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The Case of Thailand

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Global Assessment Report on Disaster Risk Reduction

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Thailand's Economy Transformation and Foreign Direct Investment

After the early 1970s, the Thai economy has undergone structural transformation, as the development strategies shifting from agricultural-led strategies to export promotion, foreign direct investment and industrialization. Between the late 1970s and early 1980s, there were surged interests in export industries, small-scale industries, resource-based and labor-intensive industries. With regards to the foreign direct investment (FDI), the Investment Promotion Law was passed in 1977, granting more power to Thailand's Board of Investment (BOI) to provide incentives to priority areas and reduce barriers and obstacles facing the private investors (Brimble, 2002).

In the first half of the 1980s, the FDI flow into Thailand was quite small and fluctuated quite substantially owing to the instability in both domestic and world economies. In the second half of the 1980s, there was a tremendous increase in the FDI inflows into Thailand. This was resulted from an appreciation of currencies of Japan, Taiwan, Hong Kong and South Korea after the Plaza Accord, and the rise in labor costs of those countries (Brimble, 2002). As a consequence, corporations in those countries decided to relocate their production bases to Thailand and other developing countries. Figure 1 shows the FDI flows into Thailand during 1970-2010.

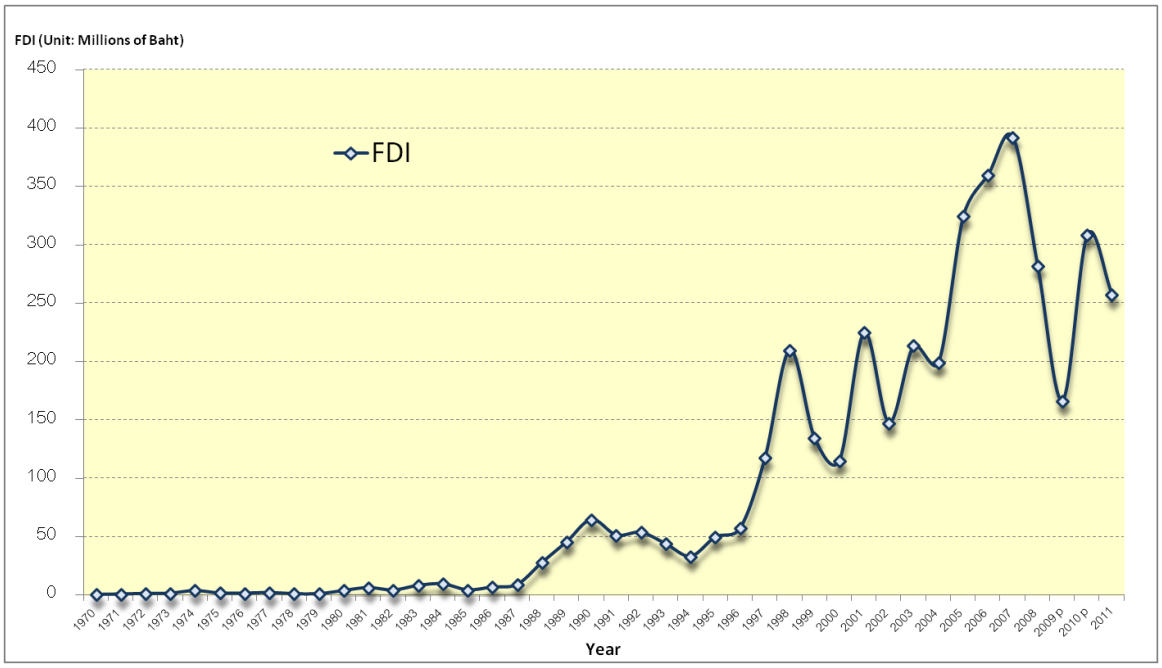

Figure 1: Foreign Direct Investment Flows into Thailand during 1970-2011

Source: Bank of Thailand

Figure 2 shows the sources of FDI flows into Thailand. The sources of Thailand's FDI flows have been quite diversified, comprising of Japan, United States, Europe and other countries. As shown in Figure 2, Japan had been quite a major source of FDI since the late 1970s, but its role has diminished in the late 1990s. The Thai Government has played quite an important role in attracting flows of these private capitals and associated technology and managerial skills over these past few decades by means of liberalizing the laws and regulations of the admission, establishing of foreign investment projects and providing guarantees for repatriation of investment and profits (Rochananonda, 2006). These different measures were increasingly adopted to facilitate entry of FDI.

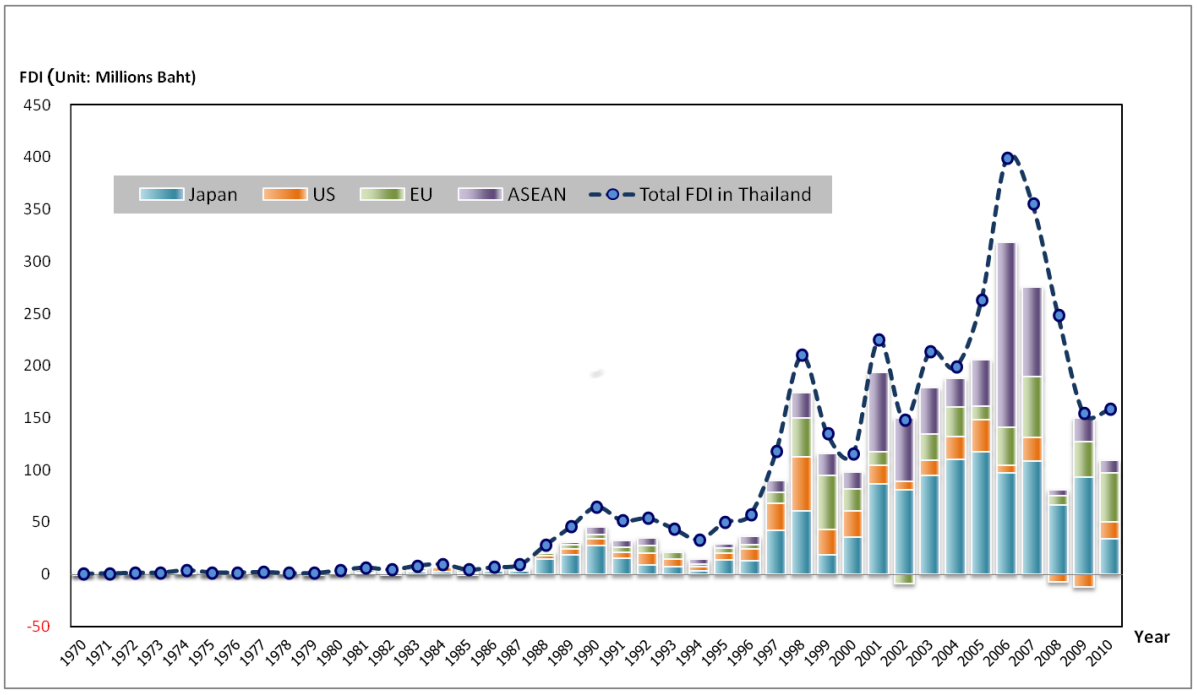

Figure 2: Major Sources of Foreign Direct Investment into Thailand

Source: Bank of Thailand

At the beginning of the 1990s, the flow of FDI into Thailand started to decline as a result of the production base adjustment by Japan and NIE's and the inadequacy of human resources and infrastructure in Thailand. After the Thai baht was floated and financial crisis erupted in 1997, the FDI flows into Thailand had increased, perhaps due to a rise in the cases of company takeover and acquisition as well as the increase in purchasing power of foreign investors due to depreciation of Thai currency. Between 2002 and 2007, the flow of FDI consistently increased in accordance with the recovery of the Thai economy.

Among different economic sectors, the manufacturing sector has been a large recipient of FDI, as shown in Figure 3, with an increasing share in the FDI flows. Within the manufacturing sector, Figure 4 shows that, since the 1970s, the electronic industry had attracted quite large inflows of FDI. Nevertheless, in the post-crisis period, as the Japanese automotive parent companies injected capital to assist their subsidiaries and suppliers in Thailand, the share of machinery and transport equipment increased quite substantially (Brimble, 2002).

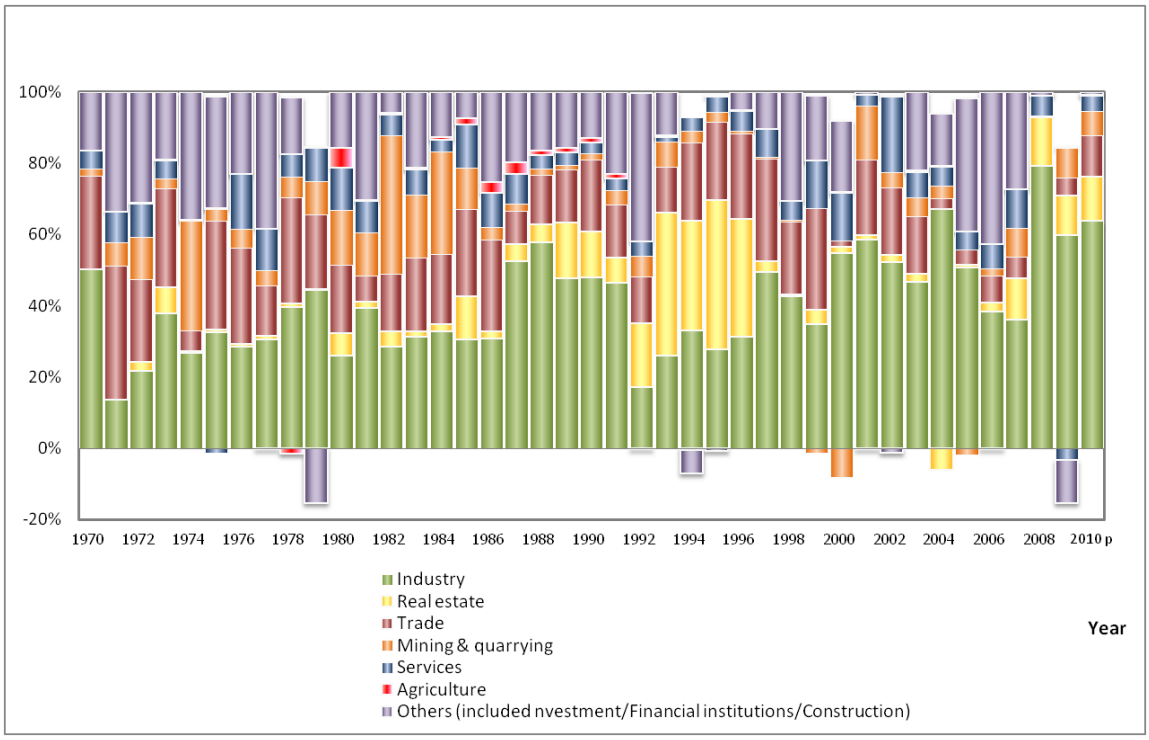

Figure 3: Foreign Direct Investment Classified by Recipient Sectors

Source Bank of Thailand

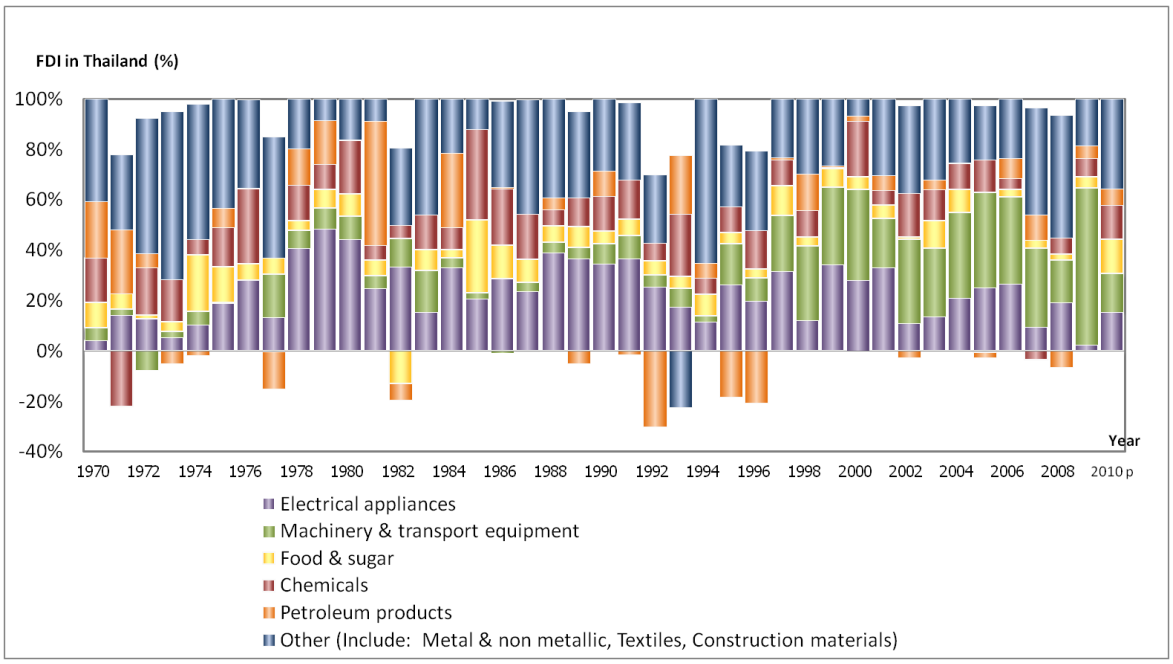

Figure 4: Decomposition of Foreign Direct Investment within the Industrial Sector

Source: Bank of Thailand

1. Natural Disaster Trends

According to the International Disaster Database (EM-DAT), the number of disaster events reported in Thailand during 1970-2011 increased, from 5 (during 1970-1979) to 63 (during 2000-2011). Figure 5 shows such increase in occurrence of natural disaster events. After decomposing the occurrence of events by disaster types, Figure 6 shows that flood occurred with the highest frequency.

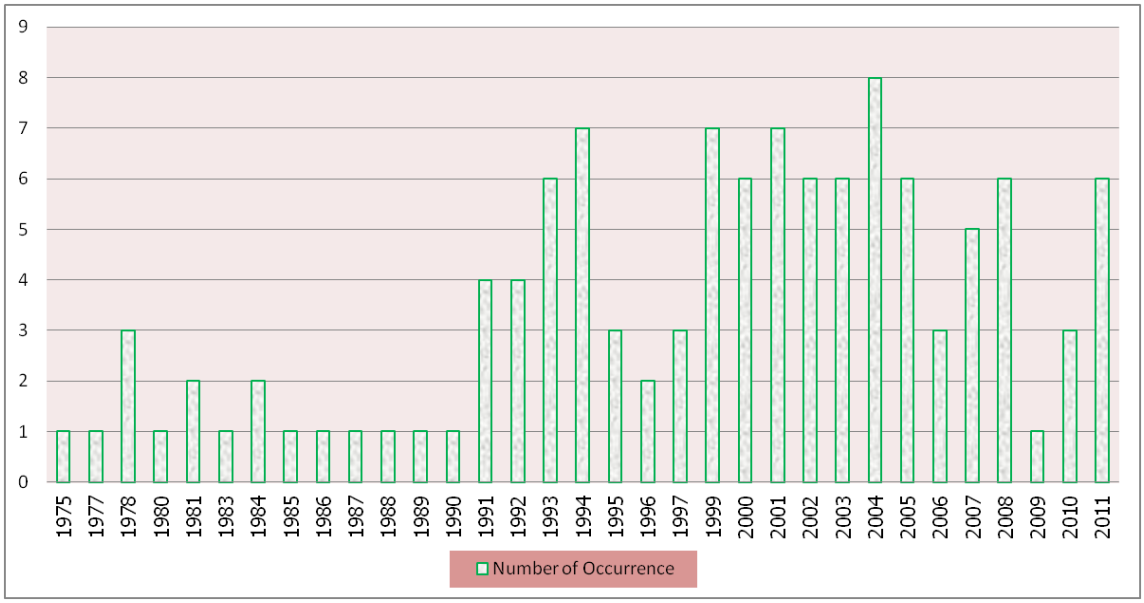

Figure 5: Occurrence of Natural Disaster in Thailand during 1970-2011

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

www.emdat.be – Université Catholique de Louvain – Brussels – Belgium

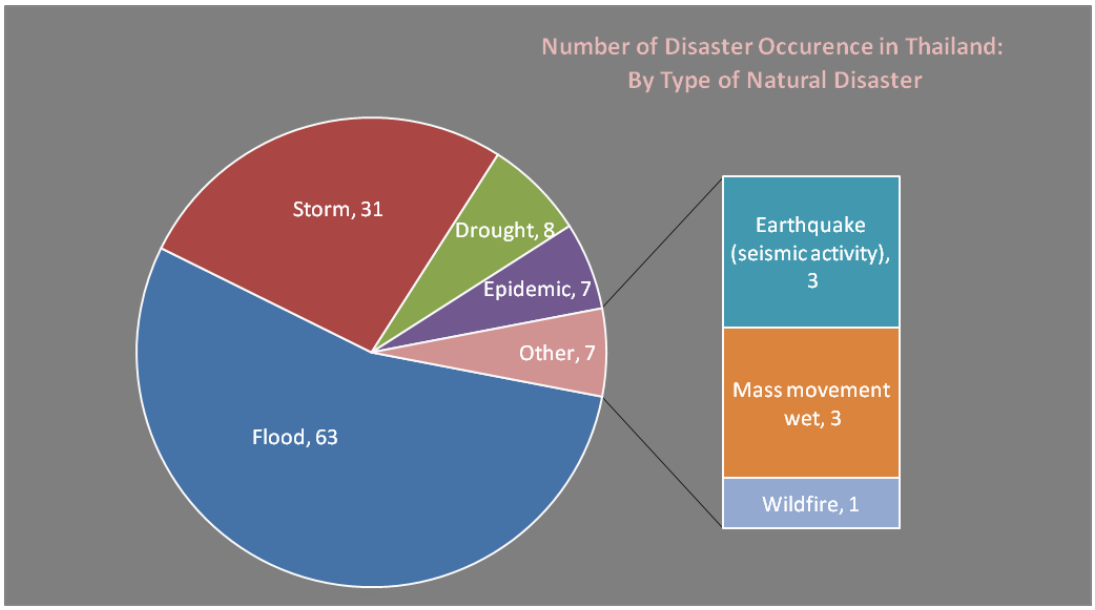

Figure 6: Decomposition of Disaster Occurrence in Thailand during 1970-2011

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

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Moreover, as shown in Figure 7 and 8, since the 1970s, flood has been the natural disaster that has imposed tremendous impacts on Thailand, both in terms of total number affected (i.e. affected, rendered homeless, injured or died) and in terms of economic losses. Thus, in this report, our focus is on the connection between foreign direct investment and flood risks.

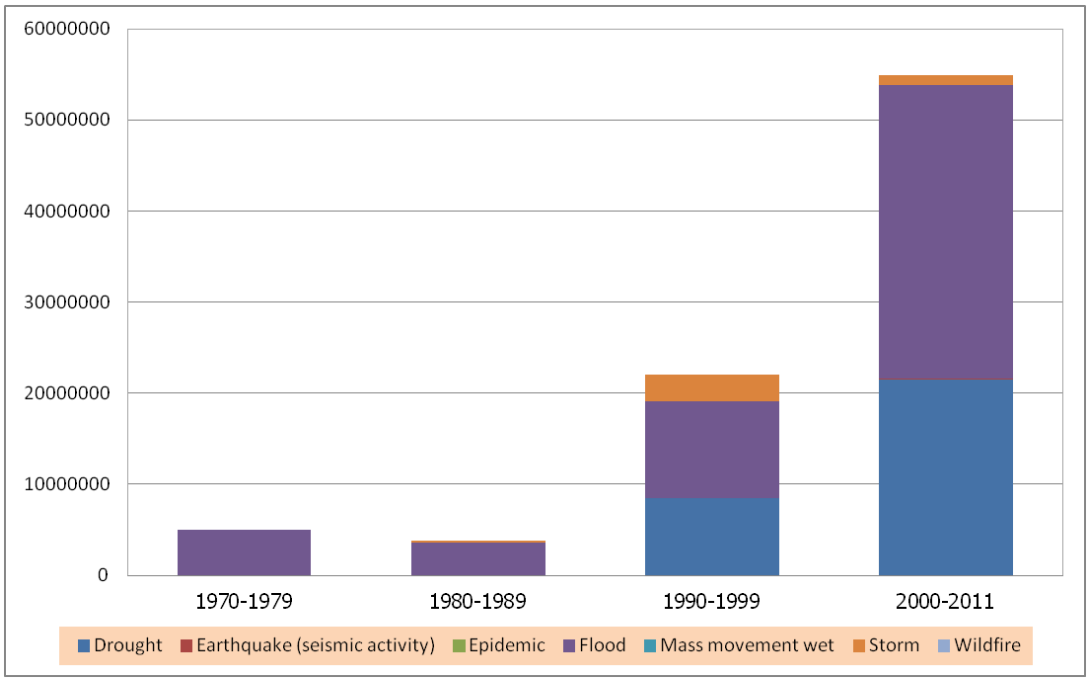

Figure 7: Total Number of People Affected by Natural Disaster in Thailand during 1970-2011

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

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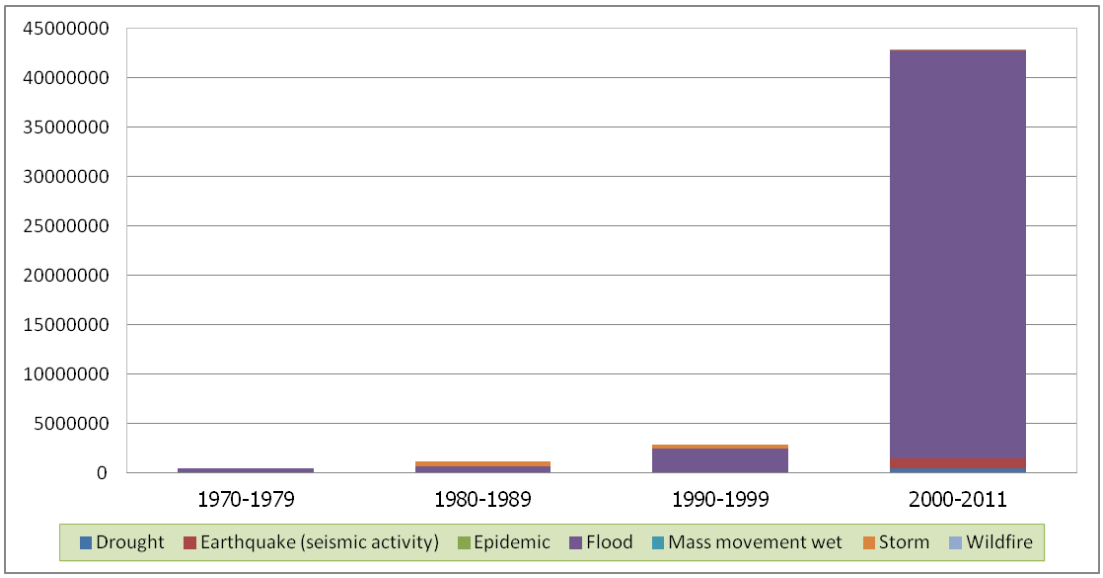

Figure 8: Total Economic Losses (Damages) from Natural Disaster: Thailand (thousands US$)

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

www.emdat.be – Université Catholique de Louvain – Brussels – Belgium

According to the EM-DAT disaster database, the total number affected by flood increased quite substantially between 1970s and 2000s. Figure 9 illustrates. Such increase could be related to many factors, including an increase in the population exposed to flood.

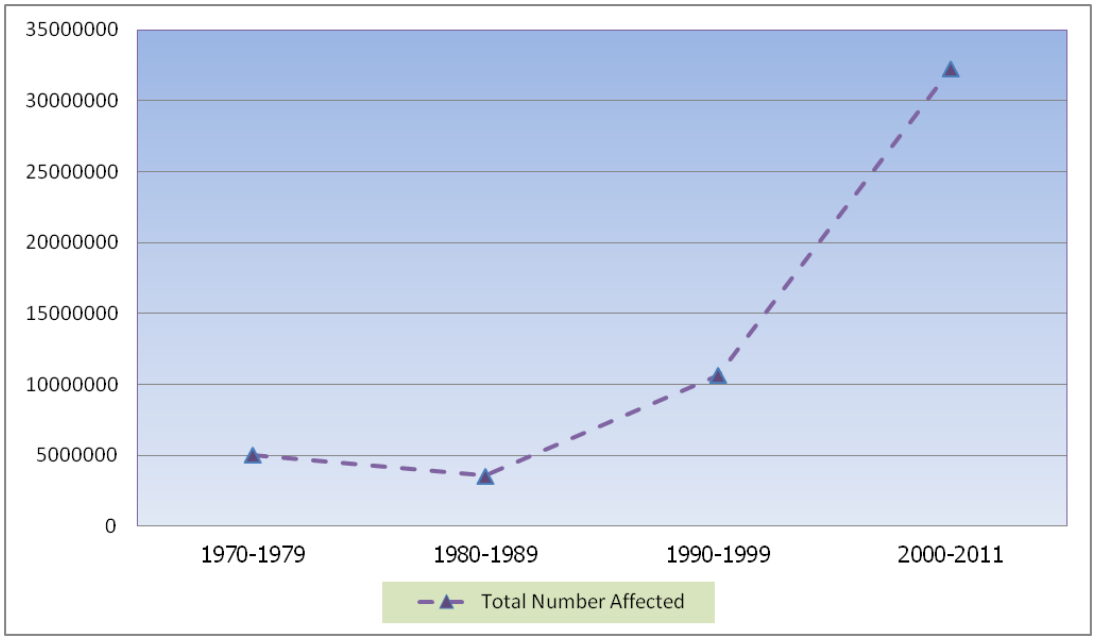

Figure 9: Total Number Affected by Flood - Thailand

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

www.emdat.be – Université Catholique de Louvain – Brussels – Belgium

In terms of losses, Figure 10 shows that the economic losses from flood between 1970s and 2000s increased quite dramatically. The extent of such losses tends to depend on the values of economic activity and infrastructure in the flood-prone areas.

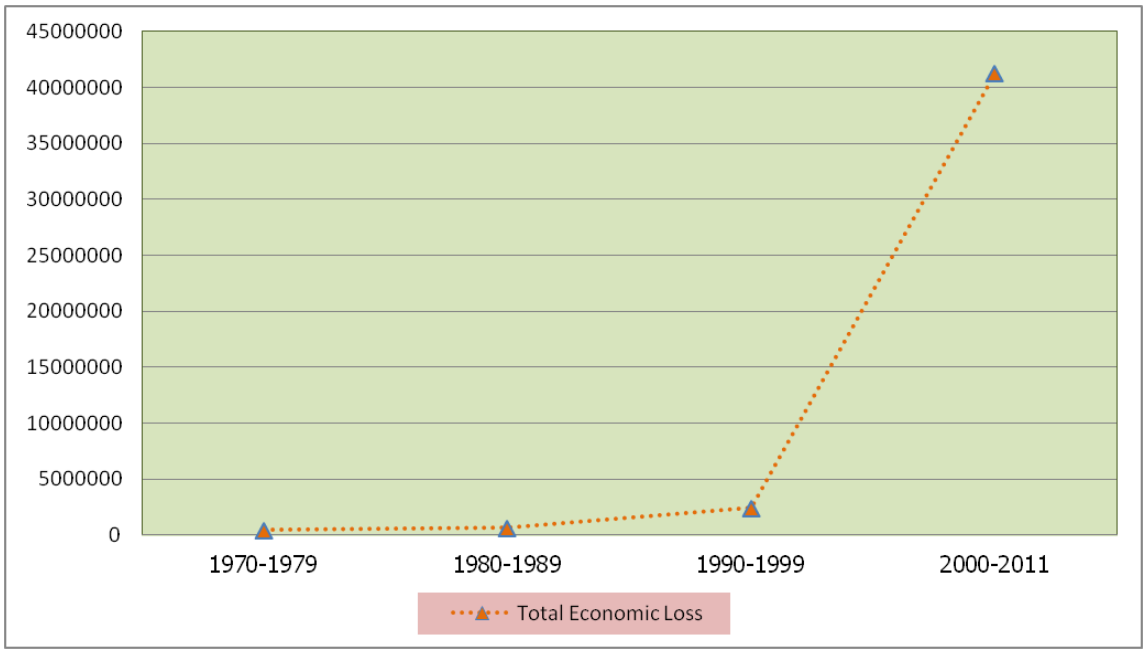

Figure 10: Total Economic Losses (Damages) of Flood - Thailand

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

www.emdat.be – Université Catholique de Louvain – Brussels – Belgium

Basing on the information shown in Figures 9 and 10, during the 1970s-1980s when the national development strategies supported promotion of foreign direct investment, flooding occurred with low frequency and the impacts of flood were relatively small. Thus, it is not clear whether this factor caused the foreign investors to discount low probability future losses from floods and explained why flood hazards have not been sufficiently factored into their investment planning.

The flood risk differs across different parts of the country. According to the flood risk map created by OCHA Regional Office for Asia Pacific illustrated in Figure 11, relative to other regions in the country, the Central region especially the provinces surrounding Bangkok Metropolitan are labeled as having high to extreme flood risks. Given the flood hazard map, such as that illustrated in Figure 11, the second question that arises is how publicly available was this type of information to the investors at the time they made their investment planning.

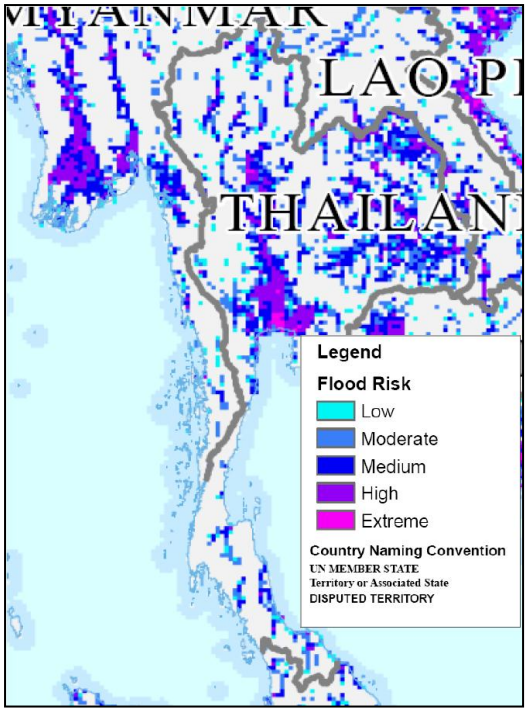

Figure 11: Flood Risk Map – Thailand

Source: OCHA Regional Office for Asia Pacific

2. FDI, Natural Disaster and Disaster Risk Management

3.1 Perception of Disaster Risk

The bunching of disaster events can affect the attitudes of investors and recipients of FDI in a particular time period, determining the way in which risk is perceived and the tolerance to such events. Risk aversion could be influenced by ignorance; thus, the same risk environment can look very different to different people. This could perhaps, to some extents, be resulted from different degree of impacts brought by particular disaster events, with some events having particularly intense impacts, while others do not. Applying the concepts discussed in White and Fan (2006), first, the disaster events may be perceived by investors as being irrelevant or their probability of occurrence is very low that can be ignored. Second, the disaster events may have impacts on the operation of the private firms but their impacts are only temporary or their occurrence is infrequent. Third, the disaster events may have a long term continuing impacts. Therefore, depending on how the investors and recipients of FDI perceived

about the likelihood of occurrence and the potential impacts caused by natural disasters, the degree of disaster risk aversion could differ.

Once they occurred, the natural disaster could affect the enterprises in different ways. First, the disaster events could impose direct costs on the enterprises and/or reducing revenues as they cause interruption in production. Second, if the enterprises voluntarily undertake disaster risk mitigation measures, some costs need to be incurred. For instance, if the enterprises put in place the early warning system for disaster, the costs associated with such system need to be factored in. Last but not least, according to White and Fan (2006), the disaster events could initiate or trigger changes in attitudes or perception of disaster risks by raising the level of risk aversion and therefore the likelihood of an avoidance response.

3.2 FDI and Disaster Risk

Determinants of FDI Flows

Given that the disaster events could potentially inflict different types of impacts on the enterprises, the enterprises should conduct risk assessment and be encouraged to factor the disaster risks into their FDI investment planning. This section of the report is devoted to examine this issue. We investigate whether the investors and the recipients of FDI, especially in the manufacturing sector, factored the flood risk into their investment planning. In the case in which there are poor concerns for managing flood risk, we also discuss different types of market failure that help explain why such risk has not been sufficiently incorporated in the investment planning process.

Figure 12 shows the relationship between FDI flows and occurrences of natural disaster during 1970s-2000s. From our casual observations of the figure, it appears that FDI does not seem to be deterred by occurrences of natural disaster, in general, and flood, in particular. The correlation coefficients for FDI and frequency of natural disaster and FDI and frequency of flood are 0.5649 and 0.5706, respectively.

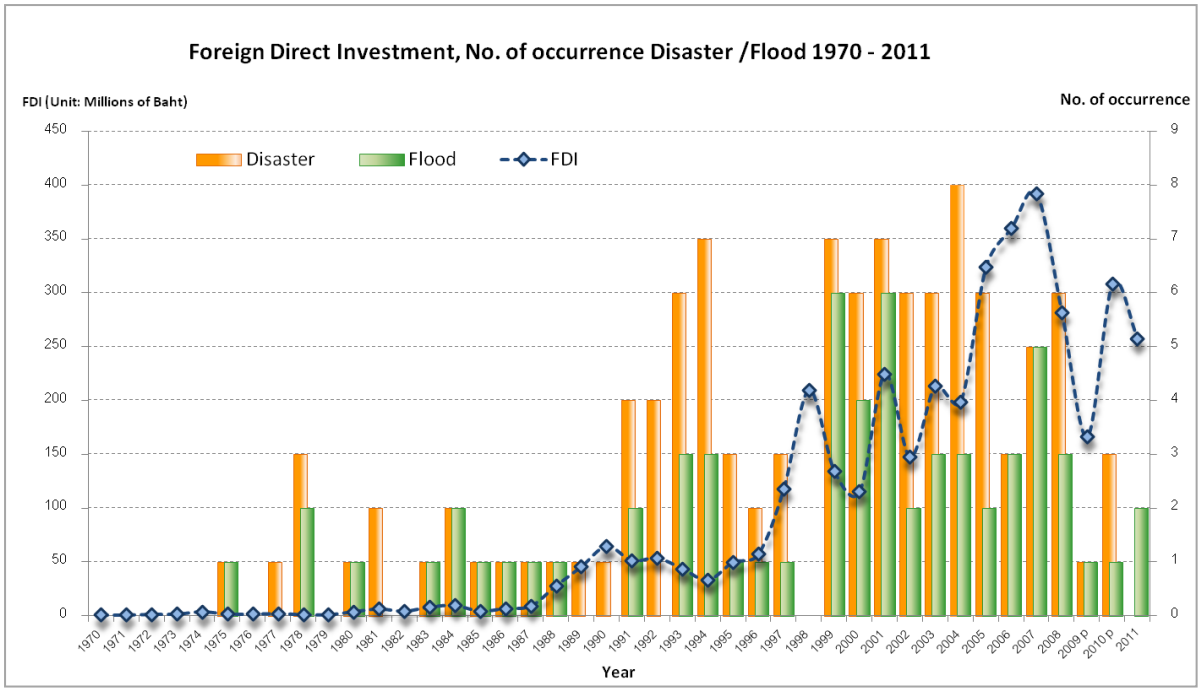

Figure 12: FDI and Occurrence of Natural Disaster and Flood during 1970s-2000s

Source: Bank of Thailand and EM-DAT: The OFDA/CRED International Disaster Database

www.emdat.be – Université Catholique de Louvain – Brussels – Belgium

Even though the simple time-series plots are useful in helping us conceptualizing the connection between FDI and occurrence of natural disaster, it is important that one should not hastily make inference basing on the graph. The FDI literature is flourished with empirical studies that investigate the determinants of FDI. According to Dunning (1993), there are four key motives that explain why parent firms engage in foreign direct investment, namely access to resources of the host countries, access to markets, efficiency gains and acquisition of strategic assets. Blonigen (2005) provides an extensive review of literature on FDI determinants. It was reported that, in addition to the firm-specific factors that motivate firms to become MNE, the external factors that are likely determinants of the location and magnitude of FDI include exchange rates, taxes, quality of institutions, trade protection, and trade effects.

In Walsh and Yu (2010), the variables that were found to have connections with FDI flows include the size and growth potential of the host market, economic stability, the degree of openness of the host economy, income level, the quality of institutions and the level of development.

Few papers have conducted empirical analyses on the determinants of FDI in the case of Thailand. Using the extended Gravity model and panel regression to evaluate the determinants of FDI in Thailand during 1980-2004, Thanyakhan (2008) found that FDI flows are increasing in the GDP and trade between Thailand and its investing partners. The distance between Thailand and its investing partners was found to have negligible impact on FDI and the 1997 Asian financial crisis has no impact on FDI. By employing the cointegration and error-correction-model (ECM) to investigate the determinants of FDI inflows from Japan, US and EU during 1970-1996, basing on the results of the cointegration tests, Chuleerat Kongruang found that the market size, the exchange rate and the production costs are the key determinants of FDI from developed countries. The results from the ECM indicate that the FDI inflows from this group of developed countries are increasing in the growth of the Thai market, while the real wage rate puts a downward pressure on FDI from developed countries.

The empirical analysis that investigates whether FDI decisions are influenced by natural disasters is scarce, with exception to Escaleras and Register (2011). In their paper, Escaleras and Register considered the relation between FDI and natural disasters that struck 94 countries during 1984-2004. Their findings show that relationship between natural disasters and FDI is negative and statistically significant.

In what follows, we conduct a simple empirical analysis on the determinants of FDI flows into Thailand, including some control variables suggested in the existing literature and the occurrences of natural disaster or flood as supplementary explanatory variables.

Empirical Model, Data and Regression Results

- Empirical Model

The empirical model to be estimated in this study is developed based on the hypothesis that the foreign direct investment inflows into Thailand are determined by the following economic factors, namely the market size, the unit user cost of capital and the occurrences of natural disasters. The market size in Thailand can be proxied by Thailand's real gross domestic product (GDP). For the unit user cost of capital, we use the average lending interest rates in Thailand as a proxy. Last but not least, for the occurrence of natural disaster, we estimate the annual occurrence of natural disasters in Thailand. The regression model to be estimated is given by:

$$FDI_t = \beta_0 + \beta_1 GDP_t + \beta_2 UC_t + \beta_3 OCD_t + \varepsilon_t$$

where t denotes time period from 1976 to 2010, FDI denotes real foreign direct investment inflows into Thailand, UC denotes the lending interest rates, OCD denotes the number of times in which natural disaster occurred annually, and ε denotes the error term. Even though, the existing empirical studies on determinants of FDI suggested the use of more sophisticated econometric method such as the vector autoregression model (VAR), cointegration test and error correction model (ECM), we estimate this empirical model using the ordinary least square (OLS) method with robust standard errors because the objective of this empirical investigation is to preliminarily examine the connection between FDI and some possible set of determinants.

- Data

In this simple empirical analysis, we use Thailand's annual time series data from 1976 to 2010. The data on Thailand's nominal GDP, lending interest rates and consumer price index (CPI) were obtained from the World Development Indicator (WDI) 2012. The FDI data was obtained from the Bank of Thailand. Data on the occurrences of natural disaster was obtained

from the EM-DAT: The OFDA/CRED International Disaster Database.[1] The series for GDP and FDI are measured in terms of 2005 prices, using the CPI in converting from nominal into real values.

- Results and Discussion

The results from our estimations using the OLS method are shown in Table 1.

Table 1: OLS Regression Results

FDI	Estimated Coefficients
GDP	0.0359532***
	(0.00773)
UC	-0.00000055
	(0.000000397)
OCD	-0.000000172
	(0.000000735)
Constant	0.00000002
	(0.0000000607)
Number of Observations	35
R-squared	0.7607
F-values	37.87

Remark: *, ** and *** denote statistical significance at 10%, 5% and 1%, respectively and standard errors are shown in parentheses

As shown in Table 1, the market size, captured by the variable GDP, has a statistically significant and positive impact on the foreign direct investment, suggesting that a larger market in Thailand attracts the inflows of FDI. The effects of user cost of capital and disaster occurrence are not clear since the estimation results for both variables are not statistically significant. Nevertheless, the estimated coefficient for the variable, UC, is negative, indicating that an increase in the cost of capital leads to a decline in foreign direct investment. Last but not least, the variable, OCD, is negative but not statistically significant indicating that, basing on the

[1] Source: www.emdat.be – Université Catholique de Louvain – Brussels, Belgium

data used in our study, occurrence of natural disaster is not a factor that affects the foreign direct investment flows into Thailand. However, in the future works, it is important that one extends the empirical analysis undertaken in this report to conduct an in-depth empirical investigation on the determinants of foreign direct investments.

Flood Risks and FDI Decisions

In what follows, we consider the connection between flows of FDI into Thailand's manufacturing sector and the flood risk.

In Thailand, investment zones have been used to support the strategies of decentralizing Thailand's industrial base from Bangkok Metropolitan Area. Tax incentives and special privileges were granted by the BOI to facilitate the compliance of such strategies by the host companies. Projects that are granted incentives by the BOI are referred to as promoted projects. In other words, the host companies will be provided tax incentives for constructing their manufacturing plants inside specific or targeted industrial areas, which are categorized into 3 zones (Rochananonda, 2006).

Zone 1 includes Bangkok and the other five provinces surrounding Bangkok; Zone 2 includes 12 provinces surrounding Zone 1 and Zone 3 comprises of the remaining provinces (36 provinces and other provinces with lower development). Broadly, to encourage projects in the less developed areas, promoted projects of the BOI located in Zone 1 receive the least generous tax privileges, while those located in Zone 3 receive the most generous tax privileges (United Nations, 2000). Table 2 summarizes the tax privileges in each of the three promotional zones in Thailand.

Table 2: Tax Privileges and Incentives for Different Promotional Zones

Promotional Zone	Tax Privileges
Zone 1	• A corporate income tax exemption for 3 years, provided the project locates its factories in industrial estates or promoted industrial zones. • A 50 percent reduction in import duty on machinery to be used in the project. • Exemption from import duty on raw materials used in the export products for 1 year.
Zone 2	• A corporate income tax exemption for 3 years, which may be granted to 7 years provided that project locates its factories in industrial estates or promoted industrial zones. • A 50 percent reduction in import duty of machinery to be used in the project. • Exemption from import duty on raw materials used in export products for a period of 1 year.
Zone 3 (36 provinces)	• A corporate income tax exemption for 8 years. • Exemption from import duty on machinery to be used in the project. • Exemption from import duty on raw material used in export products for a period of 5 years. • An additional 25 percent deduction for costs associated with developing certain infrastructure facilities connected with the project. • Extra privileges, provided the project locates its factories in industrial estates or promoted industrial zones, including - 50 percent reduction in CIT for an additional period of 5 years - Double deduction from taxable income of transportation, electricity and water costs for 10 years from the first day of the first sales. - 75 percent reduction in import duty on raw material used in the production for domestic sales for a period of 5 years.
Zone 3 (22 provinces)	• A corporate income tax exemption for 8 years with 50 percent reduction in CIT for an additional period of 5 years. • Exemption from import duty on machinery to be used in the project. • Exemption from import duty on raw material used in export products for a period of 5 years. • An additional 25 percent deduction for costs associated with developing certain infrastructure facility connected with the project. • Extra privileges, provided the project locates its factories in industrial estates or promoted industrial zones: - Double deduction from taxable income of transportation, electricity and water costs for 10 years from the first day of the first sales. - 75 percent reduction in import duty on raw material used in the production for domestic sales for a period of 5 years.

Source: Rochananonda (2006) and BOI (2005)

In additional to the tax incentives and privileges to encourage the host companies to construct their manufacturing plants inside specific industrial zones, the BOI has also provided sectoral incentives. First, the BOI identified the priority projects in areas such as basic transportation systems, public utilities, environmental protection and technological development (including, for examples, machinery and equipment, vehicle parts, electronic appliances and computers). These identified projects are then entitled to receive corporate income tax exemption for 8 years regardless of location and import duty exemption on machinery regardless of location (Rochananonda, 2006). Second, according to Rochanadonda (2006), the customized incentive scheme was launched by the BOI to encourage cluster-based investment. The industries that were targeted by the BOI include, for instances, automotive, hard disk drive, alternative energy, semi-conductors, and software. For these industries, additional period of corporate income tax exemption would be granted, provided the project meets investment condition for each industry.

Given the tax incentives and different types of privilege offered by the Thai government to invest in the specific industrial zones, particularly in the provinces surrounding Bangkok, a number of foreign manufacturers were attracted to set up their production hub in these areas. How much FDI resulted from the BOI sectoral and cluster incentives?

Due to limited FDI data made available through the BOI, we are able to trace FDI resulted from the sectoral and cluster incentives provided by the BOI only back to 2003. We refer to the BOI's database on foreign investment projects approved by the BOI. Figure 13 shows the total number of investment projects approved by the BOI and the total investment value. According to the figure, as a result of the global financial crises during 2007-2008, there was a sharp decline in the number of BOI approved investment projects and the total investment value in 2009.

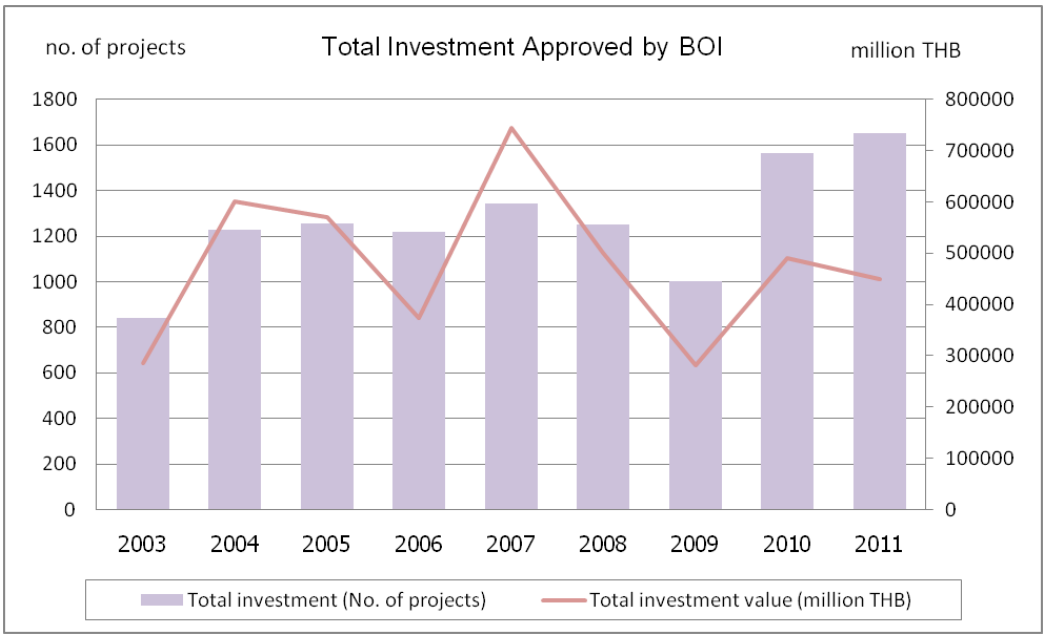

Figure 13: Investment Projects Approved by BOI during 2003 – 2011

Source: Board of Investment (BOI)

The total investment shown in Figure 13 comprises of foreign investment, 100 percent Thai investment and other investment. Since our focus here is on the foreign direct investment, we show here the total number of foreign investment projects approved by BOI and the foreign investment value in Figures 14 and 15, respectively. The foreign investment projects can be categorized into two types, namely 100 percent foreign projects and the projects with joint-venture.

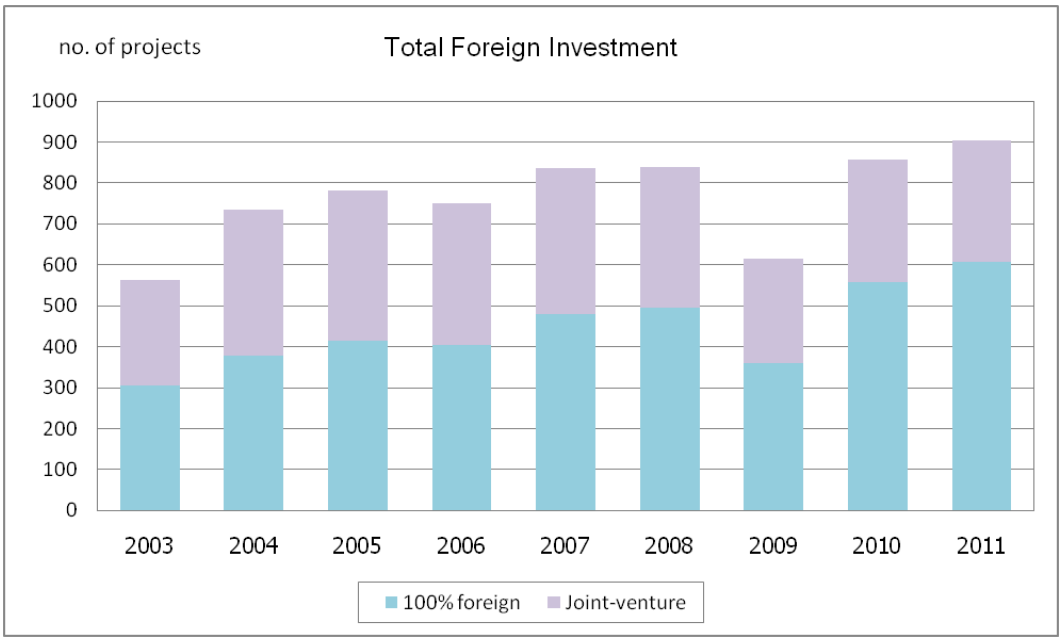

Figure 14: Number of foreign investment projects approved by BOI during 2003-2011

Source: Board of Investment (BOI)

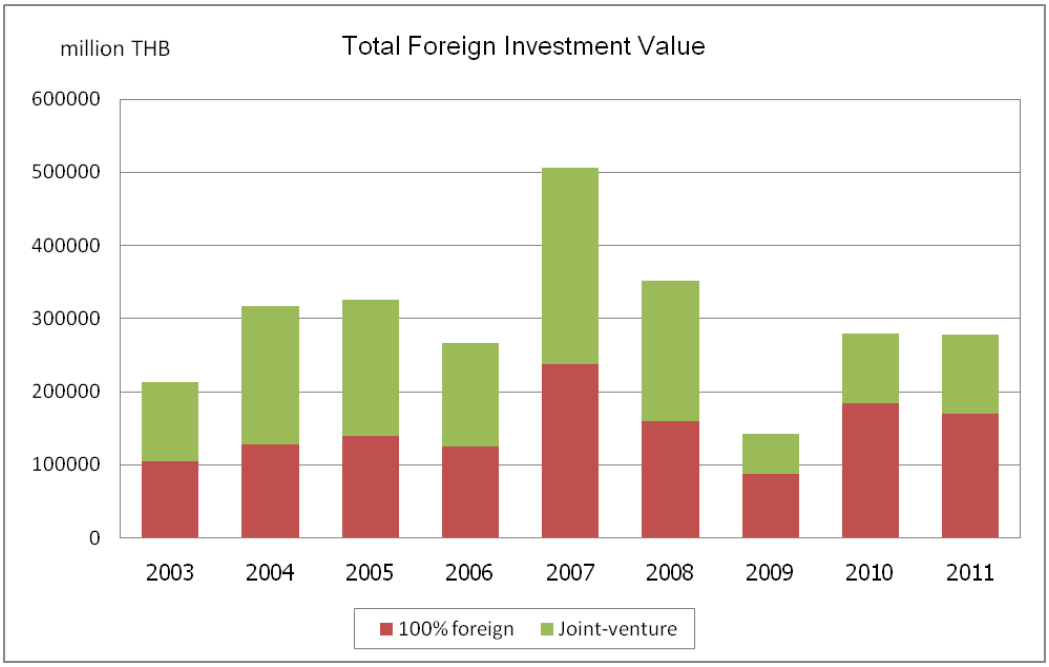

Figure 15: Value of foreign investment approved by BOI during 2003-2011

Source: Board of Investment (BOI)

The BOI also provides information on the classification of foreign investment projects it approved by sectors. This information is shown in Figures 16 and 17.

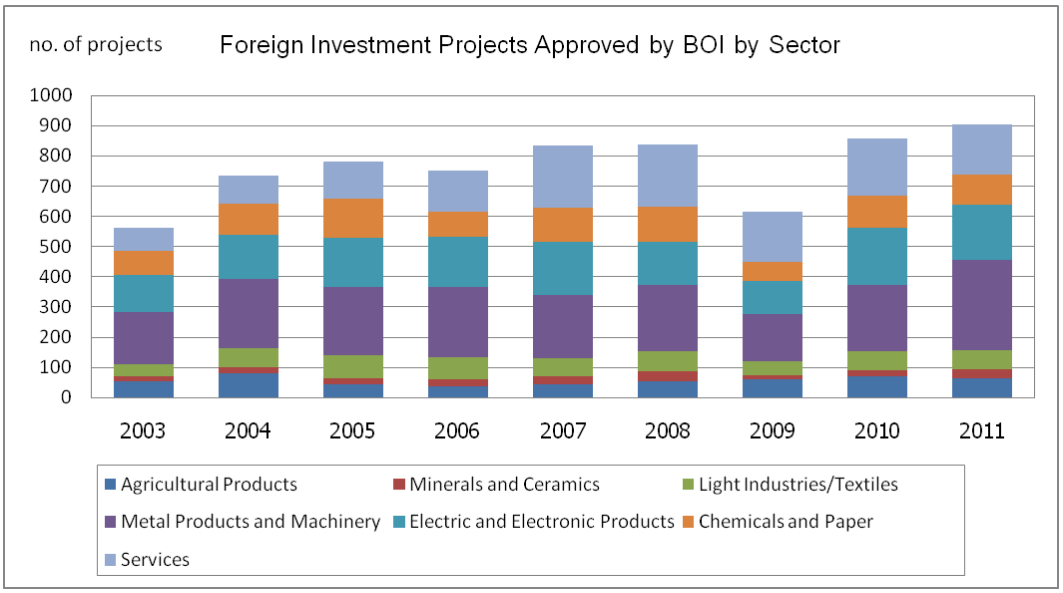

Figure 16: Number of foreign investment projects approved by BOI classified by sector

Source: Board of Investment (BOI)

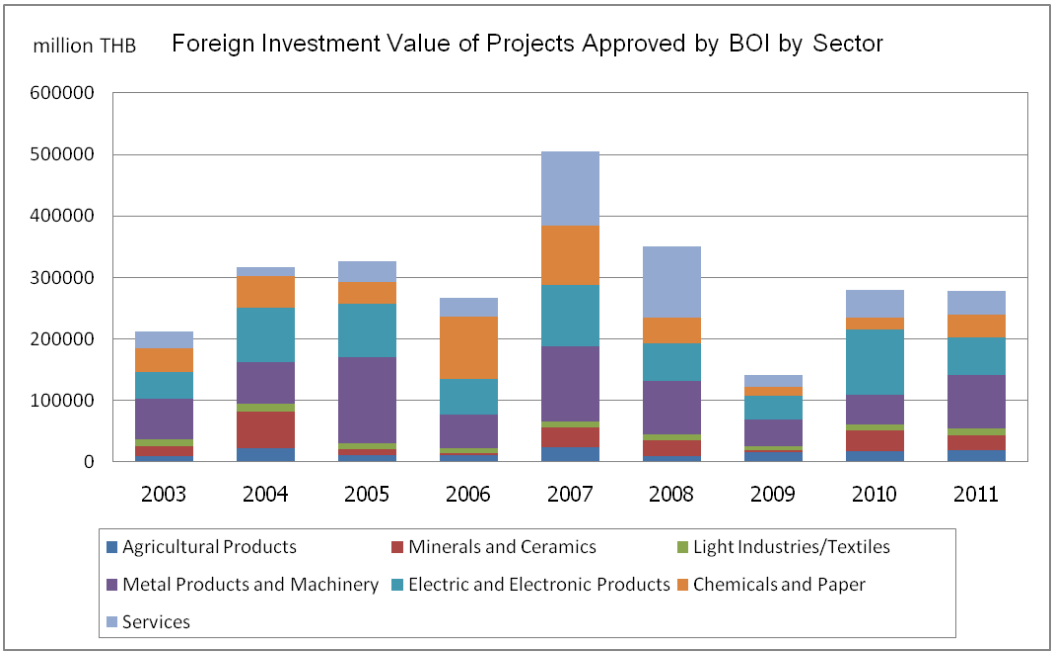

Figure 17: Value of foreign investment projects approved by BOI classified by sector

Source: Board of Investment (BOI)

As shown in Figures 16 and 17, the top three sectors that attracted inflows of foreign investment through BOI initiatives are metal products and machinery; electric and electronic products and services.

According to the study conducted by Naiyutti (1997), industries in the lower part of Ayutthaya province, especially in the Bang Pa-In and Bangsai districts, are located in the areas that were mostly rice field wetland and historical settlement, which were supposed to be prohibited for industrial purposes. The distribution of the industry in these areas could be categorized into four zones, comprising of the River side industrial zone, the industrial zone along railway, the industrial zone along major highways and the planned promotion industrial zone. The forth zone, i.e. the planned promotion industrial zone, had attracted the largest number of industrial investment and concentration in Ayutthaya district. Some examples of industrial estates developed in this zone include Bang Pa-In Industrial Estate, Hi-Tech Industrial Estate, Saha Nakorn Industrial Estate and Rojana Industrial Estate.

What were the factors that influence the site selection of industries in lower Ayutthaya province? According to Leang-Anan (1992), the major factors that made areas in lower Ayutthaya attractive for investment and influencing industrial selections include transportation, infrastructure, and available labor force. These industries tended to cluster near raw materials sites or disperse along the major transportation routes.

From the above discussion, one can see that much of the FDI flows into Thailand have concentrated in the industrial sector, especially in the electrical appliances, machinery and transport equipments, and a large number of these industries have located their manufacturing plants in the designated industrial zones. Quite a few of these zones designated for industrial development are situated on the alluvial floodplain, which should be prohibited for industrial purposes. Yet, due to tax incentives provided by the Board of Investment, good infrastructure, convenient transportation, proximity to raw materials, and availability of labor force, several industries built their plants inside these industrial zones.

Evidence on how many industrial estates or zones designated for industrial developments are situated on the floodplain is not available. According to the Industrial Estate Authority of Thailand (IEAT), the industrial estates that are located in Bangkok and surrounding provinces which are flood-prone are contained in Table 3.

Table 3: Industrial estates in Bangkok and surrounding provinces

Industrial Estate	Area (rai)
Ayutthaya	
Hi-tech Industrial Estate	2,379
Bangpa-in Industrial Estate	1,962
Saharatnakorn Industrial Estate	2,050
Bangkok	
Bangchan Industrial Estate	677
Ladkabang Industrial Estate	2,559
Aunyathani Industrial Estate	172.93
Anuyathani Industrial Estate 2	330
Samut Prakarn	
Bangpoo Industrial Estate	5,472
Bangplee Industrial Estate	1,004
Asia Industrial Estate Suvarnabhumi	3,552
Samut Sakorn	
Samut Sakorn Industrial Estate	1,456
Sinsakorn Industrial Estate	840
Maharaj Nakorn Industrial Estate	140

Source: Industrial Estate Authority of Thailand (IEAT)

The total areas occupied by the industrial estates shown in Table 3 are 22,594 rai or approximately 13.58 percent of the total industrial estate areas nationwide. Among these industrial estates, the industrial estates that were damaged or at risk of being affected by the

2011 Flood are shown in Figure 18. The total area occupied by these industrial estates is 12,087 rai or 53.49 percent of all industrial estates shown in Table 3.

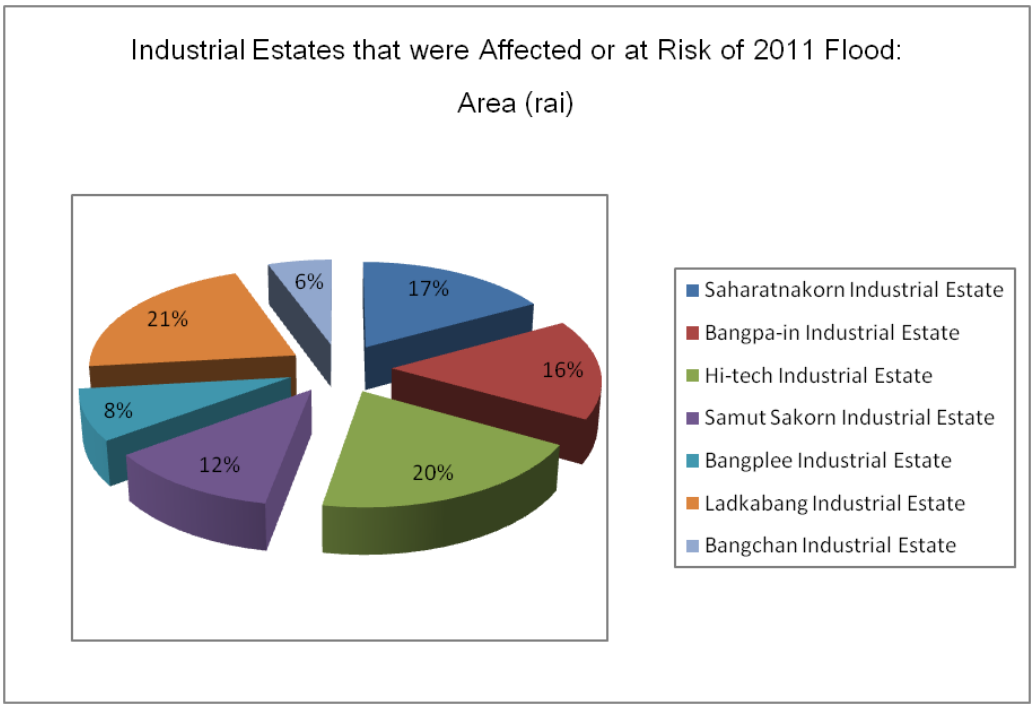

Figure 18: Industrial estates affected or at risk of 2011 Flood

Source: Industrial Estate Authority of Thailand (IEAT)

The question that arises is whether these foreign investors that built plants inside these industrial zones were well aware of the potential of flooding and whether flood risk was factored into the investment planning.

Was flood risk factored into the investment planning of these industries? First, as shown in Figure 12, during the 1970s-1980s, flooding occurred but with low frequency; thus, it is possible that flooding may be perceived by investors as being irrelevant or their probability of occurrence is very low that can be ignored. Second, once flooding took place, its impacts on the operation of the industries could be temporary. Third, once flooding occurred, given that the Thai Government provided flood reliefs and budgets for rehabilitation through the Department of Disaster Prevention and Mitigation (DDPM), this could have adverse impacts on these industries' attitude towards disaster risks (see Figure 19). In addition to the flood relief granted

by the Government, the Board of Investment offered a variety of supports to BOI-promoted companies affected by flood. The types of assistance provided are shown in Table 4. In addition, according to the Industrial Estate Authority of Thailand, some committees were established to assist in post-flood rehabilitation and recovery among the industrial firms in the affected industrial estates. Some examples of these committees include Flood Recovery and Restoration Committee, Flood Recovery and Restoration Committee on Economy, Industry and Livelihood, Flood Recovery and Restoration Committee on Infrastructure, Strategic Committee for Water Resources Management and Strategic Committee for Reconstruction and Future Development.

Table 4: Post-flood Relief Provided by Board of Investment

Government Agencies	Assistance Offered
Board of Investment	• BOI-promoted companies are entitled to duty-free importation of machinery damaged by flooding. • Raw materials imported under section 36 (duty-free importation) that are damaged by the flooding can be counted as part of the waste allowance and therefore there will not be any tax burden. Raw materials imported under section 36 that are still useable can be transferred to another BOI-promoted project that is still entitled to section 36. • BOI-promoted companies affected by flooding are allowed to outsource some part of their manufacturing process on a temporary basis to avoid business interruptions. • Additional tax incentives for projects directly affected by floods.

Source: Board of Investment

As a result, flood risk has not been sufficiently factored into the investment planning of these industries, investment in disaster prevention and mitigation by private firms has been quite small.

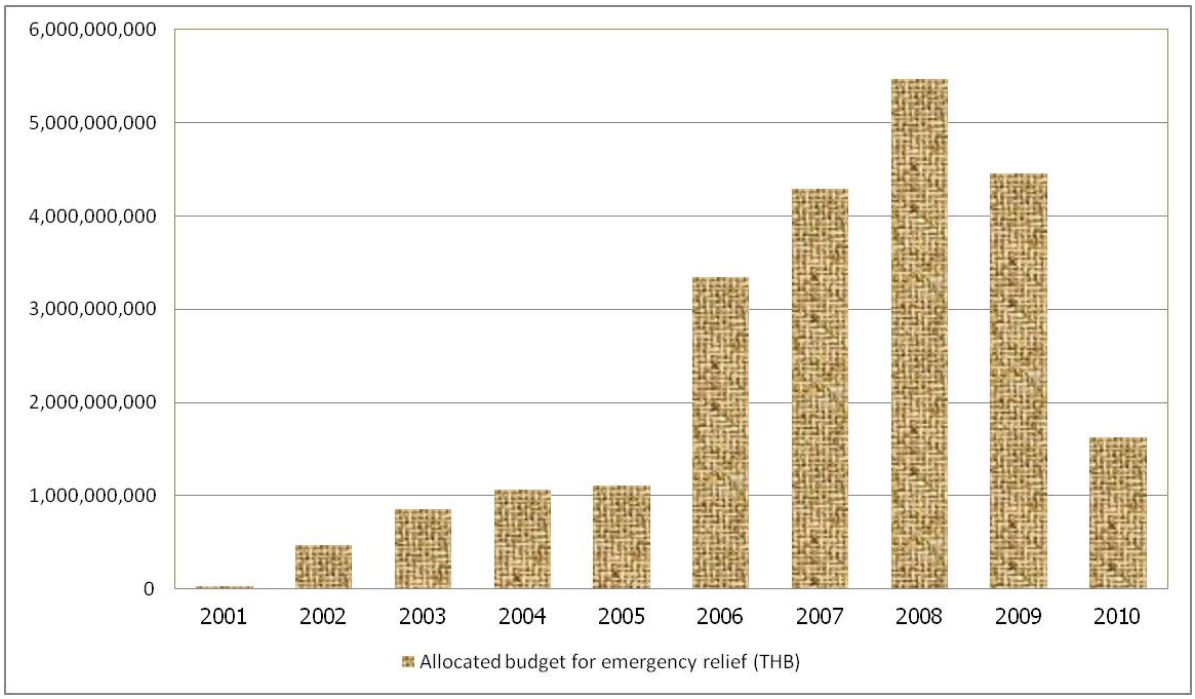

Figure 19: Allocated Budget for Emergency Relief (in Thai Baht)

Source : Department of Disaster prevention and mitigation

How did public spending via flood relief subsidize risky investments? As highlighted by Kousky and Shabman (2012), the post-disaster aid could trigger a moral hazard problem, disincentivizing the purchase of flood insurance, discouraging the adoption of risk reduction measures and encouraging people to locate in floodplains. According to Lichtenberg (1994), federal post-disaster aid could result in disincentives against the personal adoption of risk reduction measures, such as purchase of insurance because the post disaster aid provided by the federal government is essentially perceived as free insurance. In addition, the presence of post-disaster aid could affect individuals' or enterprises' choices on floodplain occupancy. In the U.S., Murphy (1958) emphasized that, prior to being coerced into adopting floodplain management regulations, virtually no local governments in the U.S. had adopted building or zoning regulations to minimize flood losses. Moreover, lack of enforcement of minimum building standards also appeared to be problem in dealing with flood risks.

Burby (2006) refers to the belief held by some scholars that the federal encouragement of the intensive use of areas exposed to natural hazards creates a form of moral hazard, which

discourages local governments and individuals from taking actions to reduce the risk of loss. As also discussed in Burby (2006), the Interagency Floodplain Management Review Committee (1994) observed that "through provision of disaster assistance and, in some cases, enhanced flood protection, the government may in fact be reducing incentives for local governments and individuals to be more prudent in their actions." Due to anticipation of receiving disaster relief from the federal government, this would discourage investment in disaster preparedness, mitigation, response and recovery as individuals, enterprises or local governments would be encouraged to take risks they think they will not have to pay for. Basing on a general equilibrium analysis of disaster policy, Wildasin (2011) found that disaster relief provided by the federal government could create moral hazards for subnational governments and private sector decision makers, resulting in inefficiently low amounts of investment in costly disaster avoidance.

Raschky and Schwindt (2011) conducted an empirical analysis on the impact of past foreign aid on the recipient country's preparedness against natural disasters. By using data of 81 developing countries during 1979-2007, they found that past foreign aid crowds out recipient's incentives to provide protective measures that decrease the likelihood and impact of a disaster. To undertake this type of analysis in the case of Thailand, time series data on disaster relief or aid provided by the government and detailed data, the impacts of disaster and private sector investment in disaster preparedness and mitigation are required. However, given that this is not the case, it is not in our capacity to test this hypothesis or prove with some form of empirical evidence.

In the aftermath of the flood that struck Thailand at the end of 2011, there was an emergency decree entitled "Emergency Decree Establishing Fund for Promotion of Catastrophic Insurance B.E. 2555 (2012)". Three types of catastrophe are under the Fund's coverage, comprising of storm, flood and earthquake (as well as other calamities as notified by the

Minister). According to Office of Insurance Commission (OIC), the coverage of the Catastrophic Insurance is summarized in Table 5.

It was stipulated that the SMEs and industries that want to purchase the Catastrophic Insurance need to first obtain the fire insurance and the Industry All Risks (IAR) insurance. In addition, it is clearly stated that the Catastrophic Insurance will not cover properties that are located in the regions designated to be flood detention areas by the Thai Government.

Table 5: Details of the Catastrophic Insurance

Types of Insured	Coverage	Annual Insurance Premium
Residential	Fire insurance and catastrophic insurance policies offer automatic protection of an amount not exceeding 100,000 THB	0.50%
Small and Medium Enterprises (SMEs)	The amount of coverage available to cover losses due to catastrophe not exceeding 30% of the aggregate limit	1.00%
Industries	The amount of coverage available to cover losses due to catastrophe not exceeding 30% of the aggregate limit	1.25%

Source: Office of Insurance Commission (OIC)

In addition to the widespread adoption of Catastrophic Insurance by residential owners, SMEs and industries as the strategies to manage the risks associated with flood and other types of disaster, some large industries, particularly those located in the areas designated as industrial zones, industrial parks or industrial estates, have invested in their own protective measures, such as constructing concrete wall or dyke (see Tables 6 and 7).

Table 6: Industrial estates, industrial parks and industrial zones affected by the 2011 Flood

Industrial Estate/Industrial Park/Industrial Zones	Province	Number of Factories	Factories Closure or Moved	Insurance Claim Processing	Received Insurance Compensation
Saharatnakorn Industrial Estate	Ayutthaya	46	5	18	3
Rojana Industrial Zone	Ayutthaya	213			
Hi-tech Industrial Estate	Ayutthaya	143	16	99	37
Bangpa-in Industrial Estate	Ayutthaya	90	1	59	0
Navanakorn Industrial Zone	Pathumthani	227			
Bangadee Industrial Park	Pathumthani	36			
Factory Land Industrial Zone	Ayutthaya	84			

Source: Industrial Estate Authority of Thailand (IEAT)

Table 7: Investment in flood protection by industries

Industrial Estate/Industrial Park/Industrial Zones	Province	Length (kilometer)			Budget (million THB)	Maximum Flood Defense Capacity (m. mean sea level)
		Concrete Wall	Dyke	Sheet Pile		
Saharatnakorn Industrial Estate	Ayutthaya		7.21		339.046	7
Rojana Industrial Zone	Ayutthaya		75		2145.456	5.5
Hi-tech Industrial Estate	Ayutthaya	2	11.03		492.433	4.9
Bangpa-in Industrial Estate	Ayutthaya		9.89		474.016	4.6
Navanakorn Industrial Zone	Pathumthani			18	1058.934	4.7
Bangadee Industrial Park	Pathumthani		9.12		345.16	4.5
Factory Land Industrial Zone	Ayutthaya	0.41			1.6	
Ladkrabang Industrial Estate	Bangkok		17		1769.07	1.19
Bangchan Industrial Estate	Bangkok			7	750.23	1.2
Bangpoo Industrial Estate	Samut Prakarn		12		1034.79	0.6
Bangplee Industrial Estate	Samut Prakarn		12.3		384.93	1
Samut Sakorn Industrial Estate	Samut Sakorn		14.5		1462.9	1.4
Phichit Industrial Estate	Phichit		3.8		39.55	39.25
Well Grow Industrial Estate	Chacheongsao					
Sinsakhon Industrial Estate	Samut Sakorn		13			
Aunyathani Industrial Estate	Bangkok					

Source: Industrial Estate Authority of Thailand (IEAT)

3. Concluding Remarks

The Thai economy has undergone structural transformation since the 1970s, with its current economic development model emphasizing on export promotion, foreign direct investment, and industrialization. A substantial amount of foreign direct investment flows has been attracted, particularly into the industrial sector and largely concentrating in the disaster-prone areas.

This report is devoted to examine different types of market failures that have contributed to poor concerns for disaster risks among the private firms that invest in Thailand. First, we examine the issue of information asymmetry, whether those private firms that invested in Thailand had information that their selected sites for constructing production hubs sit on the alluvial floodplain thus having a high risk of being affected by flood. Provided that, in the past, it was widely known that these areas designated for industrial development used to be devoted to agriculture, especially growing rice, the issue that arises is the extent to which this information was conveyed to the foreign investors before they made their investment decision. Second, given that these foreign investors had complete information that the areas in which they chose to develop their manufacturing plants were subject to flood risk, the tendency that these investors discount low probability future losses from disasters could perhaps explain why flood hazards have not been sufficiently factored into their investment planning.

Once flooding already took place, provided that it creates knock-on effects through interruption of supply chain and impact on livelihood of the workforce, there is a transfer of risk from private investors to other sectors of the Thai society, calling for greater fiscal budgets and resources from the public sector. As the government begins to cutback in social protection and investment in disaster risk reduction, both the vulnerable rural and urban residents would experience higher levels of vulnerability as the austerity measures imply less investment in infrastructure and increased asset and mortality risks. Therefore, with increased disaster losses and reduced fiscal space, these private sectors should be contemplating investment in disaster

risk reduction, realizing that the governments would have less financial resources for post-disaster recovery.[2] In addition, the Industrial Estate Authority of Thailand and the Board of Investment should not promote investors to construct or set up their manufacturing plants in the floodplain or other disaster-prone areas. Information should be disseminated to foreign investors prior to assist them in their investment planning.

[2] In the 2011 flood that struck the Central part of Thailand, several manufacturing firms in different industrial estates in Ayutthaya invested in flood prevention by constructing flood walls using their own budget (Industrial Estate Authority of Thailand).

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