3.5. Development Plans in Turkey and Link to Disasters

Earthquakes have affected Turkısh economy for many years. As mentioned in the third section, the most destructive earthquake in Turkish history is counted as the 17 August 1999 Marmara Earthquake which caused total fiscal burden in the range of $16 to $20 billion, that is between 5 and 7% of Turkey's GDP inferentially (Erkan, nd.). However, development plans and disaster management could not be integrated successfully and sufficient attention could not be allocated to diminish disaster losses in the plans (Şengün, 2011 as cited in Turan 2012).

Turkey development plans mentions about Turkish economic policies and determines way of economic growth and aim, tools and sources of growth. Public institutions are obliged for the implementation of policies in development plans. The first development plan was prepared for 1963-1967 and since then nine development plans were prepared and implemented in years. Therefore, development plans can be key materials to analyze how disaster takes place in the development paradigm in Turkey after 1960s.

Turkish disaster management system focuses on crisis management rather than risk reduction. Development plans also reflect this understanding and “disasters” included in urbanization, housing, environment and R&D studies.

In the first three plans, prepared between 1963 and 1977 years, manufacturing, import substitution, and the intermediate goods sector were the main focus. “Disaster” word was only mentioned in housing topics. There was no policy for reduction of disaster losses. Unfortunately, Turkey has experienced 1964 Manyas, 1966 Varto, 1967 Mudurnu, 1968 Bartın, 1968 Alşehir,1970 Gediz, 1971 Bingöl, 1975 Lice, 1976 Muradiye destructive earthquakes within the period of the first three development plans.

1979-83 development plan is the first plan that pointed out that disaster losses could be decreased with preventive precautions and settlement and building construction

should be controlled. It underlined the reason of disaster losses such as uselessness of city development plans and insufficiency of the technological improvement in rural construction technology. Although the disaster loss problem is started to be underlined in this plan, there was no policy development for resource allocation to solve the problem.

1985-89 development plan mentions disaster subjects as in the first plans.1990-1994 plan, like earlier plans deals with the disaster subject only in housing sector part of plan. It indicates the need for the development a new building construction control system and determination of new technologies for resilient buildings. In this period, disaster, earthquake and civil protection funds were included in general government budget and not used for disaster risk reduction. In implementation of this plan, the Erzincan earthquake occurred in 1992 and caused $ 0.75 billion economic damaged. "Disaster" was mentioned more in 1996-2000 plan. The plan proposed that land use maps and local earthquake seismicity maps should be renewed and regional and physical plans should be designed according to these maps. The plan foresees that regulations about disaster, especially Law No. 7269 should be renewed. Another important point in the plan is that there is a need to restructure of institutions related to disasters to provide efficient coordination in disaster management. Turkey experienced destructive earthquakes and floods in the period of 1996-2000. The most significant ones were 1999 Marmara earthquake, 1998 Adana Earthquake, 1998 West Black Sea Region Floods, 1996 Amasya–Çorum Earthquake, and 1998 Balıkesir earthquakes.

In the 2001-2005 development plan, disaster subject was indicated widely with the effect of 1999 Marmara Earthquake. For example, it was said in the plan that Marmara Regional Plan should aim to decrease negative effects of disaster and agriculture, industry, housing and tourism areas should be located according to land use planning that were prepared for determination of disaster risks. Municipalities should develop action plans against critical infrastructure damages in case of disasters and Development Plan Law No: 3194 and related regulations should be revised that they will include new construction control system and technical prevention for resilient structures. More importantly, this development plan adviced to develop a new disaster management system for disaster risk reduction, where it includes risk reduction in terms of economic, social and psychological aspects.

The Ninth five-year development plan (2007-2013), is highly criticized in terms of deficiencies of subject of disaster. Disaster and disaster management system did not take place in the vision and basic principles of the plan. Moreover, there are confusions in authorities and duties of public institutions in the plan.

The last development plan (2014-2018) disaster management is discussed in three parts of the plan: situation analyses, aim and targets and policies. In situation analyses, it is said that since disaster affects all sectors such as economy, social life and physical infrastructure, the importance of disaster subject in development plans was raised. In policies part, the plan states that:

- Institutional responsibilities and authorities will be regulated for increase effective of response and the determination, evaluation and control of disaster risks.
- Micro zonation studies will be completed after the determination of disaster risk giving priority to high-risk disaster areas and disaster risk will be taken into account in development plan.
- Risk reduction studies will fasten according to socio-economic and physical attributes and different disaster types and reconstruction plan will be developed for high risk zones.
- Disaster information system that will provide fast, secure and efficient data share between public institutions will be developed to manage disaster and communication infrastructure should be strengthened to provide efficient, rapid and continuous communication.

However, these policies are not related to economic development and there is no attempt to integrate development and disaster. Beside these plans, there are Disaster Management Activities Special Commission Report prepared by the Ministry of Development. The last one was prepared in 2012. This report analyzes disaster management in wide scale. The report made some suggestions for improvement of disaster management system. These suggestions are the preparation of hazard and risk maps, the preparation of housing inventory, building resilient houses and settlements, preparation of national disaster management strategy and action plan, education and awareness programs, improvement of disaster insurance system, uninterrupted communication system, participation of citizens and NGOs to disaster management, strengthening local DEMPs, preparation of local disaster and

emergency plans, updating of disaster legislations and allocation of resources for disaster risk reduction.

To wrap up, five-year development plans determine the sectors that will be drivers of economy and plan of investment sectors. However, disaster is seen neither as obstructs nor the driver of economic development in these plans. The policies related to disaster in the plans are limited with housing sector because of focus on reconstruction phase of Turkish disaster management system. There is a need of policies and budget to implement policies for risk reduction. The development plans are important guides to make policies and allocate budget for risk reduction expenditures. Turkey should learn from past experiences that if you invest before an event occurs you will be so far after its occurrence. The development plans should be integrated with disaster risk reduction and mitigation strategies for a so far future with fewer losses.

CHAPTER 4

CASE STUDIES

In this thesis, 23 October/9 November 2011 Van & 1 May 2005 Bingöl earthquakes are worked through. These earthquakes are two of the most effective earthquakes in Turkey in the last decades. After 2000s, Turkey experienced Dinar, Afyon Earthquake in 2002, Tunceli Earthquake in 2003, Bingöl Earthquake in 2003, İzmir Earthquake in 2005, Elazığ Earthquake in 2010, Simav, Kütahya Earthquake in 2011 and Van Earthquakes in 2011. Bingöl and Van earthquakes are the most significant ones in terms of life losses and the number of people affected.

In this chapter, information about the effects of the earthquakes will be explained in detail. A simple linear regression analysis is suggested for Van Earthquake as an example of the modeling items.

4.1. The Bingöl Earthquake, 1 May, 2003

Bingöl city is located in east part of Turkey. Demographic and economic profile of the city may give general idea about the city. Bingöl's population is 265.514 in 2013. Between 1935 and 1990, the population of city has increased. Figure 28 indicates that there is a stabilization of population since 1990s although the population of Turkey continues to increase.

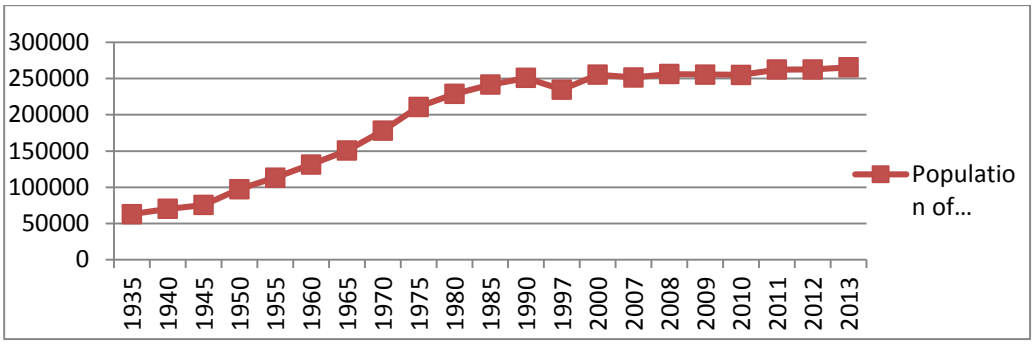

Figure 28:The population of Bingöl in years
(Source: TURKSTAT,2014)

As well as the increase of the population, the number of buildings have increased in years. Table 16 shows that total number of buildings have doubled from 1984 to 2000 years.

Table 16: The Number of Buildings in Bingöl
(Source: TURKSTAT, 2014)

Year	Total Number of Building	Housing	Workplaces	Education-Cultural building	Health Building	Public Building	Religious Building	Mixed
1984	9815	8334	1254	79	13	61	34	38
2000	17,209	15111	1646	140	26	127	76	40

According to 2001 data, the GDP of Bingöl is $795. This number is below the average GDP of TRB1 (NUTS)[12] and average GDP of Turkey (Table 17). The number of the enterprises is 3.410 in 2012. Wholesail and retail trade, transportation, storage and communication and hotel, restaurant and cafés are the most common three sectors in terms of the number of enterprises and employment oppurtunities.

[12] Turkish Statistical İnstitute has seperated Turkey to 26 NUTS (nomenclature of territorial units for statistics). Bingöl is placed in TRB1 with Elazığ, Malatya and Tunceli.

There are 53 enterprises that are registered to the Bingöl Chamber of Commerce and Industry, hire 892 people. The industrial activities and production capacity are limited in Bingöl. Unemployment is an important problem for Bingöl economy. Unemployment rate is 14.8 % in 2008. The employment rate is 33.3% and this rate is below under the average of Turkey (41.7 %) (Fırat Development Agency. accessed on: 13.04.2013).

Table 17: The GDP of Bingöl, TRB1 and Turkey, 2001
Source: TURKSTAT, 2010

	Bingöl	**TRB1**	**Turkey**
GDP per Capita ($)	795	1429	2146
Share	0.1	1.7	100
Growth Rate	42.9	47.7	43.2

These economic conditions forced people to migration. Table 18 shows the change in migration in Bingöl since 1975.

Table 18: The Migration Rate of Bingöl since 1975
(Source: TURKSTAT, 2014)

Years	**Population**	**In-migration**	**Out-migration**	**Net migration**	**Rate of net migration(‰)**
1975-1980	190 193	6 148	16 826	- 10 678	-54,6
1980-1985	205 716	7 703	16 989	- 9 286	-44,1
1985-1990	216 793	9 878	29 766	- 19 888	-87,7
1995-2000	222 139	13 795	25 202	- 11 407	-50,1
2007-2008	256 091	8 977	10 192	- 1 215	-4,7
2008-2009	255 745	6 986	10 726	- 3 740	-14,5
2009-2010	255 170	8 453	10 448	- 1 995	-7,8
2010-2011	262 263	9 292	10 782	- 1 490	-5,7
2011-2012	262 507	7 569	11 145	-3576	-13,5
2012-2013	265 514	10 968	10 940	28	0,1

Bingöl experienced an earthquake with magnitude of Mw=6.4, on 1 May 2003 Thursday in local time 03:27. The epicenter of earthquake was 14 km away from the city center. The earthquake is classified as a very severe earthquake. After earthquake, it is estimated that the loss of lifes will be high and search and rescue and health teams were sent immediately. This earthquake caused 176 casualties and, 521 people injured. A lot buildings were destroyed, especially public buildings were heavily damaged. Damage assessment determined that in Bingöl city center 833 building collapsed or heavily damaged.

Bingöl has been exposed to earthquakes in years due to high seismic risk. Table 19 shows the earthquakes in last century that affect the Bingöl. The province has been affected by earthquakes nearly every 20 years. Because the East Anatolian, Arabian Plate and Eurosia Plate have pressure to each other and they cause fault motion. The Turkey Plate that is bordered by NAF and EAF moves to west direction. 1 May 2003 Bingöl Earthquake caused by the movement of second level fault in EAF System. The NAF also starts in Bingöl, Karlıova. NAF &EAF increase the seismicity of Bingöl.

Table 19:The Earthquakes Occured in Bingöl

(Source: Ergünay, 2003)

Date	Place	Magnitude	Details
18.07.1784	Erzincan and East	IX	1500 deaths in Kiği and villages
15.12.1934	Bingöl	VI-VII	12 deaths, 200 heavily damaged and collapsed buildings.
17.08.1949	Karlıova	VIII-IX	450 deaths, 300 damaged buildings.
04.02.1950	Kiği	VI-VII	20 Deaths, 100 damaged or collapsed buildings
31.08.1965	Karlıova	VI- VII	3 deaths, 40 injured, 1200 damaged buildings.
19.08.1966	Varto	IX	31 deaths, 49 injured, 1800 damaged or collapsed buildings.
24.09.1969	Kiği	VI-VII	2 deaths, 87 injured, 1128 damaged or collapsed buildings
22.05.1971	Bingöl	VIII	878 deaths, 7000 injured, 5617 damaged or collapsed buildings.
13.04.1998	Karlıova	VI	13 injured, 69 damaged or collapsed buildings

1 May 20003 Earthquake caused heavily damage to buildings on alluvial ground of Goynük stream and lots of people lost their lives. Beside ground properties, the failure of reinforcement and material became effective for building damage. It is observed that iron, cement and reinforce, which were used in construction do not conform to building code standards and the junctions of column and joist of buildings were not constructed according to rules in legislations.

The earthquake demolished Çeltiksuyu Boarding School and 84 students were trapped under collapsed school. Many public buildings were damaged. Many buildings were damaged especially in settlement areas near to City Center and Sancak Town. 15 people lost their lives in Çimenli (Lek) village. 70 people confirmed dead in 18 buildings that are heavily damaged or collapsed.

Figure 29: The One of the Symbols of Bingöl Earthquake, the Collapsed Dormitory of Çeltiksuyu Boarding School

(Source: Gülkan et al, 2003)

Bingöl Public Hospital was also damaged by the earthquake and the injured where hospitals should function at time were transferred to hospitals in Elazığ and Diyarbakır. One positive aspect is telecommunication to region was not disturbed.

Also infrastructure were not heavily damaged by earthquake. There was no damage on bridge and viaducts. Only few village ways were closed (Selçuk, et al, 2003). Moreover, many buildings were damaged. 46.557 units were evaluated for damage assessment (DEMP, 2014). Table 20 shows the results of the damage assessment results of the earthquakes. In the city center, 2085 housing unit and 187 workplaces were heavily damaged. 6206 housing unit and 211 workplaces were heavily damaged by the earthquake.

Table 20: The Damage Assessment of Bingöl Earthquake
(Source: DEMP, 2014)

Settlement Type	**Housing Units**			**Offices/Shops**		
Damage Type	Heavily	Medium	Slight	Heavily	Medium	Slight
Center	2.085	3172	4833	187	871	660
Town	430	27	697	18	7	67
Village	3691	47	7338	6	3	17
Total	6206	3246	12868	211	881	774

After the earthquake, 2515 housing units were planned to reconstruct. Damage assessment became a problem in reconstruction phase of earthquake. Most of the households objected to the damage assessment reports of their homes. After their objections, the assessments were repeated. However, households still were not glad of the results. Therefore, most of them sued and some of the court cases still continue.

In Bingöl, the last destructive earthquake occurred in 1971 with magnitude Mw=6.9. The magnitude of this earthquake and 1 May 2003 earthquake are nearly same. The comparison of these two earthquakes is shown in Table 21 in terms of losses and damages. The total number of buildings has tripled from 1971 to 2003.The heavily damaged and collapsed buildings are nearly same in two earthquakes

Table 21: The Comparison of Earthquakes in Bingöl
(Source: Ergünay, O, 2003 adopted by author)

	22 May 1971 Earthquake	**1 May 2003 Earthquake**
Magnitude	6.8	6.4
Number of Buildings	4.332	15.048
The Number of Collapsed-Heavily Damaged Building	1.571	1.642
Percentage of Collapsed-Heavily Damaged Building to Total Number of Buildings	36	11
Deaths	294	70
The Percentage of Deaths To Heavily Damaged Buildings	18	4

The table shows that there is noticeable decrease in number of deaths and percentage of collapsed buildings. However, there is still a need to rehabilitation in risk reduction policies since one of the school collapsed and 85 people lost their lives.

4.2. The Van Earthquakes, 23 October and 9 November, 2011

Van is situated in East Anatolian Region of Turkey near to border of Iran. There are 12 district, 20 municipalities, 84 neighborhoods, 576 villages. It is one of the trade center in the East Anatolian region.(East Anatolian Development Agency, 2011)It has a population of 353.419 in city center and rural population is 92,496 in 2012. The city has been growing in the last year's so the population of Van and Erciş have doubled in the last 25 years (Erdiket al, 2012).

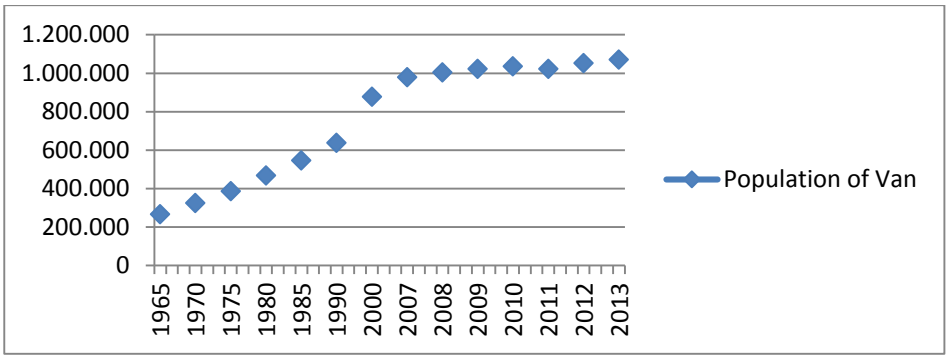

Figure 30:The Population of Van since 1965
(Source: TURKSTAT, 2014)

The GDP of the Van in 2001 is $ 859.This number is below the average of Turkey and average of the region TRB2[13]. GDP per capita is $2146 average in Turkey. Van is 72th in terms of GDP per capita in all cities of Turkey. Table 22 compares the GDP of Van and TRB2 and Turkey. Although the GDP of Van is higher than the TRB2 , it is still lower than the average of Turkey.

Table 22: GDP per capita (200, current prices, $)
(Source: East Anatolian Development Agency, 2011)

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Van	1015	997	1053	1212	1109	1118	859
TRB2	869	860	975	1089	996	980	749
Turkey	2727	2888	3021	3175	2847	2941	2146

[13] Turkish Statistical İnstitute has seperated Turkey to 26 NUTS (nomenclature of territorial units for statistics).. Van take place in TRB2 with Bitlis, Muş, Hakkari. Appendix A also shows the name and the cities included in NUTS.

Unemployment rate is 17.2% in 2010. Table 23 indicates that according to 2009 figures, Van has high unemployment rate in Turkey. Unemployment rate of downtown is higher than average unemployment rate of Turkey. Also employment rate is below the average rate of Turkey.

Table 23: The Employment Participation Rate, Unemployment Rate and Employment Rate in 2009

(Source: East Anatolian Development Agency, 2011, 2009)

	Employment Participation Rate (%)	**Unemployment Rate (%)**	**Employment Rate (%)**
Van	41.6	15.6	35.1
TRB2	41.03	16.45	34.33
Turkey	47.9	14	41.2

Van is prone to very different types of disasters such as landslides, rock falling, floods and avalanches. However, the most destructive disaster is earthquake for the city in terms of loss of lifes. The city has a potential of earthquakes due to high seismic risk. Since 1940s, five devastating earthquakes has occurred in Van. The most devastating earthquake struck in 1976 (Muradiye- Çaldıran). The Muradiye-Çaldıran earthquake has a magnitude of 7.2 and caused 3840 life losses and 9552 building damaged.

Table 24: Earthquakes Occured in Van

(Source: Uzunparmak, 2010 adapted from Turan 2012)

Year	Region	Severity	Life Loss	Damaged Buildings
1941	Van-Erciş	5.9	194	600
1945	Van	5.8	12	2000
1945	Van			1000
1972	Van	5.2	1	400
1974	Başkale			20
1976	Çaldıran	7.2	3840	9552
2011	Erciş ve Van	7.2- 5.6	644	33.016

Lastly Van earthquake, which occurred in 23 October 2011 with a magnitude of 7.2 at local time 1.41 pm .After the mainshock, 180 aftershocks were registered in following three months. The most destructive one of aftershocks occurred in 9 November 2011 at 21.23 (local time) with a magnitude of 5.6. Total economic loss due to disaster is $ 1.5 million (Akar, 2003). 644 people lost their life, 1966 people were injured and 252 people were rescued from the rubble. 65 buildings were totally collapsed. The earthquake also caused economic losses and it was the more destructive when compared to Düzce Earthquake. In table 24, 1999 Düzce, 1999 Marmara and 2011 Van earthquakes are compared. However, economic loss in 2011 Van is much more than 1999 Düzce Earthquake although the affected people and damaged housing units are more in 1999 Düzce Earthquake.

Table 25: The Comparison of Earthquakes of Kocaeli, Düzce and Van Earthquakes (Source: Akar, 2013)

Year	**Place**	**Mw**	**Death**	**Affected People**	**Damaged Housing Unit**	**Damaged Workplace Unit**	**Economic Loss ($ Million)**
1999	Kocaeli	7,6	17.127	1.358.953	133.683	20282	20.000
1999	Düzce	7,1	845	205.100	205.100	32.755	1.000
2011	Van	7,0	644	49.674	49.674	6.641	1.500

The response stage of earthquake

The response to Van earthquake is evaluated as more successful than other earthquakes experienced in Turkey. Medical team organization and the rescue of people from rubbles are successful implementations. For example, 699 UMKE personnel, 2522 search and rescue personnel and all equipment needed by these personnel reached to the disaster prone region within 24 hours. In response phase, a lot of personnel and equipment were transferred to the disaster region. However, lack of coordination of response teams and distribution of aid materials, especially tents are observed as critical problems during response phase.

13 tent cities and 35 container cities were constructed in Van and Erciş according to 2012 figures (DEMP, 2012). There were also educational, health, religious and social facilities in these temporary sheltering centers. 30.000 containers were produced for survivors and 197.784 dollars were paid for production of containers by DEMP. Moreover 70.676 dollars were paid for electricity bills of the temporary sheltering centers by DEMP (DEMP, 2012).

In 2011 earthquake, settlement areas in Van, Erciş and Edremit were affected and 147.622 houses, 18.735 workplace and 20.279 barns were damaged in total. 36.203 houses, 2.884 workplace and 2884 barn collapsed or heavily damaged (Table 26).

Table 26: Damage Level according to the results of the appeals to Final Damage Assessments.

(Source: Van's Governor, 2012 as cited in Turan (2012))

	Type	Van	Van/ Villages	Erciş	Erciş/ Villages	Edremit	Total
Damage Detection	House	91749	13564	25008	12790	4511	147622
	Workplace	14167	179	4097	137	155	18735
	Barn	2831	7092	3385	6228	743	20279
Collapsed/Heavily Damaged	House	17828	7266	6303	4005	801	36203
	Workplace	1434	82	1347	10	11	2884
	Barn	1593	4350	1826	1689	336	9794
Medium Damaged	House	15333	326	2050	257	215	18181
	Workplace	3153	8	739	1	6	3907
	Barn	75	143	64	113	3	398
Less Damaged	House	34873	4351	10838	6614	1777	58453
	Workplace	6353	51	1476	66	46	7992
	Barn	811	1876	974	2714	267	6642

TMMOB Report published in 2012 indicates that the number of buildings that not constructed according to development plan is so high, although the last development plan was declared in 1994. Another reason that the last development plan had not projected the population increase as much as in real and potential settlement areas were not allocated for increase of population. The city settlement moved down inappropriate ground conditions. As mentioned in 3.4., the basic urbanization problems such as the increase of population, design of development plan and implementation of them, have also repeated in Van and caused the damages. In Van city center, 60,000 buildings and ın Erciş only 500 have building licence. Demolished buildings in Van usually had 7-8 floors, however the development plan only give permission to 4-5 floors for these buildings.

During the reconstruction phase of earthquake, first shelters were tents then container cities with prefabs were built. All tent cities were deactivated in Erciş in 15 January 2012 and in Van 15 February 2012. There were 32 container city with 17800 containers. The Mass Housing Development Administration of Turkey (hereafter TOKİ) and DEMP started to construct permanent housing in Van, and Erciş after 39

days following the earthquake.15.323 housing units, 25 schools, 24 mosques and 11 commercial centers constructed in Van.

Table 27: The Number of Buildings Constructed in Van after Earthquakes (Source: Van's Governor, 2012 as cited in Turan (2012))

	Houses	**Schools**	**Mosques**	**Trade Centers**
Van	4.856	15	13	4
Edremit	5.362	2	3	2
Villages	225	-	3	-
Erciş	4.880	8	5	5
Total	**15.323**	**25**	**24**	**11**

DEMP published a report that explains the payments for Van Earthquake. Table 27 shows that DEMP paid $2,2 billion. Van Earthquakes did not cause budget deficit for the government since 2011 budget surplus from treasury was transferred to Van earthquake payments. Tax, penalties and default interests are canceled for one years in Van after earthquake (Akar, 2013). In 18 November 2011 week, the government announced that the crafts could take credits with free payment within the one year and interest free in 3 years (Disaster Management Implementation and Research Center, 2011)

Table 28:The Total Expenses by DEMP for 2011 Van Earthquake
(Source: DEMP [14] , 2012)

	The Quantity ($)
Total Emergency Aid Funds	236 million
The Prime Ministry	4,7 million
The Payment From Humanitarian Aid Accounts	105.million
Other Ministry, Public Agencies and İnstitutes	1.2 billion
Red Crescent	57 million
NGO's	27 million
Governorships	10 million
Private Sectors	6,5 million
Total amount of materials from abroad	36, million
Fund transferred to (TOKI) for Permanent Buildings	1,1billion
The EYY (Help for People Who construct their home)[15] Fund	119, million
Total	2,2 billion

Although the magnitude of earthquakes are not so high, the reason of destruction is the high vulnerability of city. According to studies of Ozceylan and Coskun (2012), Van has high social and economic vulnerability scores. In terms of social vulnerability it takes eighth and in terms of economic vulnerability, it takes eleventh rank in their studies. The reasons why economic vulnerability of Van is high that high rate of unemployment , high rate of housing rents, low GDP per person and high dependency ratio.

[14] 1 USD is equal to 2.12550 TRY in current prices.

[15] This is method for permanent housing. The survivors could construct their homes instead of their collapsed buildings by taking credits from government.

Table 29: The Scores of Cities In Terms of Vulnerability

(Source: Ozceylan and Coskun, 2012)

	City	Social Vulnerability Index		Economic Vulnerability Index		Social and Economic Vulnerability Index
1	Şırnak	1	Şırnak	0,88	Şırnak	0,94
2	Şanlıurfa	0,93	Hakkari	0,85	Şanlıurfa	0,84
3	Batman	0,92	Diyarbakır	0,76	Hakkari	0,83
4	Ağrı	0,89	Siirt	0,75	Batman	0,82
5	Gaziantep	0,88	Bitlis	0,74	Siirt	0,81
6	Siirt	0,88	Şanlıurfa	0,73	Gaziantep	0,81
7	Mardin	0,86	Gaziantep	0,73	Van	0,79
8	Van	0,85	Adana	0,73	Ağrı	0,77
9	Hakkari	0,81	Bingöl	0,72	Diyarbakır	0,76
10	Hatay	0,79	Batman	0,71	Mardin	0,76
11	Muş	0,78	Van	0,71	Muş	0,73
12	Diyarbakır	0,77	Tunceli	0,71	Adıyaman	0,71
13	Kahramanmaraş	0,76	Muş	0,69	Bitlis	0,69
14	Kilis	0,76	Adıyaman	0,67	Kilis	0,69
15	Adıyaman	0,75	Mardin	0,65	Hatay	0,69

Although the social vulnerability of Van is high, the number of insurance policies that sold in Van is low. TCIP took 5741 notices in 15 December 2011.It paid $ 3.3 million for 722 file. 23 October and $ 14.608 for 4 files for 9 November earthquake. The problem in TCIP payment is that the information of citizens is limited and they consult Community Center. It is advised to survivors that they may find their solutions. (Disaster Management Implementation and Research Center, 2011). Erdik et al (2012) expects that total TCIP payment may increase to $ 40 million.

4.3.Modelling

In literature, disaster and development relationship is modelled via different methods. Every hazard has unique characteristic. The effects of them change from one country to another. There are difficulties to develop a standart model to determine the effect of earthquakes on the economy of cities in Turkey. Firstly, the data is very limited for modelling purposes. Some data is registered on city base, some of them is on regional base. Moreover there is data registered only for some years. For example, there is no population census conducted between 2000 and 2007. Therefore, in this thesis, the model will give the more effective variables on GVA.

By analyzing the GVA and these variables, the change in them after disasters will be interpreted. There are two important criterias for the determination of the variables. The first one is the models which show the relationship between disaster and development in the literature and the second one is the data which is the available on city base.

The model used in this thesis has limitations like;

- Most of the data is not calculated for the years between 2000 and 2007 like population, literate rate. These variables are produced by using statistical inference. For example there is no population census between 2000 and 2007. To find the population in these years, the mean of the population in available years is found and the mean are used in missing years.
- Some data is not available after 2001, like GDP per capita
- Some data is produced in regional base like Gross Value Added (hereafter GVA).

Method

Simple regression analysis is used to understand which variables affect the GVA of cities. Then it is meaningful to compare variables before and after earthquake occurrence to understand the economic condition of Van.

R program is used to run regression analysis. The variables are used in this thesis respectively; the agricultural production value, building permits, export value, GVA, hospital bed capacity, import value, literate rate, number of doctor, number of automobile, occupancy permit, overnight of tourist, population, rate of graduate university, schooling rate in secondary school and village road length as shown in table 31. The data is obtained from TURKSTAT.

Every model builds up economic, social, political or physical system by defining the behavior of agents in system. In single equations model, the behavior of a single variable usually is tried to be explained. It is usually denoted by Y and defined as dependent variable in most common terms. The variables that influence dependent variable are defined as independent variables. They are donated by X and are called explanatory, exogenous variables. Economic theory, past experience, other studies or intuitive judgment help to choose independent variables in model.

A statistical model to represent simple linear regression analysis is expressed as

$$Y = \alpha + \beta X + \varepsilon$$

The X is explanatory variables, Y is response and ε is error term.We try to express one unit change in response Y by using one unit change in X.

Table 30: The variables in regression analysis

(Source: TURKSTAT, 2014)

Data name	Type	Definition
Agricultural production value	TL	Total agricultural production value for every city
Building permits (construction of new buildings and additions)	Number	The total number of the building permits given in the city for construction of new buildings and additions
Export value (1000 USA dollar)	$	The total value of export for city
The gross value added (base growth rate)	$	Gross value added (GVA) is a measure in economics of the value of goods and services produced in an area, industry or sector of an economy. Gross value added is the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector; gross value added is the source from which the primary incomes of the SNA are generated and is therefore carried forward into the primary distribution of income account.(OECD) The measure is calculated in regional base TR2 level in Turkey. The find the cities GVA, the total GVA is divided based on 2000 growth rate of every city.
The gross value added (base gdp)	$	The measure is calculated in regional base TR2 level in Turkey. The find the cities GVA, the total GVA is divided based on 2000 GDP of every city.
Hospital bed capacity	Number	The total number of beds in all hospitals of city.
Import value (1000 USA dollar)	$	The total value of import for city
Literate rate	Percent	The percentage of people who is literate to all population.
Number of automobile	Number	The total number of automobile in city.
Number of doctor per person	Number	The population is divided to total number of doctor.
Occupancy Permit (the fully or partially completed new buildings and structures added)	Number	The total number of occupancy permit given in the city for the fully or partially completed new buildings and structures added
Overnight of tourist	Number	The total overnight of tourist in any tourism facility
Population	Number	Total population of city
Rate of graduate of university	Percent	The percentage of people who graduated from any university to all population.
Schooling rate in secondary school	Percent	The percentage of people who graduated from any secondary school to all population.
Village road length	Kilometers	The total length of the village way.

GDP per capita is important measure to determine the economic effect of the earthquake. This variable is calculated on city base up to 2001 by TURKSTAT. After 2001 this variable is calculated in terms of NUTS. GVA is another variable that measure in economics of the value of goods and services produced in an area, industry or sector of an economy and contributes to the calculation of GDP. This variable calculated on regional base after 2001 for this study.

TURKSTAT calculated the GDP of cities up to 2001 in city base. After 2004, GVA is calculated in regional base (NUTS) instead of GDP. Bingöl is in same NUT with Malatya, Elazığ and Tunceli and Van is in same NUTS with Bitlis, Hakkari and Muş. To calculate GVA of cities, the regional GVA is separated base on GDP growth rate of cities in 2001. GVA is only valid for this study.

Table 31:Growth Rate of Cities

(Source: TURKSTAT,2014)

Malatya	**Elazığ**	**Bingöl**	**Tunceli**	**Van**	**Muş**	**Bitlis**	**Hakkari**
0.8	0.6	0.1	0.1	0,5	0,2	0,2	0,1

Table 32:The GVA of NUTS

(Source: Ministry of Development)

Year	**NUT**		**GVA Per Capita (1000 TL)**
2010	TRB1	Malatya, Elazığ, Bingöl, Tunceli	13.767.055
	TRB2	Van, Muş, Bitlis, Hakkari	11.245.883
2009	TRB1	Malatya, Elazığ, Bingöl, Tunceli	12.325.264
	TRB2	Van, Muş, Bitlis, Hakkari	9.706.378
2008	TRB1	Malatya, Elazığ, Bingöl, Tunceli	11.393.014
	TRB2	Van, Muş, Bitlis, Hakkari	8.662.709
2007	TRB1	Malatya, Elazığ, Bingöl, Tunceli	10.045.910
	TRB2	Van, Muş, Bitlis, Hakkari	7.436.404
2006	TRB1	Malatya, Elazığ, Bingöl, Tunceli	8.813.155
	TRB2	Van, Muş, Bitlis, Hakkari	6.502.317
2005	TRB1	Malatya, Elazığ, Bingöl, Tunceli	7.972.143
	TRB2	Van, Muş, Bitlis, Hakkari	5.960.077
2004	TRB1	Malatya, Elazığ, Bingöl, Tunceli	6.766.898
	TRB2	Van, Muş, Bitlis, Hakkari	5.064.326

GVA per capita in Van increased from 2004 to 2010 in parallel to GVA of Turkey. In 2011, GVA decreased although that of Turkey continues to increase. This caused probably decrease in production values.

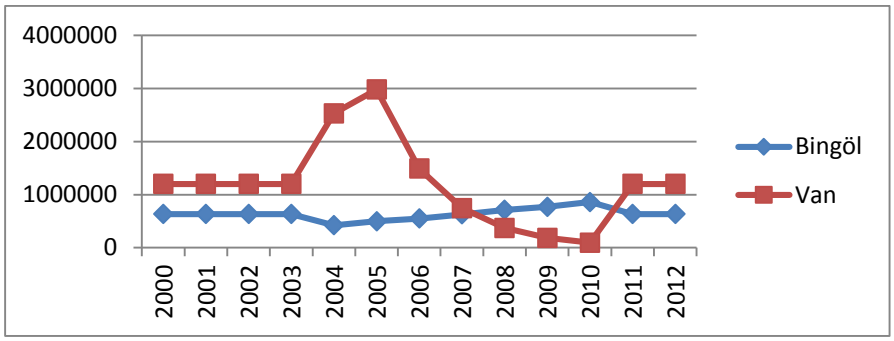

Figure 31: GVA of Van and Bingöl

(Source: Ministry of Development, 2013)

Suggested Model for Van

The statistical model for Van Earthquake can be represented as:

$$y=-11405-142.836\ X_1+ 968.61X_2+2.83\ X_3+219.8X_4$$

where, y:GVA, X_1 :Number of automobile, X_2: schooling rate in secondary school, X_3:Staying number in any tourism unit, X_4:Number of doctor per person (R^2=80.25 %)

According to the results, the GVA of Van is affected from number of automobile, schooling rate in secondary school, staying number in any tourism unit and number of doctor per person. X_2 and X_3 have highest impact on Y. Only the relationship between GVA and number of automobile is negative the others are positive.

The schooling rate in secondary school has decreased in year of disaster from 34.4 to 26.7 and it increased to 39.7 in 2012. This is probably caused by decrease in the population in 2011 in Van. The fear of children due to aftershocks may also be effective on the decreasing of schooling rate.

The number of tourist staying in any tourism unit have increased the year of disaster and decreased to lower level than 2010 in 2012. In year of disaster, lots of

researchers have stayed in Van. The number of doctor per person have slightly increased in year of disaster and decreased in 2012.

The change in some macroeconomic variables after disaster will be analyzed although they are not effective on GVA according to results of the model. Construction sector is usually highly affected by disasters. In Van Case the number of building license dropped in year of the disaster (Figure 32). The number of building permits has decreased in the year of disaster and increased the following year.

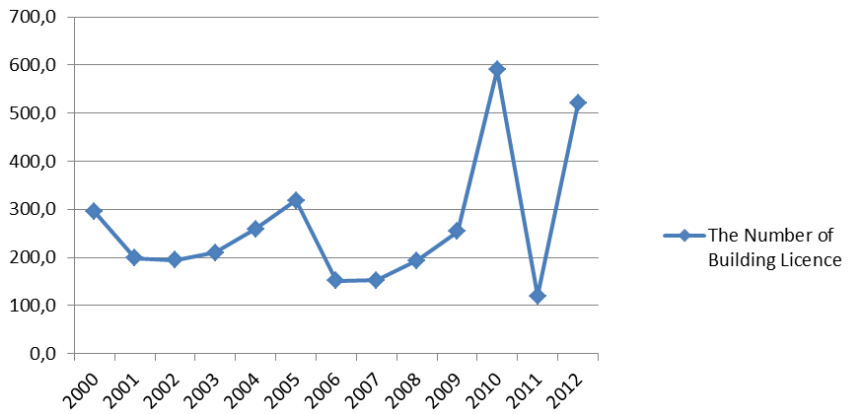

Figure 32:The Number of Building Licenses Given By Van Municipality between 2000-2012

(Source:TURKSTAT, 2013)

15.323 housing unit were constructed for survivors after Van Earthquakes by TOKI.The construction activities of Van has increased.

Export and import relations have changed with the effect of the earthquake. Export value has decreased and import value has continued to increase following year of the disaster in Van. Bingöl earthquake caused to decrease in export value and import value. However the decrease of the import value is so slight and it increased in 2012 and 2013.

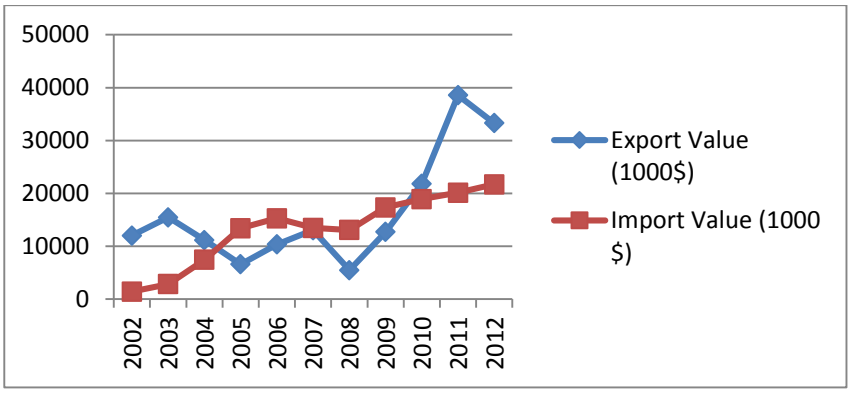

Figure 33:Van Export-Import Values between 2002-2012

(Source: TURKSTAT, 2013)

The literate rate has continued to increase following year of the disaster.

Table 33: The Literate Rate of Van

(Source:TURKSTAT,2013)

	2008	**2009**	**2010**	**2011**	**2012**
Literate Rate	85,9	86,9	90,6	91,8	92,7

Although the population is not found significant in regression analysis, the population change in Van is critical. Since it will affect the economy of cities in following years. People start to be evacuated to other cities due to cold weather conditions after the Van earthquakes, The central government promoted to host survivors living in container or tent cities in public rest houses in other cities. Therefore, survivors started to live in other cities and this policy promoted to migration. According to data of GSM firms, % 60 of the mobile phones that were registered in Van, give signals in other cities(TTB Report, 2011)The table shows the population increase rate (per mille) in Van. In disaster year, population increase rate dropped to -12.52. In 2013, the population of Van has continued to increase and reached 1.070.113.

Table 34: The population increase rate (per mille) in Van
(Source: TURKSTAT, 2013)

Year	2008	2009	2010	2011	2012	2013
The population increase rate (per mille)	24,9	17,71	12,74	-12,52	28,39	17.1

The population movement to other cities also caused the disruption of the education of the children. It is expected to affect the socio-economic development of city in long term.

The main variables of labor force have also changed. The employment rate has increased from 37.3% to 39%. The unemployment rate of Van has also decreased from 17.2% to 9.8% in year of disaster (TURKSTAT, 2012).

Agricultural production has been affected by disaster. It decreased from $ 70 million to $ 66 million and it increased to $ 74 million in 2012.

The data has so limitations to obtain accurate model for Bingöl. Therefore, the model do not take place here. However, some available data is interpreted for extra information.

The export and import values has been affected by earthqaukes in Bingöl.Both of them has increased in disaster year. However import value has increased and export value has decreased the following year of earthquake. In reconstruction period, the increase of import is normal that the need of materials and good increases.Also the export value decreased as expected situation due to decrease in production activities. Mechler (2004) indicates that some production activities decrease, the demand for some materials needed due to increase in reconstruction activities and lost materials exceeds the supply after disaster .Therefore import transactions increase and export transactions tend to decrease in developing countries.

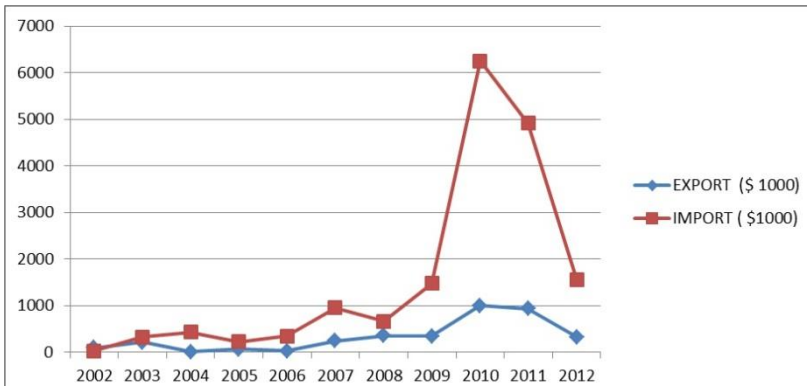

Figure 34:The Import-Export Value of Bingöl
(Source:TURKSTAT, 2013)

Disaster has not affected the agricultural production in Bingöl. Agricultural production has continued to increase. In 2002, the production value was $ 12 million. In 2003 it increased to $ 20 million.

To conclude, only a simple basic model was produced for Van Earthquake in this thesis. However more complicated and accurate models can be produced with more clear and reliable.

CHAPTER 5

CONCLUSION

5.1. Summary, Findings and Suggestions of the Research

The main concern of this thesis is to understand the relationship between disaster and development in case of Van and Bingöl Earthquakes. To analyze this relationship, the literature that tries to determine this relationship has been reviewed and a model has been developed to understand the economic effects of earthquakes for data.

An overall conclusion of the thesis will be stated as findings and understandings of previous chapters. The first chapter is an introductory chapter where aim, scope and general idea about thesis is given. Disasters usually slow down the economic development, and the central government spends a large amount of the budget for recovery and reconstruction activities. The idea of "father state" still holds in Turkey and the central government is responsible for compensating the economic losses. The 1999 Marmara Earthquakes became a turning point for Turkey; policies were developed to invest for risk reduction following years of the disaster. However, these policies were not efficient enough to enhance disaster and development relationship. For example, a new regulation called, Spatial Plan Regulation was enacted in 14.06.2014. The regulation mentions about strategic spatial plans. The planning stages consists of Spatial Strategy Plan, the Environmental Master Plan, Master Plan and Implementation Plan, the upper stage to the lower stage right, respectively. In general plan principals, it is said that all plans are based on geological properties and natural disasters data. Moreover, the plans are based on describing the hazard and risks and taking precautions for disaster risk reduction. The regulation takes into account disaster subject however, it is not enough to the integration of disaster subject to spatial plans in terms of disaster risk reduction.

Chapter 2 analyzes general literature about disaster and development relationships. It begins with the categorization of disaster impacts. Disaster impact is categorized by Mechler (2004) that disaster has economic cost, humanitarian effects and ecological effects. Economic cost of disaster is further classified as; direct, indirect and secondary effects. Life losses, building damages, energy and communication disruption are some examples of direct damages (Basbug, 2006). The interruption of business continuity, decreasing labor force and work opportunities can be listed as the examples of indirect damages (Toya and Skidmore, 2006). Lastly, macroeconomic effects, which are also considered as secondary effects, can be described as the change in macroeconomic variables due to any disaster. It can be seen in GDP, export-import rates, consumption and inflation as well as government resources are allocated for relief and reconstruction efforts.

The general trend of disaster profile shows that the number of disasters, the number of people affected from these and cost of these have increased in years *(*Laframboise and Loko, 2012). Moreover, the disaster losses are expected to increase in the following years. Lall and Deichmann (2009) notes that 370 million people live in earthquake prone areas and it is expected to shift to 870 million by 2050. The economic cost of the disasters was 138 $ billion in 2012 and it is expected to increase to 431$ billion in 2030 (UNDP, 2014).

Disasters affect the macroeconomic variables of economy of countries and the most significant change is observed on GDP, internal trade links, fiscal balance and poverty. Moreover, developing and developed countries are affected from disasters differently. The less developed countries are exposed to more disaster losses and are more vulnerable to hazards than developed countries. UNDP report published in 2012 indicates that although 47 % disasters occurred in high income countries, only 7% of deaths caused by disasters occurred in high income countries. The rate of high income countries in financial loss of disasters is 47% (GFDRR, OXCAM, UNDP and UNICEF, 2014). Ranger N and Surminski N. (2013) also indicates that in the period of 1980 to 2011, developing countries experienced the direct damages of disasters 14 times higher than developed countries in terms of GDP loss. It is stated that 1% of GDP (or 2% for droughts) of developing countries is equal to total cost of disaster while in developed countries it is only 0.25% (Raddatz, 2009) .

Different sources have analyzed disaster and development relationship in terms of different criteria. UNDP says that there are three possibilities in disaster and development relationship. Firstly, the development is limited by disasters due to loss of production capacity, market access or material inputs etc. Integrating the disaster risk management into development policies as the main focus is highly important in generating development without originating new risks. In the second possibility, development can increase disaster risk. As in the example of Kocaeli, the industrialization of the region led to the agglomeration of assets in region and increased the earthquake risk. In the last possibility, development can decrease disaster risk because of increasing trade relationship or technological development. Hochrainer (2009) analyzed different studies to explain the disaster and development relationship. He stated that there are two possibilities; natural disasters are setbacks for economic growth, or disasters have no effect on economic growth. The supporters of the first possibility are Albala-Bertrand 1993; Skidmore and Toya 2002; Caselli and Malhotra 2004 and the those of the second possibility are Benson (various), Otero and Marti 1995, Crowards 2000; Charveriat 2000, Murlidharan and Shah 2001; Freeman et all 2002; Mechler 2004; Cuaresma, Hlouskova and Obersteiner 2004; Hochrainer 2006; Noy.

Vulnerability is the most important input that shapes the complicated relationship between disaster and development. The popular figure of Stephenson (1994) indicate that development can increase vulnerability especially in developing countries. For example, Turkey has experienced migration from rural to urban areas after the 1950s and this caused unplanned and unregulated urbanization settlements on fault lines. So all these factors increased vulnerability in these settlements. In some cases, development opportunities could decrease vulnerability. Development leads to the rise the level of education and more investment on disaster risk reduction. Yet in other cases, disaster can set back development. In Turkish experience, 1999 Marmara earthquake has highly affected economy and caused loss in GDP. Ironically, disaster may open a window for development. Since during the reconstruction phase, disaster may increase the public awareness and encourage people to learn new skills to cope with disasters.

A critical dimension in analyses of the relationship disaster and development is time period. Short term effect of disaster last for 5 years and long term last following 5

years of disaster. Skidmore and Toya (2002), Noy and Nualsri (2007), Cuaresma et al. (2008) and Raddatz (2009) are researchers that studied on long term effects of disaster. Skidmore and Toya (2002) supports that climatic events have a positive relationship with the long run growth while geological events has a negative or neutral effect. Raddatz (2009) claims that climatic disasters have a negative impact on per capita GDP while geological events do not have a significant impact. In short term, there is no agreement on effect of disaster is positive or negative.

After giving general information about economic losses caused by disasters worldwide. Chapter 3 begins with disaster management system of Turkey. Since disaster management system of countries is critical in terms of economic losses. The direction and efficiency of investment on phases of disaster management system could contribute the increase or decrease the economic losses and provide sustainable development. Conventional disaster management cycle consist of four phases: mitigation, preparedness, response and reconstruction. The success of mitigation phase affect whole cycle. However, Turkey has focused on reconstruction phase and enact legislations that explains the duties, responsibilities and responsible organizations in reconstruction phase. Then chapter gives a brief information about earthquake profile of Turkey. Disasters have caused 87.000 losses of life and damaged 651.000 dwelling units since 1900s (Övgün, 2009). Natural disasters cause the decrease of GDP of Turkey, direct losses decrease of GDP by 3% in every year, and direct and indirect losses decrease nearly 4-5% of GDP of Turkey (Ministry of Development, 2012). Earthquakes have the biggest share in economic losses in all types of disaster. Ergünay (2007) states that the cost of earthquakes between 1994-2007 is $18 million. 1999 Marmara Earthquake has significant influence on this number since it occurred in industrial heart of the country. It affected eight cities on Turkey and the share of them on total GDP is % 34.7 (TURKSTAT). The World Bank explained the cost of the earthquake as 9-13 million dollars. The macroeconomic indicators of the country like economic growth, GDP and inflation affected negatively.

1999 Marmara earthquake is compared with similar magnitude earthquakes occurred in Japan and Mexico, indicators show that Turkey is more vulnerable to disasters. Urban management is one of the most significant effect of high disaster losses. The urbanization occurred rapidly and without planning due to increase in population and

migration to urban areas from rural areas. This caused the overpopulation of seismic risk areas. Ergünay (2007) claims that % 45 of the population live in first degree seismic hazard zone. The cities continue to grow without defining risks and the integration of risk concept to planning process have not been provided.

Turkey development plans mentions about Turkish economic policies and determines way of economic growth and aim, tools and sources of the growth. These plans could be critical tools to develop policies and project allocation of resources for disaster risk reduction. When these plans are analyzed, the first plan that mention disaster concern was the 1979-83 development plan. It pointed out that disaster losses could be decreased with preventive precautions and settlement and building construction should be controlled. This plan and also other plans have focused on reconstruction efforts. Disaster is seen neither as obstructs nor the driver of economic development in these plans.

Chapter 4 begins with the general information about the case studies, 23 October and 9 November 2011 Van and 1 May 2005 Bingöl earthquakes. These earthquakes are the most significant ones in terms of life losses and the number of people affected in the last decades. Both of the cities are in eastern Turkey and are evaluated as two of the most vulnerable cities to disasters (Ozceylan and Coskun, 2012). These cities have experienced damaging earthquakes in years, however the last earthquakes showed that there is no improvement in disaster risk reduction. In Bingöl Earthquake 22.320 housing units and in Van Earthquakes 112.837 housing units were damaged (DEMP, 2013). After Van earthquake, 15.323 housing were constructed by TOKI. The cost of Van earthquake reached to $ 1500 million (Akar, 2013). In both of the earthquakes, the government spend millions of dollars to compensate disaster losses.

In the last part of the chapter a regression analysis was run. The aim of the model is to determine variables that affect the GVA of cities so the economic effect of the earthquakes can be analyzed the change of these variables before and after earthquakes. The GVA of Van is affected from number of automobile, schooling rate in secondary school, staying number in any tourism unit and number of doctor per person. Only the relationship between GVA and number of automobile is negative the others are positive. The population and export and import values do not seem effective on GVA of cities, however they are critical for economy of cities.

Proposals to Develop Policies to Mitigate Earthquake Losses

> *"More effective prevention strategies would save not only tens of billions of dollars, but save tens of thousands of lives. Funds currently spent on intervention and relief could be devoted to enhancing equitable and sustainable development instead, which would further reduce the risk for war and disaster. Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible; they are the disasters that did NOT happen.* "- Kofi Annan (UNDP, 2004, p.)

This section of thesis tries to offer policies to decrease economic losses caused by disasters in Turkey. Disaster risk reduction is a comprehensive work that requires strong political support, high public awareness, high level of education and financial policies. To reach all these aims, multi-sectoral, multi-disciplinary and multi-level approaches are needed.

Governments make some policies before disasters to lessen the impact of disasters such as building reinforcement, promoting households to disaster insurance especially in disaster risk areas and restriction or limitation building construction in risk prone areas.

Some policies will be offered to decrease economic losses caused by earthquakes in Turkey in this part of the thesis.

First of all, the focus of disaster economy policies should be orientated from reconstruction to mitigation process. Cost of and economic effects of disasters on cities should be calculated carefully and cost-benefit analysis should be made. Usually, reconstruction and recovery efforts could necessitate additional funds. Governments cannot cope with losses caused by disasters and borrow from external sources. Taxes increase and spending of government are cut to pay back this borrow. The report published by the WB and the UN in 2010 shows that spend on relief efforts are higher than government expenditures on prevention even if following years. Figure 38 shows that the post disaster spending are higher in developing countries such as Mexico, Nepal and Indonesia (UN and WB 2010). The cost of reconstruction efforts is high in Turkey. Thousands of housing was constructed after earthquakes. The cost of the reconstruction efforts and mitigation efforts should be calculated and compared. So the contribution of mitigation efforts to decrease the cost of the reconstruction efforts is understood clearly.

Cost-benefit analyses are useful tools to measure the effect of mitigation efforts. For example, Smyth et al. (2004) as cited in Hochrainer-Stigler, S et all. (2011) estimated the cost effectiveness of apartment building retrofitting in İstanbul. The study was conducted according to periods by with including the monetary value of saving lives and without including. It is found that projects become cost-effective with including the value of saving lives in comparison.

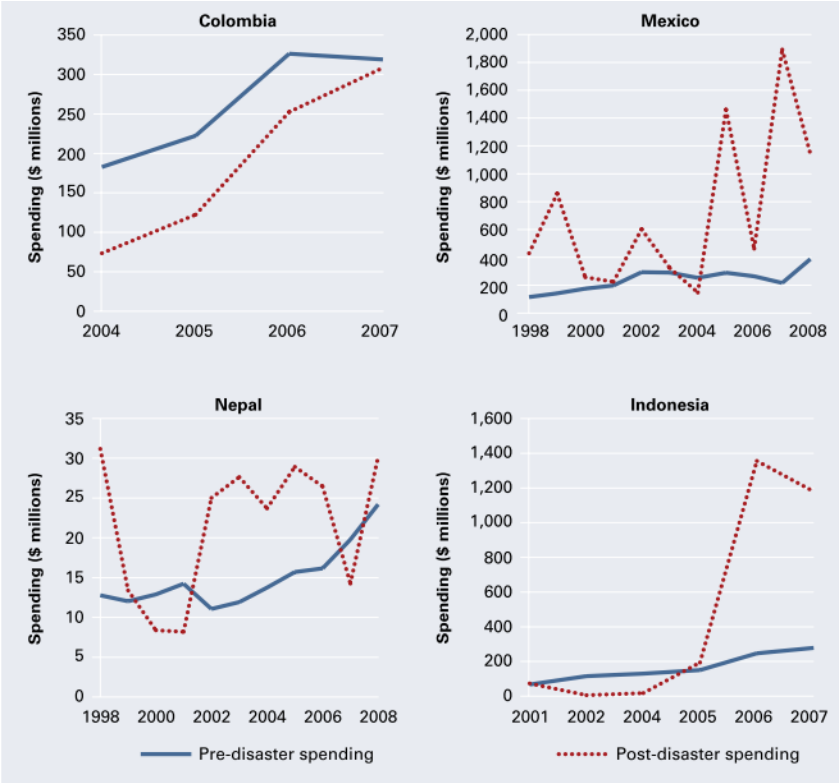

Figure 35:Post-disaster spending fluctuates more than pre-disaster spending (Source : UN and WB 2010 as cited in de la Fuente 2009)

Mechler (2004) says that the governments in developing countries having low level of capital, limited tax infrastructure and limited ability to borrow, suffer from lack of risk financing options and they try to find external capital for meeting the need of low level income survivors, to return economic variables to old level and repairing infrastructure. In Turkey, the idea of “father state” still holds in Turkey and government pay all cost of disasters. Risk transfer mechanism like insurance is necessary for financial risk reduction.

One of the most effective way to sharing responsibilities of risks and decreasing effect of disaster is instituting international insurance markets that consisting of local insurance which working with international companies to reinsurance. Insurance is a general method that applied unfortunately; many developing countries are not successful to develop the market for natural disaster insurance or not developed the market (Rasmussen 2004). Insurance coverage is also different in developing and developed countries. Insurance cover 30% of losses (total of 3.7% of GNP) in high income countries, while this ratio is only about 1% of losses (amounting to 12.9% of GNP) (Mechler and Bayer, 2008).

Turkish Catastrophe Insurance Pool (hereafter TCIP), as an insurance pool was constructed by The Prime Mınıstry Undersecretiat of the Treasury. It started operation in 27 September 2000.The national risk was transferred to worldwide risk sharing pools under the international reinsurance companies' management. TCIP does not also cover earthquakes, but also fires due to an earthquake, explosions as a result of earthquake and landslides following an earthquake are covered by the pool (Basbug, 2003) The yearly premium of houses change according to hazard zone, building type and size of the houses. The number of total insurance policies has been increased in years (Figure 39). However extend of the culture of insurance is critical.

The government has to finance disaster payments. However, the risk is shared with insurance companies and government has not to pay big amounts of money for reconstruction efforts. TCIP has only expected to pay $ 120 million. However, the payment of DEMP as an governmental institutions has paid $ 2.2 billion for Van earthquake and most of the payments was for the construction of new buildings for survivors (DASK, 2013). The rate of insured housing is lower in East Anatolian region when compared to other regions. The payment of government could be decreased by improving insurance system.

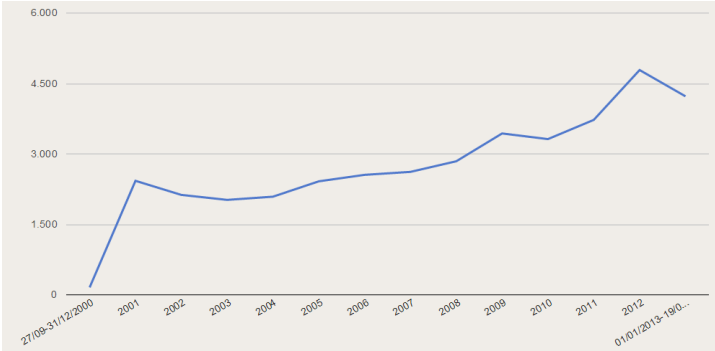

Figure 36: The Number Total Insurance Policies after 2000

(Source:TCIP, 2014)

Van and Bingöl take place in less developed part of Turkey. The GDP of the provinces is low, the unemployment rate is high. Moreoever the provinces have experienced out-migration. The earthquakes has affected the macroeconomic variables negatively. Moreover the migration has increased after earthquakes. To restore macroeconomic indicators government may increase initiatives for private sector to increase economic boom.

Changing building regulation to build up safer cities is critical policy to decrease economic loss of earthquakes for Turkey. After 1999 Marmara Earthquake, new laws and legislations were enacted like Construction Inspection Law. Plans related with development of cities from regional plans to implementation plans do not represent the policies of risk reduction. There are problems in the implementation of plans and control mechanism. Recenlty Spatial Plan Regulation was enacted. It includes a large scale of plans from Environmental Master Plan to Implementation plan. It says that the urban risk analysis and mitigation plans were made in required cases and measures about urban and disaster risks are based on planning. However, the critical questions are how disaster concern will handle in these plans, how the mitigation plans of cities will be made and implemented and what the enforcement will be.

UNDP Report published in 2012 says that there are three steps to integrate disaster risk reduction to development concerns:

a. The collection of basic data on disaster risk and the development of planning tools to track the relationship between development policy and disaster risk.
b. The collection and dissemination of best practice in development planning and policy that reduce disaster risk.

c. The galvanizing of political will to reorient both the development and disaster management sectors (UNDP, 2004, p.2).

There is need to coordination mechanism to develop regional development plans and disaster risk reduction to increase local and regional capacity. The regional development agencies are critical for this coordination and have potential to orientate and connect the actors of disaster risk reduction. Disaster risk reduction-Development Coordination Council that can be established under development agencies can take on some tasks like the definition and analyze of disaster risk concept in development plans. Erkan and Ozden (2011) developed a model about disaster risk reduction through the development agencies. This model has four components that information collection, the definition and analyze of disaster risk, planning of disaster risk reduction and observation of disaster risk. All of these components has continuity and provide sustainability of the system.

Policies that integrate disaster strategies into development policies are not enough in Turkey. Development plans have limited contribution to put effective disaster risk reduction policies. Disaster risk reduction policy should be related with other sector policies of government like agriculture, construction and transportation. Since disaster risk reduction policies includes all sectors. There is need to develop policies and allocate budget to implement the policies for risk reduction and the development plans are important guides to make policies and allocate budget for risk reduction expenditures. Therefore, development plans has given enough contribution disaster risk reduction policies in means of economy.

5.2. Recommendations for Further Studies

This study tried to analyze the general trends of the relationship between disaster and development worldwide. Moreover Turkey disaster profile, effects of disaster on Turkish economy and causes of earthquake losses have been examined. Van and Bingöl earthquakes are chosen as case studies.

Every model is subject to change or update. The model used in thesis could change or updated by reducing the limitations. Because some limitations as mentioned before, not being calculated of the data the years between 2000 and 2007 like population, literate rate and data manipulation affected the accuracy of the model. Moreover, the limitations such as not being calculated of some data after 2001, like GDP per capita and production of some data in regional base like GVA may prevent

the attaining the accurate results from model. There is no standardization to produce data related with the economy of disasters. Development agencies could be pioneer for standardization of data production.

If data pollution decreases and data accessibility increase, the further studies can put more detailed models or other models can be conducted. DEMP could be pioneer in terms of standardization of disaster data. Regional development agencies could be pioneer for data collection. Moreover, different analyses could be used instead of regression analyses or different variables could be used in regression analyses.

Moreover not only the effect of earthquakes, but also the effects of other types of disaster like flood, avalanches could be modelled. In recent days, Turkey has experienced the one of the most effective socio-tech disaster in history. On 13 May 2014 an explosion was occurred in Soma, Manisa with local time 15.10. The explosion was occurred in one of biggest mining industry of Soma and caused 301 losses of life. This disaster may affect the region socially, economically and environmentally. In further studies, the economic effects of this explosion on economy of cities and on the socio-economic welfare of the households could be modeled.

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GLOSSARY

In this section, concepts that are necessary to comprehend the related aspects of disaster management and economic development are provided to give general idea. The definitons are usually given with reference of ISDR Terminology of Disaster Risk Reduction.

Damage: Damage on stock, including physical and human capital.

Damage and loss have different meanings. The direct physical effects of earthquakes are defined as damage. All social effects of disasters including deaths, injuries, direct financial costs, indirect costs and social effects like shift of number of homeless people are included in definition of loss. (U.S. Congress, Office of Technology Assessment Report, 1995)

Development Plan: A development plan is an aspect of town and country planning in the United Kingdom comprising a set of documents that set out the local authority's policies and proposals for the development and use of land in their area.

Disaster: A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. (ISDR Terminology of Disaster Risk Reduction, 2009)

Disaster Risk: The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period. (ISDR Terminology of Disaster Risk Reduction, 2009)

Disaster Risk Reduction: The systematic development and application of policies, strategies and practices to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) adverse impact of hazards, within the broad context of sustainable development (UNISDR)

Economic Vulnerability: Potential impacts of hazards on economic assets and processes (business interruption, secondary effects)

(http://www.cyen.org/innovaeditor/assets/Disaster_Management_Notes_and_Questions.pdf)

Economic Development: Economic development typically refers to improvements in a variety of indicators such as literacy rates, life expectancy, and poverty rates. GDP is a specific measure of economic welfare that does not take into account important aspects such as leisure time, environmental quality, freedom, or social justice.

Economic Growth: refers to the increase (or growth) of a specific measure such as real national income, gross domestic product, or per capita income. National income or product is commonly expressed in terms of a measure of the aggregate value-added output of the domestic economy called gross domestic product (GDP). When the GDP of a nation increases, economists refer to it as economic growth.

Exposure: People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses. (ISDR Terminology of Disaster Risk Reduction, 2009)

Ex-ante: Before the event

Hazard: A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. (ISDR Terminology of Disaster Risk Reduction, 2009)

Natural Hazard: Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. (ISDR Terminology of Disaster Risk Reduction, 2009

Mitigation: The reduction or limitation of the adverse impacts of hazards and related disasters. (UNISDR Terminology of Disaster Risk Reduction, 2009)

Post-ante: After the event.

Preparedness: The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions. (ISDR Terminology of Disaster Risk Reduction, 2009)

Prevention: The outright avoidance of adverse impacts of hazards and related disasters. (ISDR Terminology of Disaster Risk Reduction, 2009)

Recovery: The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. (ISDR Terminology of Disaster Risk Reduction, 2009)

Regression Analysis: Statistical tools for investigation of relationship between variables. (Sykes, O.A.)

Resilience: The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. (ISDR Terminology of Disaster Risk Reduction, 2009)

Response: The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected(ISDR Terminology of Disaster Risk Reduction, 2009)

Risk: The combination of the probability of an event and its negative consequences. (ISDR Terminology of Disaster Risk Reduction, 2009)

Total Impacts: Total of flow impacts, adding first-order losses and higher-order effects (Okuyama, 2009)

> **First-order Losses:** loss of flows due to business interruptions, such as production and/or consumption, caused by damages
>
> **Higher -order Effects:** system-wide impact on flow caused by the first-order losses through inter industry relationships

Urbanization: The rate of urban population to all population including urban and rural population.(TURKSTAT)

Sustainable Development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (ISDR Terminology of Disaster Risk Reduction, 2009)

Vulnerability: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. (ISDR Terminology of Disaster Risk Reduction, 2009)

APPENDIX A

NUTS LEVEL 2- 26 REGIONS

Table 35:The NUTS LEVEL 2- 26 Regions
(Source: TURKSTAT, 2014)

Kod	Düzey 1 (12 bölge)	Kod	Düzey 2 (26 alt bölge)	Düzey 3 (81 İl)
TR1	İstanbul	TR10	İstanbul alt bölgesi	İstanbul
TR2	Batı Marmara	TR21	Tekirdağ alt bölgesi	
				Tekirdağ, Edirne, Kırklareli
		TR22	Balıkesir alt bölgesi	Balıkesir, Çanakkale
TR3	Ege	TR31	İzmir alt bölgesi	İzmir
		TR32	Aydın alt bölgesi	Aydın, Denizli, Muğla
		TR33	Manisa alt bölgesi	Manisa, Afyonkarahisar, Kütahya, Uşak
TR4	Doğu Marmara	TR41	Bursa alt bölgesi	Bursa, Eskişehir, Bilecik
		TR42	Kocaeli alt bölgesi	Kocaeli, Sakarya, Düzce, Bolu, Yalova
TR5	Batı Anadolu	TR51	Ankara alt bölgesi	Ankara
		TR52	Konya alt bölgesi	Konya, Karaman
TR6	Akdeniz	TR61	Antalya alt bölgesi	Antalya, Isparta, Burdur
		TR62	Adana alt bölgesi	Adana, Mersin
		TR63	Hatay alt bölgesi	Hatay, Kahramanmaraş, Osmaniye
TR7	Orta Anadolu	TR71	Kırıkkale alt bölgesi	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir
		TR72	Kayseri alt bölgesi	Kayseri, Sivas, Yozgat
TR8	Batı Karadeniz	TR81	Zonguldak alt bölgesi	Zonguldak, Karabük, Bartın
		TR82	Kastamonu alt bölgesi	Kastamonu, Çankırı, Sinop
		TR83	Samsun alt bölgesi	Samsun, Tokat, Çorum, Amasya
TR9	Doğu Karadeniz	TR90	Trabzon alt bölgesi	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane
TRA	Kuzeydoğu Anadolu	TRA1	Erzurum alt bölgesi	Erzurum, Erzincan, Bayburt
		TRA2	Ağrı alt bölgesi	Ağrı, Kars, Iğdır, Ardahan
TRB	Ortadoğu Anadolu	TRB1	Malatya alt bölgesi	Malatya, Elazığ, Bingöl, Tunceli
		TRB2	Van alt bölgesi	Van, Muş, Bitlis, Hakkâri
TRC	Güneydoğu Anadolu	TRC1	Gaziantep alt bölgesi	Gaziantep, Adıyaman, Kilis
		TRC2	Şanlıurfa alt bölgesi	Şanlıurfa, Diyarbakır
		TRC3	Mardin alt bölgesi	Mardin, Batman, Şırnak, Siirt