# Impacts of the 2011 Flood on the Employment Sector in Thailand

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## Abstract

This study seeks to examine the short-term impacts of the 2011 flood on the labor market outcomes of workers who lived in the flooded areas, with a particular focus on the 20 most affected provinces. Data used in the analysis are from Labor Force Survey (LFS) collected by Thailand's National Statistical Office. Results suggest that the flood had a statistically significant negative impact on employment and earnings of temporary workers. Nonetheless, this flood did not have any statistically significant impact on the earnings of permanent workers. In addition, the flood created only a short-term impact. Findings that temporary workers and informal sector workers were more affected suggest that these workers are more vulnerable to shocks from natural disasters, mainly due to lack of social protection and access to credit. However, most of government measures to assist these two groups are still unclear. Lessons from the 2011 flood detailed in this study suggest the need for social security system reform in Thailand. This would provide a way to lessen or protect against negative impacts on labor of possible natural disasters and/or crises in the future.

Keywords: Labor Market, Earnings, Employment, Difference-in-Difference

JEL Classification: J20, Q54, O17

## 1. Introduction

In recent years, natural disasters such as storms, floods, and earth quakes have occurred more frequently and severely. These disasters not only have negative impacts on people's lives and assets in the short run, but they also affect the whole economy and people's well-being in the long run. The after maths often remain even after the immediate impacts of natural disasters have vanished.

The 2011 'mega' flood in Thailand significantly affected the economy and people's lives as the most severe flood in Thailand since 1942. This flood relentlessly affected a vast area, covering many provinces in the North, Central, and Northeast regions,[1] and it persisted for almost five months from the end of July until December, 2011. The World Bank's preliminary estimated loss from flood damage is around 1.43 trillion baht (approximately 46.5 billion US dollars), most of which occurred the production sector. The most affected provinces include Bangkok, Ayutthaya, Nakhon Sawan, Patum Thani, and Samut Sakhon, where the main manufacturers in the country are located. In particular, seven main industrial estates[2] in the Ayutthaya and Patum Thani provinces are ones of the major manufacturing areas for Thailand's domestic consumption and exports. A preliminary estimate of loss in physical assets in the industrial sector is around 630 billion baht (approximately 20.5 billion US dollars) (World Bank, 2012).

An inevitable effect of the intense and long-lasting flood in the industrial areas is on the factory workers. A pause in the production process due to the flood means a loss of income. Factories unable to recover may be closed or re-located, resulting in greater possibility

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[1]These provinces are: <u>Bangkok</u>, <u>18 provinces in the Central region</u> (Nonthaburi, PatumThani, Ayutthaya, Ang Thong, Lop Buri, Singh Buri, Chai Nat, Rayong, Chanthaburi, Trad, Chachoengsao, Prachin Buri, Nakhon Nayok, Sa Kaeo, Suphan Buri, Nakhon Pathom, and SamutSakhon), <u>16 provinces in the North region</u> (Chiang Mai, Lamphun, Lampang, Uttradit, Phrae, Nan, Phayao, Chiang Rai, NakhonSawan, UthaiThani, Kamphaeng Phet, Tak, Sukhothai, Phitsanulok, Phichit, and Phetchabun) 17 provinces in the Northeast region (NakhonRatchasima, Buri Ram, Surin, Sisaket, Ubon Ratchathani, Yasothorn, Chaiyaphum, Amnat Charoen, Bueng Kan, Nong Bua Lam Phu, Khon Kaen, Loey, Nong Khai, MahaSarakam, Roi Et, Kalasin, and Mukdaharn), 9 provinces in the South Region (Nakhon Si Thammarat, Phangnga, SuratThani, Satun, Trang, Phatthalung, Pattani, Yala, and Narathiwat) Source: The 2011 Flood: Lessons from Experience.)

[2]Rojana, Ban Wa (Hi-Tech), Nawa Nakorn, Bang Pa-in, Saha Rattana Nakorn, Banggadee, and Factory Land industrial estates.

employment termination. Based on the data from the Ministry of Labor (MOL), as of March 2012, 142 enterprises already had some employment terminations and 52,256 employees had been laid off.[3] In addition, statistics from the Social Security Office (SSO) reveal that the number of insured workers who claimed un employment benefits increased rapidly and continuously from December, 2011 to March, 2012 (see Figure 1). In February, 2012, the number of workers seeking compensation benefits rose by 38.6 percent compared to the previous year. Similarly, data from the Employment Department show that in December, 2011, the number of workers who registered as unemployed due to employment termination increased by 240.27 percent from December, 2010 (see Figure 2). These statistics in the labor market suggest that many workers in the private sector were severely affected by the flood.

The impact of the flood on the employment sector deserves to be examined closely because changes in the employment sector lead to a series of negative consequences beyond their direct effect on workers and their families. These include reduction in household purchasing power, shortage of inputs for downstream industries, and possible movement of labor to the agricultural sector. Moreover, Thailand is currently transitioning from a relatively low-wage to a higher-wage country. Together with the government's 2012 policy on a new minimum wage, the flood's impact on the labor sector could negatively affect Thailand's ability to compete in Southeast Asia. Finally, the government allocated a significant budget to assist people affected by the flood. Examples of government measures include a project to alleviate employment termination,[4] a one-year exemption of contributing to Social Security funds by employers and employees, and the approval of 100 million baht for ad-hoc assistance. The question is how efficient these measures were in helping the laborers affected by the flood.
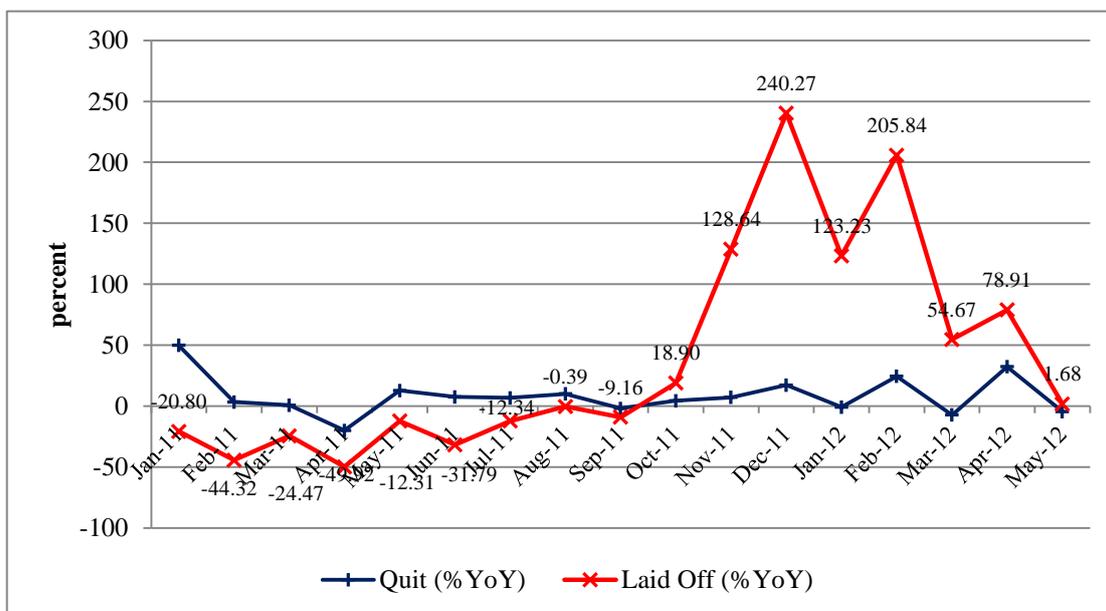
[3]Information as of April 11, 2012.
[4]The government contributes a monthly payment of 2,000 baht to employees for 3 months.

**Figure 1**

**Number of Unemployment Beneficiaries during 2011-2012**
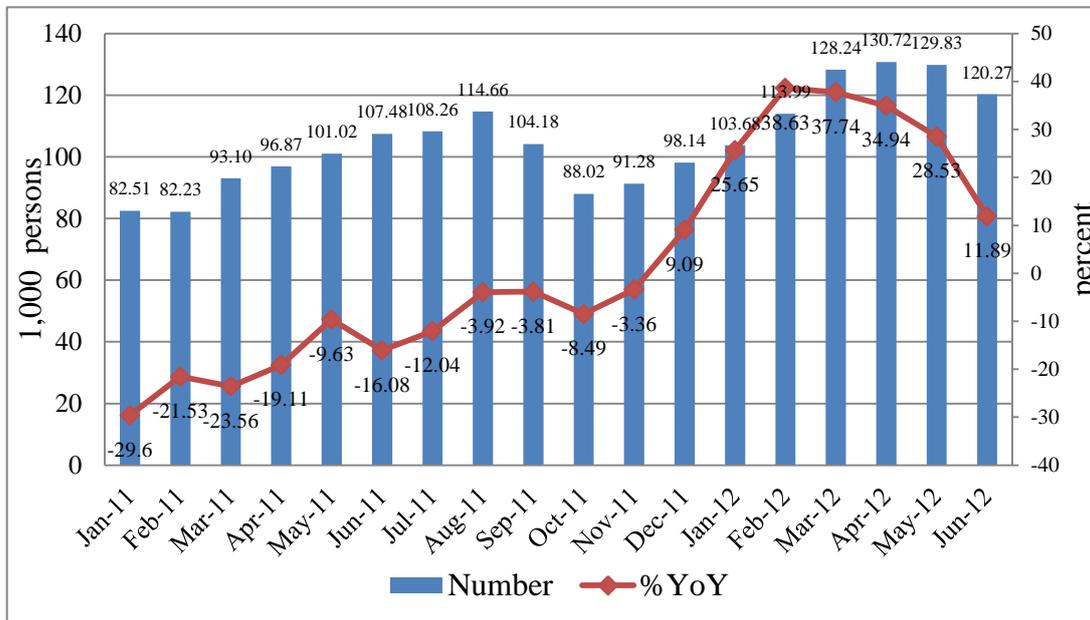


Source: Social Security Office (SSO).

**Figure 2**

**Rates of Changes in Number of Workers Registered for Unemployment Benefits**



Source: Department of Employment, Ministry of Labor

This study aims to examine the short-term impact of the 2011 flood on the labor market. Specifically, it seeks to analyze the impact of the flood on employment and earnings of temporary and permanent workers who work or reside in the affected areas, and to evaluate governmental measures to assist impacted labor. By analyzing the flood's impact on the employment sector, one can determine whether the 2011 flood resulted in a temporary or eventually structural change in the economy. Identifying the laborers most affected and vulnerable would help policy makers target the right groups, when natural disasters or shocks occur in the future. In a larger context, findings from this study can exemplify how a developing country and its government respond to natural disasters, compared to developed countries. Hence, this study can contribute to the literature on the impact of natural disasters on the labor market, as well as the literature on the labor market in developing countries.

This paper's analysis is restricted to workers who live in the affected areas, including 20 provinces in the Northern and Central regions, during the third and fourth quarters of 2011.[5] In addition, only private sector workers are included in this analysis. The time frame is from just before the flood (the third quarter of 2011) until after the flood (the first quarter of 2012). This study does not cover the second quarter of 2012, which was affected by the implementation of the 300-baht minimum wage policy starting on April 1, 2012.

The rest of this paper consists of the following. Section 2 reviews the Thai government's labor-related measures to relieve the flood's impact. Section 3 reviews the literature related to the flood's effect on the labor market. Section 4describes data and presents descriptive statistics. Section 5explains empirical strategies, and econometric results are shown in Section 6. Finally, Section 7discusses and concludes.

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[5]The selected 20 provinces include Bangkok, Samut Prakan, Nonthaburi, PatumThani, Ayutthaya, Ang Thong, Lop Buri, Singh Buri, Chai Nat, Saraburi, Nakhon Sawan, Sukhothai, Phitsanulok, Phichit, Nakhon Nayok, Suphan Buri, Nakhon Pathom, and Samut Sakhon. Based on the 2011 Labor Force Survey, employed workers in these 20 provinces account for approximately 29 percent of all employed workers in the country.

## 2. Governmental Labor-Related Measures

To analyze the flood's impact on the employment sector and to evaluate implications on governmental labor policies, it is important to first identify the government's measures implemented to assist affected workers. Responding to the 2011 flood, the Thai government launched several labor-related measures by targeting employers, employees, and foreign workers. The following paragraphs review and group the government's assistance and remedial measures by target groups.

### 2.1. Measures Targeted at Employers:

1. Prevention and mitigation project: the government paid affected employees 2,000 baht per month for three months. Combined with the employer's contributions, employees should receive at least 75 percent of their pre-flood wages.

2. "Friends Help Friends" project: workers from affected enterprises were allowed to work in other nearby enterprises unaffected by the flood.

3. Credits program to promote employment: provided credits to employers up to 10,000 million baht. Employers could borrow to increase business liquidity and enhance labor productivity.

4. The Social Security Office (SSO) support flood victims by giving loans to employers to repair flood damage.

5. Reducing social security contributions: the government allowed a discount in employers' contribution to Social Security funds for one year.

6. Reducing interest rates for loans used to enhance workers' skills.

### 2.2. Measures Targeted at Employees:

1. Assisting employees to receive compensation according to labor laws: employees could request compensation from the Employee Relief Fund if they received no compensation from employers.

2. Ensuring that Social Security Scheme (SSS) beneficiaries received unemployment benefits according to the Social Security Act.

3.  An urgent employment and skill development project: the government hired laid-off workers in affected areas to repair public infrastructure for 20 days.

4.  Skilled development for affected workers project: the government provided skill development programs for a target group of 15,000 affected workers for 10 days.

5.  The SSO supported the flood victims by making loans to employees for repair of flood-damaged homes.

6.  Meetings for affected workers project: the government arranged for 9,000 unemployed workers to meet directly with employers.

7.  Facilitating the transport of affected Japanese-company workers to be trained at the headquarters in Japan.

8.  Providing impromptu assistance to affected people before the relief and restoration process: the government approved a central budget for draining, cleaning, subsidizing expenditure in shelters, etc.

9.  Providing shelter to foreign workers and others affected in flooded areas.

The above governmental measures to alleviate flood impacts on the employment sector were mostly short-term, costly solutions. The extent to which these measures were effective is not obvious. To assess these measures, one must first identify the flood's impact on different groups of laborers.


## 3. Literature Review

Natural disasters can be thought of as types of 'shocks' that can widely affect an entire economy. More generally, shocks can also be in the form of economic crises, changes in governmental policies, or political changes. Although natural disasters differ from other types of shocks in that they occur randomly and are determined by nature, effects of natural disasters on an economic system could be the same as the effects of other shocks.

Previous studies on the impact of natural disasters on the economic sector cover a wide range of topics. A group of studies uses macroeconomic frameworks to analyze the impact of natural disasters on the overall economy. For instance, Skidmore and Toya (2002) study the

long-term relationship between natural disasters and economic growth by using cross-sectional data from many countries. By determining the relationship between the frequency of natural disasters and the rate of return to capital, as well as the total productivity of all production factors, Skidmore and Toya find that natural disasters result in lower investment in physical capital, which is replaced by more investment in human capital. As a result, new technologies are adopted and overall productivity increases.

Apart from macroeconomic studies, another group of analyses employs a microeconomic framework to discern the impact of natural disasters on particular sectors, such as the business sector or household sector, or the local economy. For example, Xiao (2011) uses time-series data to examine the economic impacts of the 1993 flood in the Midwest region in the United States. Based on the quasi-experimental pair-wise matching design method, he finds that the 1993 flood lowered incomes in the short run, but in the long run only slightly affected the overall employment and general income. This result is consistent with the conclusion that local economies are resilient when facing natural disasters. This conclusion is subject to the limitation that the researcher could not identify whether after-flood's impacts resulted from local people's response to the flood or governmental assistance.

In addition to their impact on local economies, impacts of natural disasters on the employment sector have received much attention, partly because labor is an important factor of the production sector. Moreover, impacts of natural disasters on labor could reflect the consequences on consumption. Several studies examine the impact of Hurricane Katrina, which affected large portions of Florida. Belasen and Polacheck (2008) investigate the impact of Hurricane Katrina on the labor market both in counties directly affected by the hurricane and in those nearby. They find that in severely affected areas overall employment decreased, while average income increased. However, the average income of laborers residing in nearby counties decreased. Belasen and Polocheck explain that the rise in average income in the affected areas is a result of shortage in labor supply, since a group of laborers was evacuated from the impacted area. At the same time, demand for labor increased to restore damage from the hurricane.

Instead of focusing on laborers living in affected areas, another group of studies looks at the impact on hurricane evacuees. For example, Groen and Polivka (2008) determine the impact of Hurricane Katrina on labor market outcomes of evacuees. They find that the hurricane resulted in lower employment, but the impact faded over time. Furthermore, Groen and Polivka compare labor market outcomes between returnees and non-returnees, and find that evacuees who did not return to pre-Katrina areas performed much worse in the labor market than those who returned. Similarly, McIntosh (2008) studies employment opportunities and earnings in Houston, Texas, where evacuees moved to. A difference-in-difference estimation shows that evacuees' migration to Houston resulted in lower wage rates and employment opportunities for local workers, but the level of impact found in this study does not differ from the impact of labor migration in other contexts. Thus, Hurricane Katrina did not have much impact on the labor market to which the evacuees moved.

Although most studies find that natural disasters tend to have a negative impact on employment and earnings in the labor market, it is also possible that natural disasters could have a positive impact on the labor market. Ewing et al. (2005) explains that positive impacts of natural disasters, such as a rise in employment and wage rate, occurs because natural disasters could cause a temporary economic boost during the recovery period. This positive impact does not necessarily imply that natural disasters are good for the labor market, because the opportunity cost and increased wages could translate to higher expenditures for tax payers and insurance companies, as well as a loss in household income and savings. In developing countries, positive impacts of natural disasters on the labor market could be almost impossible due to limited resources and infrastructure.

None of the studies reviewed above looked at the impact of natural disasters on labor market outcomes in developing countries. Most studies examine the impact of hurricanes, which occur rapidly and do not last for a long time. Accordingly, findings in this paper would contribute to the literature by offering a case study of natural disasters in developing countries as well as an analysis of the impact of natural disasters, such as floods, that progress gradually and last for a period of time.

## 4. Data and Descriptive Statistics

### 4.1. Data

The analyses in this paper are based on the following secondary data:

1) Labor Force Surveys (LFS) data: The LFS data are collected monthly from representative households in Thailand by the National Statistical Office. The questionnaire pertains to basic demographic and socioeconomic characteristics of individuals and households. More importantly, it asks questions about work status, occupations, industry, and other work-related information, such as the number of work-hours, wage types, and wage rate. These are asked of persons 15 years old and older.

This paper employs LFS data collected in the third and fourth quarters of 2010 and 2011 as well as from the first quarter of 2012. The comparison between characteristics of the workers in the third and fourth quarters of 2010 and that of 2011 can help lessen possible biases in estimation due to seasonal fluctuation of labor. The data from the first quarter of 2012 are also used to describe the immediate impact after the flood situation improved. Note that LFS data collected monthly cover only workers in the formal sector.[6] Hence, the analysis based on a comparison between 2010 and 20111 data will apply only to these formal sector workers.

In addition to data on formal sector workers, data on informal sector workers are a part of the LFS collected only in the third quarter every year. In this context, informal labor refers to workers who are employed but are not covered by the Social Security Scheme (SSS), and do not have access to any social protection. Based on the 2011 LFS, among the 39.3 million employed workers, 24.6 million (or 62.6 percent) work in the informal sector. The majority of informal labor (61.4 percent) works in the agricultural sector, whereas the rest works in the trade and service sector (29.7 percent), manufacturing sector (8.9 percent), and other sectors.[7]

2) Flood map: The information on the severity and duration of flooding in each area is based on the flood map available on the website www.thaiflood.com, created from satellite data

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[6]Formal sector workers are either government or private sector employees who enroll in the social security system.

[7]http://thailocal.nso.go.th/suggest/enews/index.php?option=com_content&view=article&id=18:-2554&catid=1:2011-01-10-07-52-40

collected by the Geo-Informatics and Space Technology Development Agency (GISTDA).[8] The severity level of the flood is determined from the proportion of damaged areas to total area, and severity can be classified by three levels: *Level 1* or 5 percent to 20 percent of the area affected; *Level 2*, or more than 20 percent but no more than 50 percent, of the area flooded; and *Level 3*, or more than 50 percent of the area flooded. The information on flood severity levels over the flooding period is used to compile an index of average level of flood severity for each district within the 20 provinces mentioned earlier.[9] Figure 3 illustrates the average level of flood severity at the district level, and the darker shade indicates that the flood is more severe in that region. Later, this level of flood severity will be used as the main explanatory variable in analyzing flood impact on the labor market outcomes.

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[8] The data can be retrieved back only until January 2011.
[9] The average of the flood severity index is calculated from the flood severity indices in each region from August to December 2011.
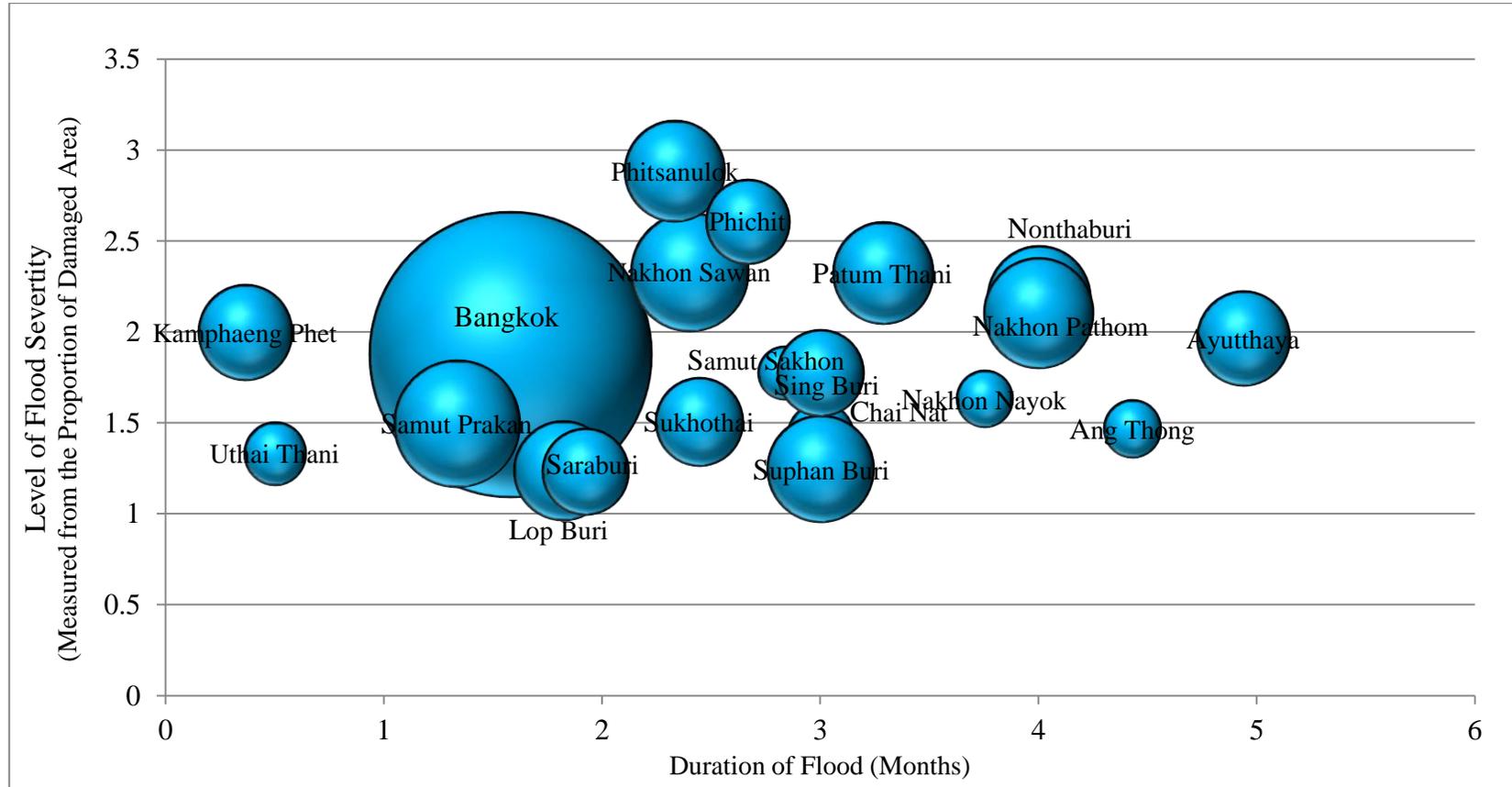
**Figure 3**

**Levels of Flood Severity in the 20 Affected Provinces**
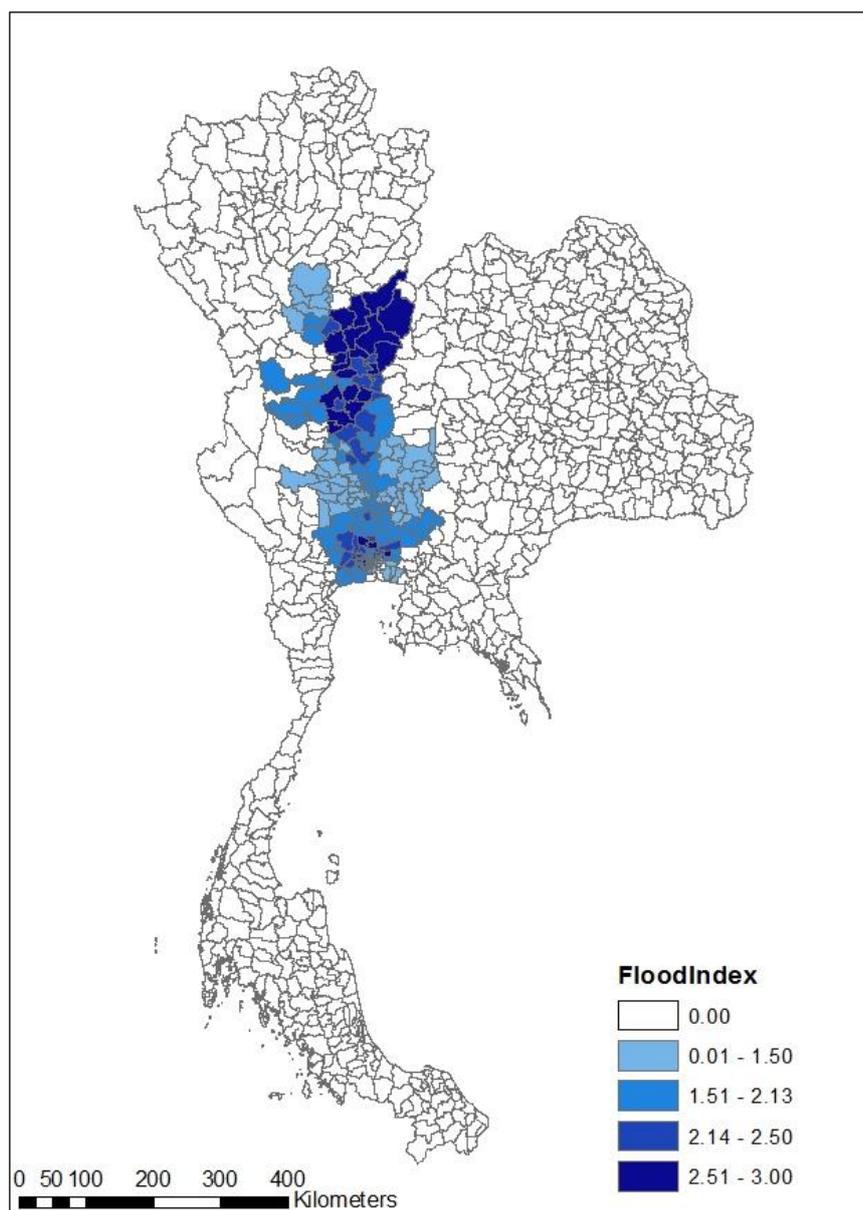


Source: Calculated by the author based on the flood map from www.thaiflood.com

**Figure 4**

**Number of Employed Workers (By Levels of Flood Severity Index and Flood Duration)**



Source: Calculated by the author based on the LFS (quarter 3/1011) and the information from www.thaiflood.com.

**4.2. Descriptive Statistics**

This section presents an overview of characteristics of workers who live in the 20 flood-affected provinces. Characteristics of formal and informal sector workers will be explained separately as follows.

*4.2.1. Characteristics of Workers in the Formal Sector*

Based on LFS data from the third quarter of 2011, approximately 11.44 million employees in the 20 affected provinces were impacted by the flood. **Error! Reference source not found.** illustrates the number of employed workers within each province as well as how severely each province was affected by the flood. In terms of number of workers, most of the affected lived in Bangkok, but this group of workers was affected by the flood for a relatively short period of time (less than 2 months). In terms of flood severity, Phitsanulok, Phichit, Nakhon Sawan, and Patum Thani were the most affected areas. However, Ayutthaya was flooded for the longest period of time, followed by Ang Thong, Nonthaburi, and Nakhon Pathom, respectively.

Before assessing the flood's impact on labor, the descriptive statistics of labor market outcomes of affected workers in the 20 provinces are shown in Figures 5-8. Figures 5 and 6 show changes in employment during the flood period (quarter 3/2011– quarter 1/2012), while Figures 7 and 8 present the average wage rates of workers during the same time. Figure 5 illustrates the number of affected workers grouped by occupations in the third and fourth quarters of 2011 and the first quarter of 2012. The first three occupations with the largest numbers of workers are (i) service workers and shop sales workers, (ii) skilled agricultural and fishery workers, and (iii) plan and machine operators and assemblers, respectively. In terms of changes in number of workers over the three quarters, the number of agricultural workers declined in the last quarter in this study (1/2012). This is could be due to the impact from the flood and seasonal fluctuation in the labor market. At the same time, workers in elementary occupations increased in the first quarter of 2012. This rise could have been caused by an increase in demand for labor during the flood recovery. In other occupations, there is no significant change.

Figure 6 demonstrates changes in the number of workers according to economic activity. In the 20 affected provinces, agriculture, manufacturing, and wholesale and retail trade are the main economic sectors. In terms of changes before and after the flood, the number of workers in the agricultural sector continuously declined over the three quarters in this study, while the number of workers in manufacturing sectors decreased only in the last quarter of 2011, and increased substantially in the first quarter of 2012. The change in number of manufacturing workers suggest that the flood's impact could be a temporary shock to this sector, and that there was an excess demand to compensate the loss in the post-flood period.

In terms of the flood's impact on wage rates, average daily wage rates of affected temporary workers and the average monthly wages rates of permanent workers in different economic sectors are shown in Figures 7 and 8, respectively. Based on Figure 7, the average wages of workers in the wholesale and retail trade sector and in real estate activities declines significantly, whereas wages for workers in construction and manufacturing sectors decreased only slightly. Nevertheless, in the first quarter of 2012, the post-flood period, average wage rates for temporary workers in almost all economics sectors returned to or surpassed pre-flood levels. This could be due to increase in demand for labor needed in flood recovery and restoration, or to employer adjustments in preparing for the new minimum wage policy.

For permanent workers, statistics in Figure 8reveal that average wage rates barely changed during the flood time. An exception is the wage rates of workers in the 'others' economic sector, which could be a result of a decrease in purchasing power in general. On the contrary, average wages for permanent workers in most economic sectors increased in the first quarter of 2012, particularly in the construction sector and financial and insurance activities. This change could be explained by the fact that there was an increase in demand for labor to restore flood losses and damage.

These descriptive statistics give a broad overview of changes in labor market outcomes for formal sector workers in flooded areas. Although these changes may be largely due to the flood, they could be caused by other factors, such as labor seasonal fluctuation or even adaptations to prepare for the new minimum wage policy in 2012. In Section 5, an econometric analysis will be employed to separate the impact of the flood from all other factors.

**Figure 5**

**Number of Workers Affected by the Flood (Grouped by Occupation)**
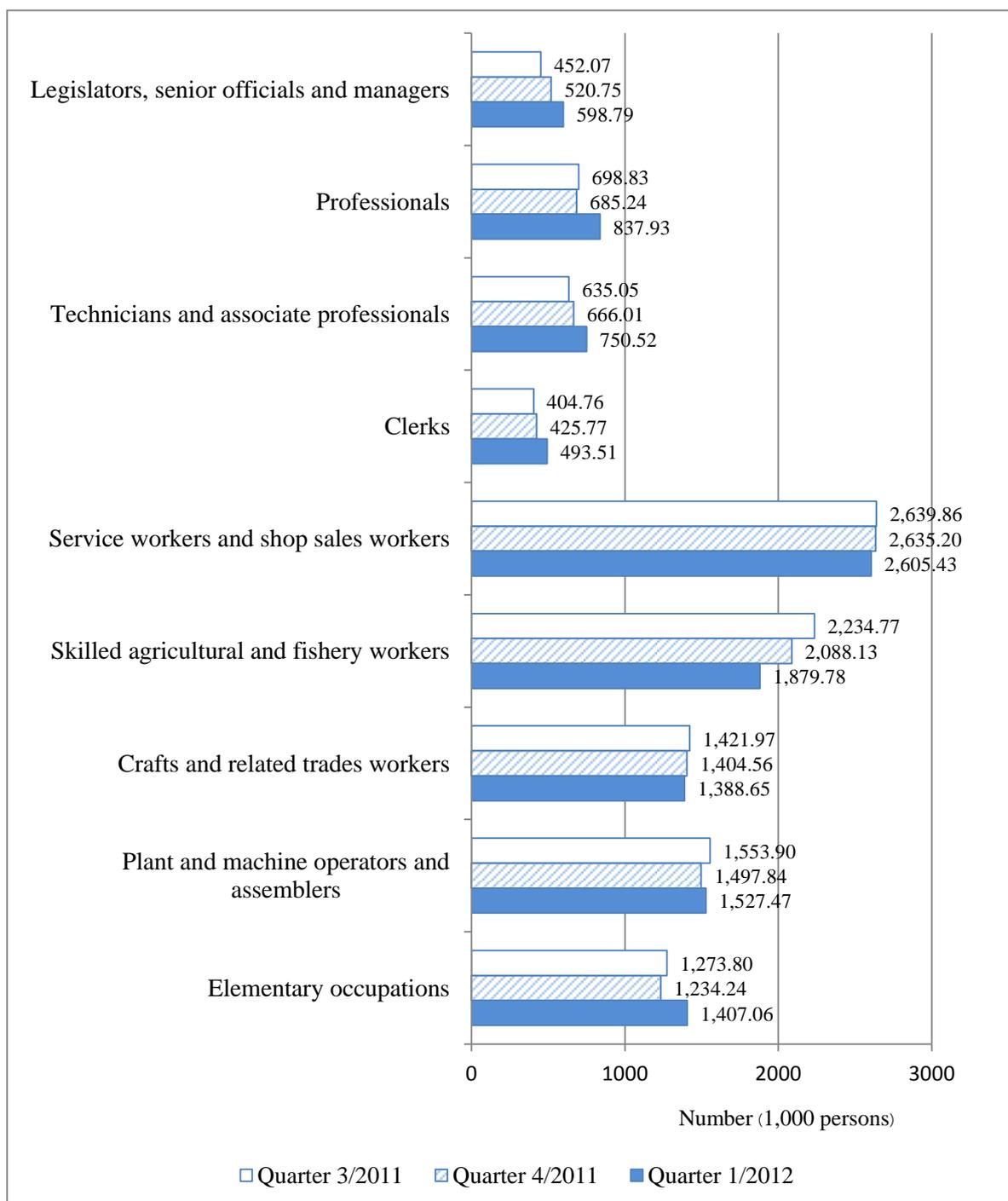


Source: Calculated by the author based on LFS data in 2011 (quarters 3 and 4) and 2012 (quarter 1)

**Figure 6**

**Number of Workers Affected by the Flood (Grouped by Industry)**
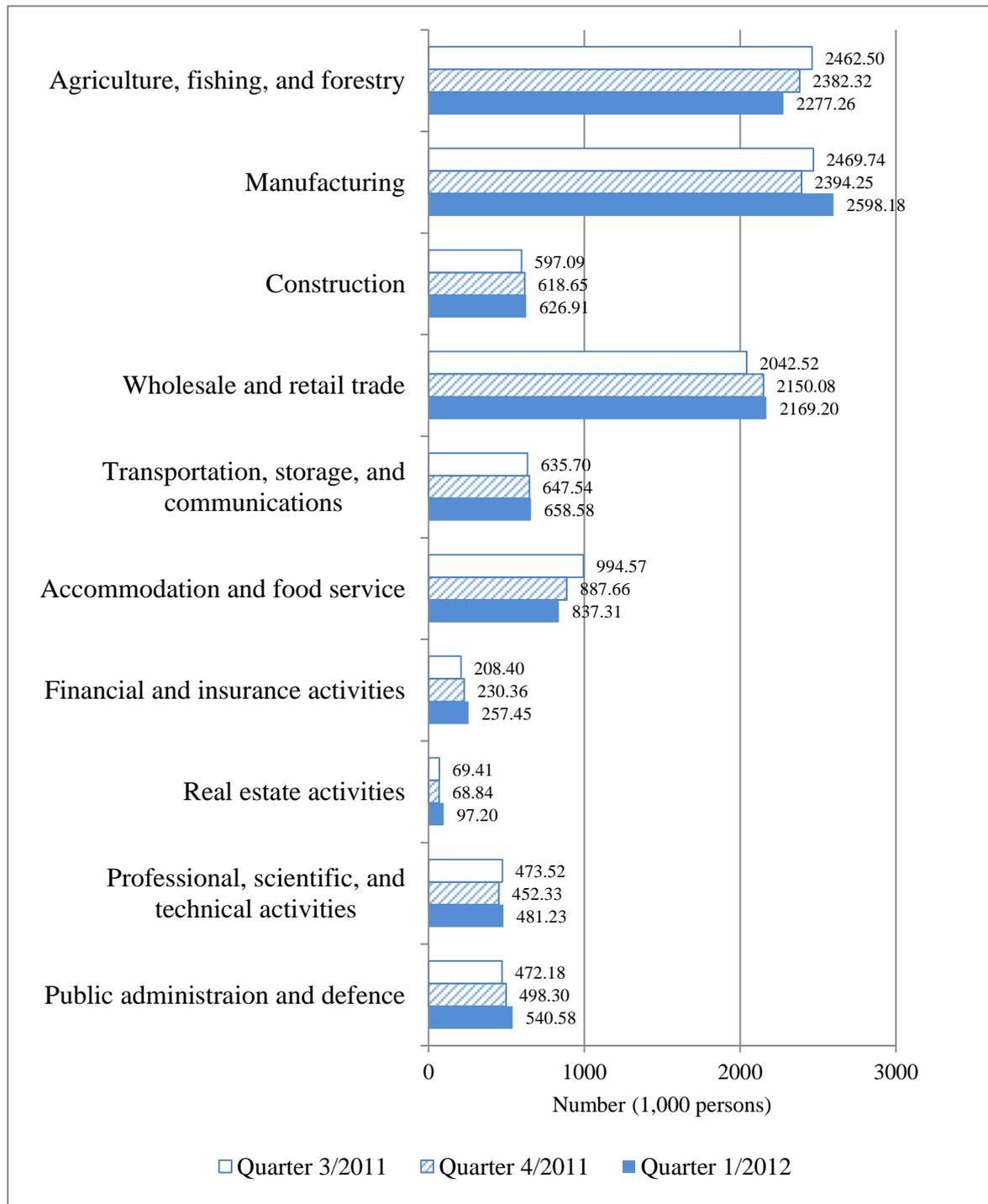


Source: Calculated by the author based on LFS data in 2011 (quarters 3 and 4) and 2012 (quarter 1)

**Figure 7**

**Average Earnings for Temporary workers in the Affected Areas (Grouped by Industry)**



Source: Calculated by the author based on LFS data in 2011 (quarters 3 and 4) and 2012 (quarter 1)

**Figure 8**

**Average Earnings for Permanent workers in the Affected Areas (Grouped by Industry)**
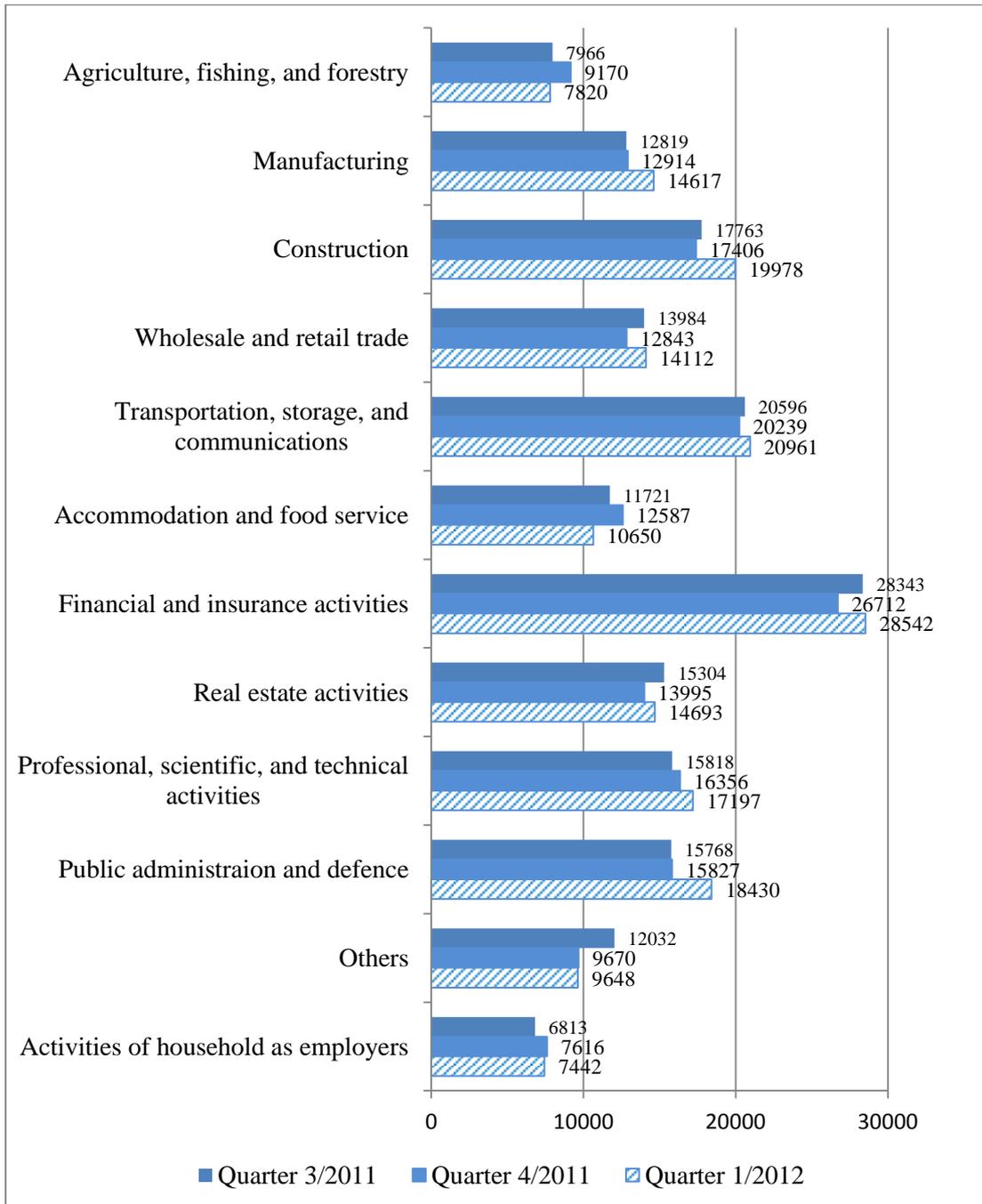


Source: Calculated by the author based on LFS data in 2011 (quarters 3 and 4) and 2012 (quarter 1)

**Figure 9**
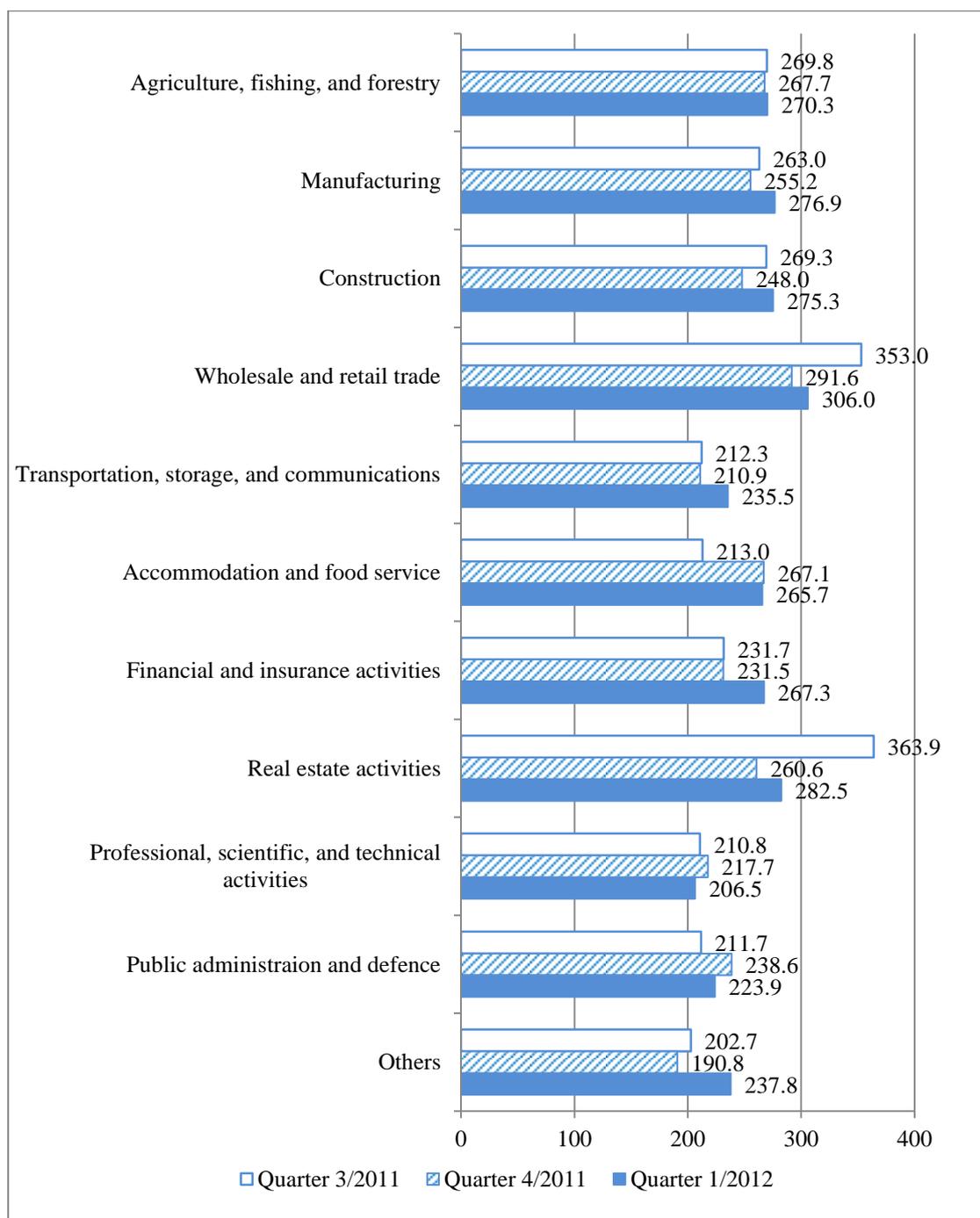
**Number of Informal Sector Workers and the Ratio of Informal Labor to Total Labor**

**(Grouped by Provinces)**
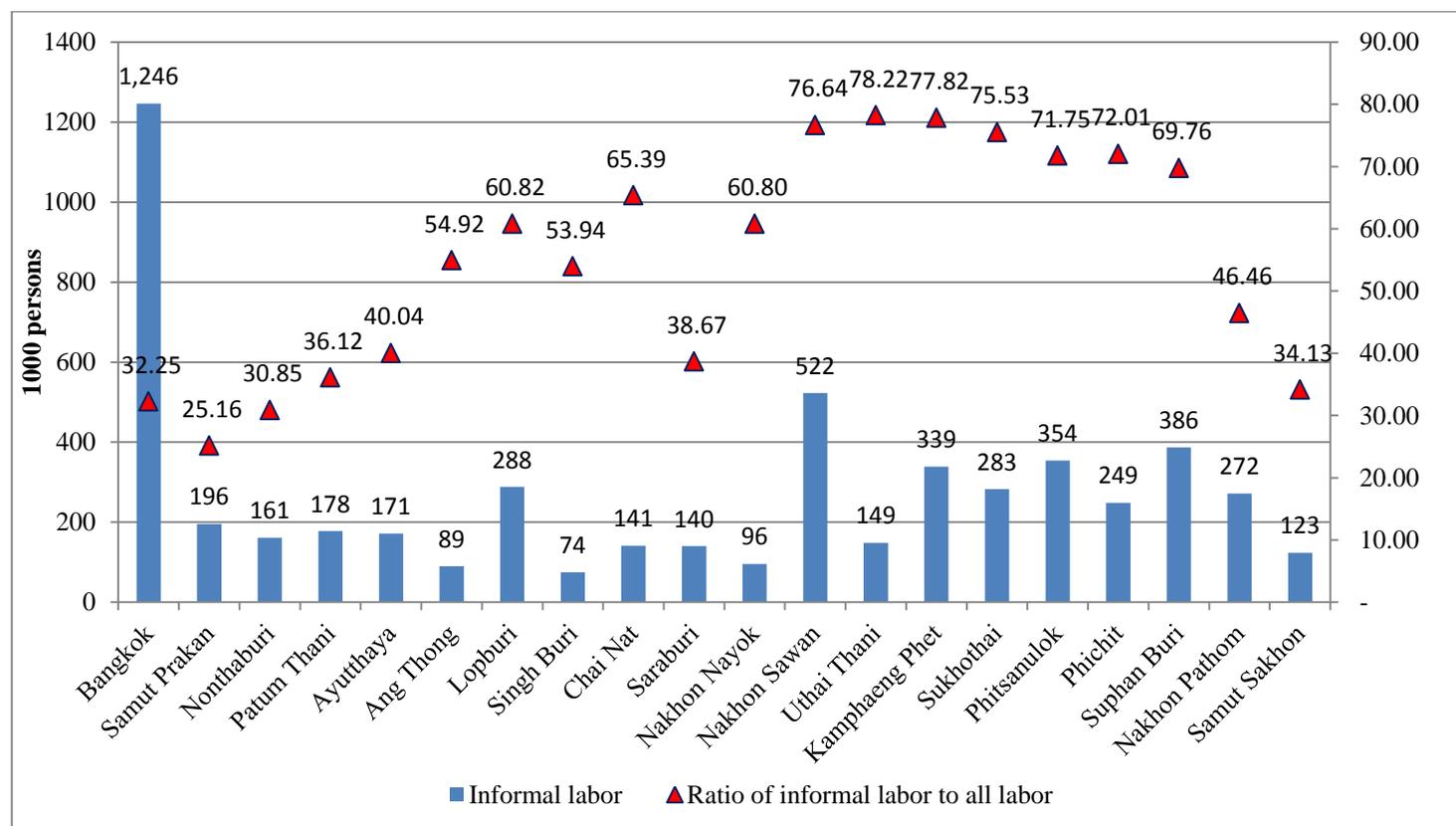


Source: Calculated by the author based on LFS data in 2011 (quarter 3)

**Figure 10**

**Number of Informal Sector Workers in the Affected Areas (Grouped by Occupation)**

| Occupation | Value (1000 persons) |
|---|---|
| Legislators, senior officials and managers | 119.57 |
| Professionals | 38.72 |
| Technicians and associate professionals | 59.49 |
| Clerks | 25.72 |
| Service workers and shop sales workers | 1,845.00 |
| Skilled agricultural and fishery workers | 2,141.00 |
| Crafts and related trades workers | 466.84 |
| Plant and machine operators and assemblers | 325.17 |
| Elementary occupations | 434.36 |

1000 persons
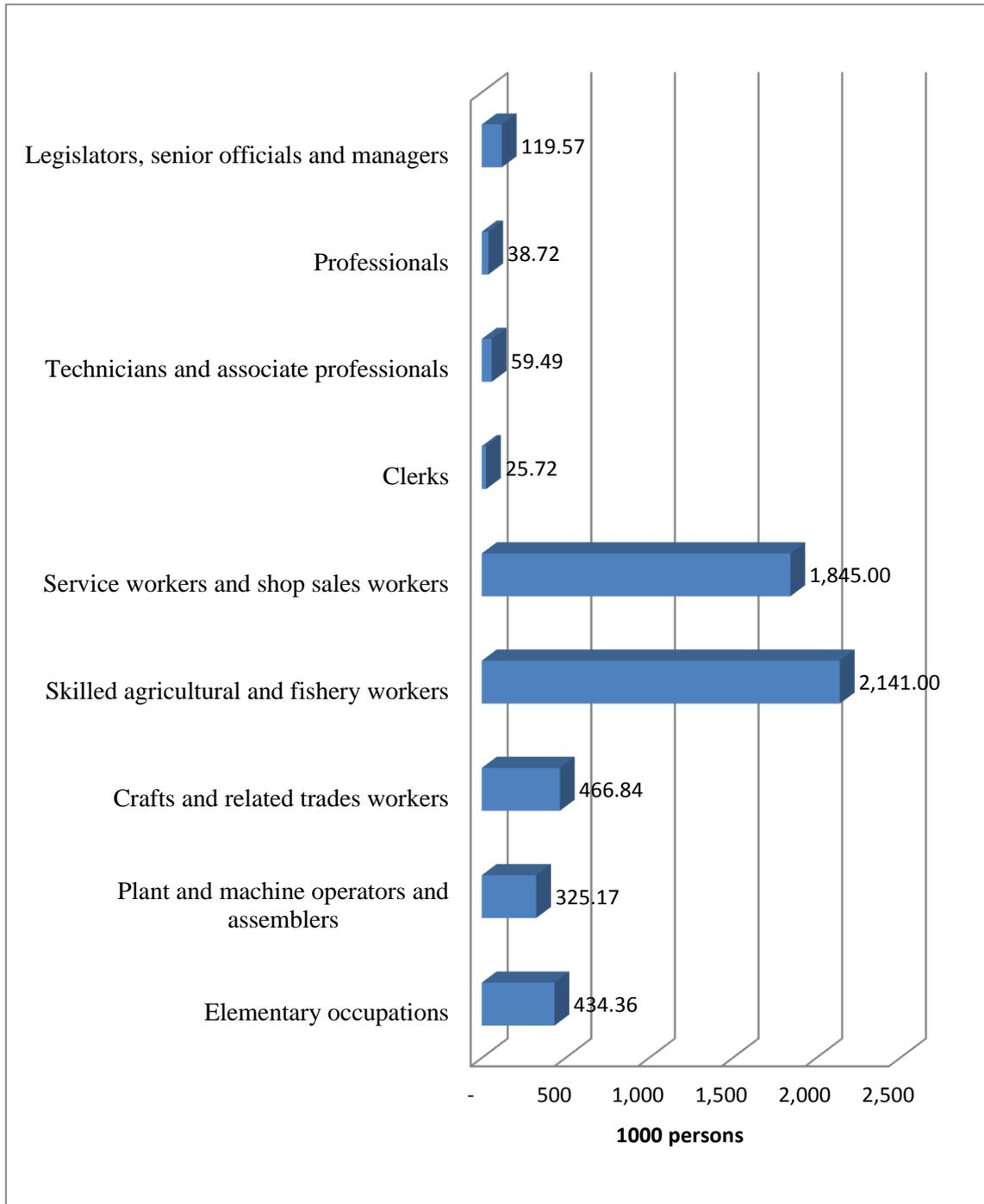
Source: Calculated by the author based on LFS data in 2011 (quarter 3)

**Figure 11**

**Number of Informal Sector Workers in the Affected Areas (Grouped by Industry)**



| Industry | 1,000 persons |
|---|---|
| Agriculture, fishing, and forestry | 2326 |
| Wholesale and retail trade | 1231 |
| Accommodation and food service | 733 |
| Manufacturing | 302 |
| Transportation, storage, and communications | 277 |
| Construction | 228 |
| Other service activities | 136 |
| Professional, scientific, and technical activities | 109 |
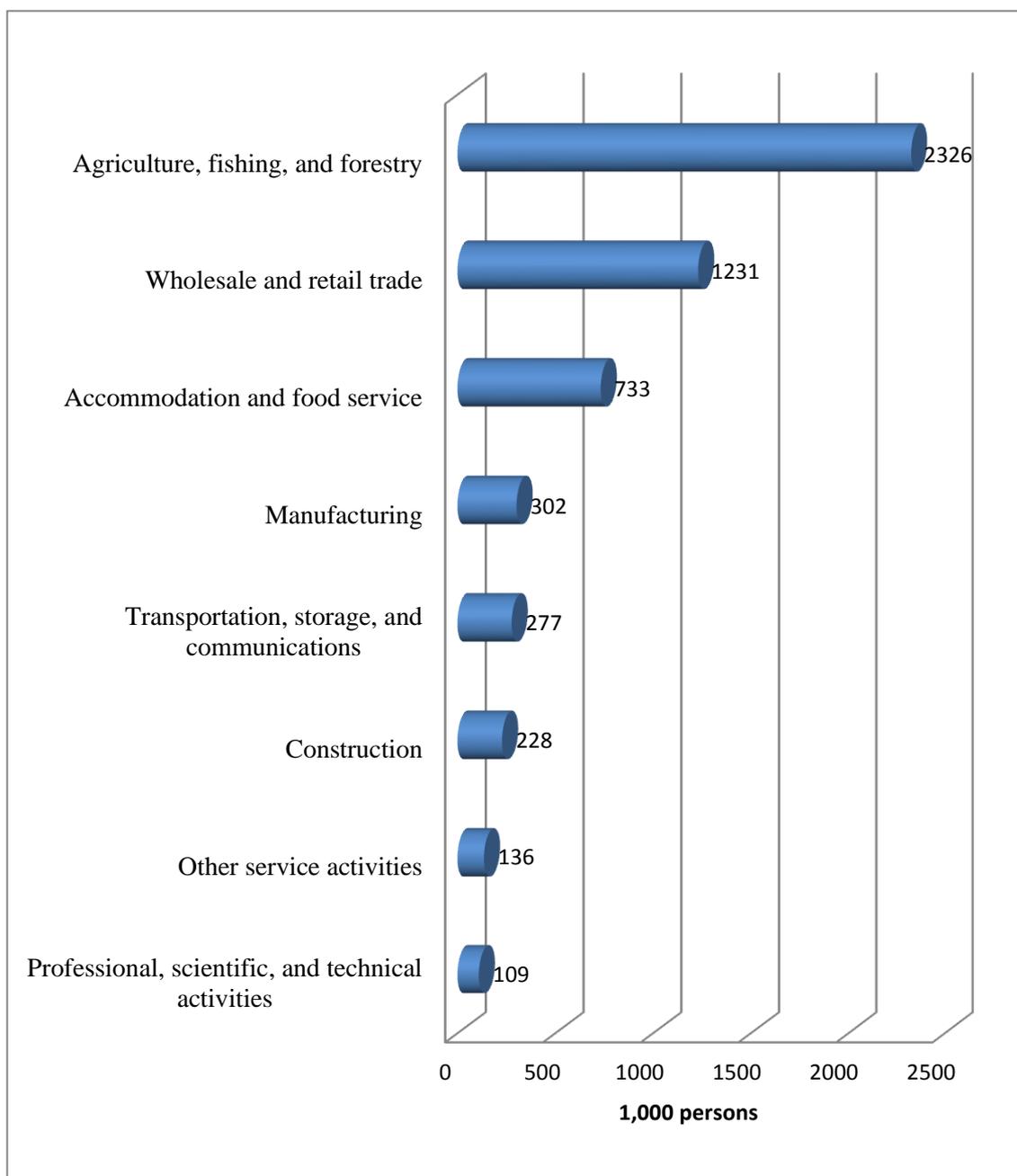
Source: Calculated by the author based on the LFS data in 2011 (quarter 3)

*4.2.2 Characteristics of Workers in the Informal Sector*

Based on LFS data from the third quarter of 2011, approximately 5.46 million informal sector workers (22.2 percent of all workers in the formal sector) lived in the 20 affected provinces. Figure 9illustrates the number of informal sector workers and the proportion of informal sector workers to all employed laborers in each province. It appears that Bangkok has the largest number of workers in the formal sector − approximately 1.25 million persons. However, Uthai Thani has the highest ratio of informal sector workers; approximately 78.2 percent of all employees are in the informal sector. Other provinces with high ratios (more than 75 percent) of informal sector workers include Kanphaeng Phet, Nakhon Sawan, and Sukhothai.

Figure 10 demonstrates the number of informal sector workers according to occupation. Most informal sector workers are skilled agricultural workers and services and sales shop workers. Other common occupations for informal labor are crafts and related trades workers, elementary occupations, and plan and machine operators. In terms of economic activities, Figure 11 reveals that the three main sectors for informal labors are agricultural, trade, and service sectors, respectively.

The basic descriptive statistics discussed above suggest that most informal sector workers affected by the flood are agricultural and sales workers, or employees in other elementary occupations. In addition to lack of social security benefits, the common characteristic of this group is that their income fluctuates according to purchasing power. Thus, if any shock affects purchasing power in general, the income of informal sector workers is likely to decrease accordingly.

# 5. Methodology

## 5.1. Conceptual Framework

The economic framework used in this analysis is based on the supply of and demand for labor. Obviously, a flood can impact both supply of and demand for labor. The end outcome depends on relative changes of both supply and demand for labor in affected areas as well as in nearby areas. On the one hand, supply of labor in affected areas decreases because

people need to migrate to safer areas. On the other hand, demand for labor can also diminish, as factories and/or machines used in production are flood-damaged. Nevertheless, after the flood, demand for labor can bounce back to even more than before the flood to recover business or to compensate for the lost production.

For the 2011 flood in Thailand, the impact on the labor market is ambiguous, depending on relative changes in supply and demand for labor in affected areas. If the damage caused by the flood is tremendous, so that production must be discontinued, demand for labor could decrease until there is an excess supply of labor. As a consequence, the wage rate would decrease, and the number of employment would decline as well. If damage is minor and the production process can be restored quickly, then the demand for labor after the flood may rebound to the same level or even higher than before the flood. This would lead to an excess demand for labor, since the supply of labor remains the same, or could be lower if some laborers move to other sectors, such as the agricultural sector. In this scenario, the wage rate would increase and employment numbers rise. Finally, it could also be the case that the flood has no impact on the labor market outcome, if the supply of and the demand for workers changes in the same direction and at a similar magnitude. These theoretical predictions can be summarized as follows:

(1)  Wage decreases if $L^{D} < L^{S}$;

(2)  Wage increases if $L^{D} > \Delta L^{S}$;

(3)  Indeterminate impact if $\Delta L^{D} = \Delta L^{S}$,

given that $L^{D}$ is the demand for labor and $\Delta L^{S}$ is the supply of labor after the flood period.

To assess the impact of the flood on labor market outcomes, this study uses an econometric analysis in determining the direction of impact as well as estimating the magnitude of impact based on data collected before and after the flood. The empirical specification is explained in the next sub-section.

**5.2. Estimation Strategy**

This section explains the estimation strategy used in investigating direction and magnitude of impact of the flood on labor market outcomes. Again, due to lack of data on informal sector workers  after the flood, the analysis in this part will focus only on changes in

the labor market outcomes for formal sector workers. The following econometric analysis employs micro data at individual and household levels to examine the impact of the 2011 flood on worker employment status and wage rate. In this model, the severity and duration of the flood are considered as exogenous factors that affect labor market outcomes, while other individual and household characteristics are controlled for.

Given the difference in nature of the two dependent variables a logit model is used to estimate the impact on employment, while a pooled ordinary least square (Pooled OLS) is used to estimate the impact on earnings. In both models, labor market outcomes based on data from the third and fourth quarters of 2011 are compared with outcomes from the third and fourth quarters of 2010. This analysis includes only workers in the private sector who face greater risk of employment termination. Workers are separated into two groups according to type of employment; employees receiving monthly or weekly wages are considered as permanent workers, while employees being paid daily or hourly are considered as temporary employees.

The following econometric models are based on the difference-in-difference estimation method, which compares labor market outcomes before and after the flood, and compares outcomes between workers affected by the flood (treatment group) and those unaffected (control group). In this context, flood severity in each district and at a particular time is the exogenous factor (or treatment effect) that affects labor market outcome. Net impact after comparing the treatment and control groups and pre-flood and post-flood times can indicate the impact of the flood on changes in employment and labor earnings. In this analysis, there are two models:

**Model 1** is an evaluation of overall impact of the flood. The flood index used in this model is the average level of flood severity in each area, and computed from the flood index for August to December 2011, as illustrated in Table 1. The regression analysis is based on the following specification:

$$Y_{it} = \beta_0 + \beta_1 Flood_{it} + \beta_2 X_{it} + \beta_3 T + \varepsilon_{it}$$

where *i* indicates the worker *i* (unit of analysis), and *t* indicates the time (month) when the workers answer the survey, given that

$t\epsilon \{Jul'10, Aug'10, Oct'10, Nov'10, Dec'10, Jul'11, Aug'11, Sep'11, Oct'11, Nov'11, Dec'11\}^{10}$

The dependent variable ($Y_{it}$) is the employment status (employed or unemployed)[11] and labor earnings as measured by daily or hourly wages for temporary workers and monthly wages for regular workers. $Flood_{it}$ is the flood index, its values in the range between 0 and 3, where $Flood_{it}= 0$ indicates no flood and $Flood_{it}=3$ indicates the highest level of flood severity. Accordingly, the coefficient $\beta_1$ reflects the magnitude of flood's impact on labor market outcomes. If $\beta_1$ is negative, it suggests that the flood results in lower employment and lower earnings.

In addition, control variables ($X_{it}$) consist of demographic and socioeconomic characteristics of workers, including age, gender, education, marital status, occupation, and industry in which the worker works, as well as the dummy variables of provinces and whether the household is located within the municipal area. The set of time dummy variables (T) indicates the month and year that the respondent answers the questionnaire. This set includes the dummy variables of months (August, September, October, November, and December) the dummy variable of the year 2011. Finally, $\varepsilon_{it}$ is the error term.

**Model 2** is an assessment of flood impact according to the time for which each area is affected by the flood. In this model, the flood index indicates the severity of flood in each district <u>and</u> within each month. The empirical specification can be written as follows:

$$Y_{it} = \beta_0 + \beta_{11}(Flood_{it} * Aug) + \beta_{12}(Flood_{it} * Sept) + \beta_{13}(Flood_{it} * Oct) + \beta_{14}(Flood_{it} * Nov) + \beta_{15}(Flood_{it} * Dec) + \beta_2 X_{it} + \beta_3 T + \varepsilon_{it}$$

where $Flood_{it}*$ *month* is the interaction term between the flood index and the dummy variables of the month that the flood affected the area, given that all months in the year 2010 and July 2011 are the base group. Accordingly, the coefficient $\beta_{11}$, $\beta_{12}$, $\beta_{13}$, $\beta_{14}$, and $\beta_{15}$ illustrate the impact of the flood in August, September, October, November, and December 2011, respectively. All other variables in this model are the same as in the first model.

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[10]The LFS in 2010 did not collect data in September.

[11]The questionnaire used in the LFS asks only the current employment status of the workers at the time of interview. It does not ask about the employment status prior to the interview. Thus, this information cannot be used to identify whether the current unemployed were previously employed or not.

## 6. Econometric Results

### 6.1. The Flood's Impact on Employment

Table 1, including two models, illustrates estimates of the flood's impact on the probability of being employed based on the logit model. Results from the first model suggest that overall, the 2011 flood caused a significant negative impact on employment of workers in the 20 affected provinces. That is, the flood event resulted in lower employment levels in the affected areas when compared to non-flooded areas. Other factors that have statistically significant impacts on employment include age, gender, occupation, and economic activity. In particular, older people have a higher probability to be employed, while males have a lower probability to be employed, compared to females.

The second model considers the impact of the flood based on the severity level and the time for which the flood affected particular areas. Results show that the flood in October had a negative and statistically significant impact on the probability of being employed, but the flood in other months had a negative but statistically insignificant impact. This finding suggests that the flood in October had the strongest impact on workers' employment status, but this impact faded in subsequent months.

### 6.2. The Flood's Impact on Labor Wages[12]

Table 2 presents an estimation of the flood's impact on average wage rates of temporary workers based on pooled OLS regression analysis. Results from the first model suggest that the 2011 flood had a negative impact on workers' wage rates, and this impact is statistically significant at 95% level of confidence. Similarly, when taking into account the timing of the flood in the second model, the impact of the flood in September and October on wages is found to be negative and statistically significant at 99% and 90% levels of confidence, respectively. This result can imply that, particularly in September and October, the flood caused a decrease in demand for temporary workers, which led to an excess supply and, in turn, lowered wage rates.

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[12] In this context, wage rates are used to approximate the earnings of laborers.

**Table 1**

**Impact of the Flood on Employment (Based on Logit Model)**

| Y=Probability of being employed | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | Coefficient | s.d. | Coefficient | s.d. |
| Flood | -0.177* | 0.094 | | |
| Flood x August | | | -0.044 | 0.202 |
| Flood x September | | | -0.311 | 0.272 |
| Flood x October | | | -0.325** | 0.141 |
| Flood x November | | | -0.003 | 0.166 |
| Flood x December | | | -0.131 | 0.165 |
| Age | 0.032*** | 0.007 | 0.032*** | 0.007 |
| Gender (Male = 1) | -0.435*** | 0.124 | -0.435*** | 0.124 |
| Marital status (single is base) | | | | |
|   Married | 0.508*** | 0.160 | 0.506*** | 0.160 |
|   Widowed | 0.205 | 0.338 | 0.208 | 0.339 |
|   Divorced | 0.110 | 0.344 | 0.111 | 0.344 |
|   Separated | -0.076 | 0.280 | -0.076 | 0.280 |
| Years of schooling | 0.011 | 0.018 | 0.011 | 0.018 |
| Living outside municipal area | -0.035 | 0.159 | -0.034 | 0.160 |
| Surveyed month (November is base) | | | | |
|   July | 0.029 | 0.233 | 0.138 | 0.241 |
|   August | -0.129 | 0.188 | -0.044 | 0.196 |
|   September | 0.154 | 0.310 | 0.444 | 0.420 |
|   October | 0.031 | 0.246 | 0.260 | 0.240 |
|   December | 0.007 | 0.215 | 0.099 | 0.249 |
| Year dummy (2011 = 1) | 0.302** | 0.153 | 0.278* | 0.155 |
| Constant | 3.727*** | 0.806 | 3.590*** | 0.824 |
| Number of observations | 52,855 | | 52,855 | |
| F statistics | 11.81 | | 12.76 | |
| Prob (F>0) | 0.000 | | 0.000 | |

Remarks:
1. *** indicates confidence level at 99%, **at 95%,and * at 90%
2. Control variables included in the estimation but are not shown in this table are dummy variables for occupations, industries, and provinces.
3. Gender, marital status, living outside municipal area, months, and year are dummy variables.

**Table 2**

**Impact of the Flood on Earnings for Temporary Workers (Based on Pooled OLS Model)**

| Y= Wage (daily) | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | **Coefficient** | **s.d.** | | **Coefficient** |
| Flood | -0.014** | 0.006 | | |
| Flood x August | | | 0.004 | 0.013 |
| Flood x September | | | -0.045*** | 0.015 |
| Flood x October | | | -0.023* | 0.012 |
| Flood x November | | | -0.009 | 0.007 |
| Flood x December | | | 0.006 | 0.012 |
| Age | 0.001 | 0.000 | 0.001 | 0.001 |
| Gender (Male = 1) | 0.075*** | 0.008 | 0.076*** | 0.008 |
| Marital status (single is base) | | | | |
|   Married | 0.056*** | 0.010 | 0.056*** | 0.010 |
|   Widowed | -0.012 | 0.020 | -0.009 | 0.021 |
|   Divorced | 0.016 | 0.024 | 0.018 | 0.024 |
|   Separated | 0.061*** | 0.016 | 0.053*** | 0.016 |
| Years of schooling | 0.243*** | 0.092 | 0.233** | 0.094 |
| Living outside municipal area | 0.007*** | 0.001 | 0.006*** | 0.001 |
| Surveyed month (November is base) | -0.001 | 0.009 | 0.003 | 0.009 |
|   July | | | | |
|   August | -0.017 | 0.012 | -0.013 | 0.014 |
|   September | -0.007 | 0.010 | -0.006 | 0.011 |
|   October | -0.002 | 0.017 | 0.035 | 0.022 |
|   December | -0.005 | 0.013 | 0.004 | 0.014 |
| Year dummy (2011 = 1) | -0.024* | 0.013 | -0.023 | 0.016 |
| Constant | 0.073*** | 0.010 | 0.071*** | 0.010 |
| Flood | 8.756*** | 0.225 | 8.755*** | 0.224 |
| Number of observations | 20,991 | | 20,991 | |
| R-squared | 0.3186 | | 0.3288 | |

Remarks:

1. *** indicates confidence level at 99%, **at 95%,and * at 90%

2. Control variables included in the estimation but are not shown in this table are dummy variables for occupations, industries, and provinces.

3. Gender, marital status, living outside municipal area, months, and year are dummy variables.

**Table 3**

**Impact of the Flood on Earnings for Regular Workers**

**(Based on Pooled OLS Model)**

| Y= Wage (monthly) | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | Coefficient | s.d. | | Coefficient |
| Flood | 0.004 | 0.006 | | |
| Flood x August | | | -0.015 | 0.018 |
| Flood x September | | | 0.017 | 0.012 |
| Flood x October | | | 0.007 | 0.010 |
| Flood x November | | | -0.001 | 0.010 |
| Flood x December | | | 0.008 | 0.013 |
| Age | 0.015*** | 0.001 | 0.015*** | 0.001 |
| Gender (Male = 1) | 0.090*** | 0.008 | 0.090*** | 0.008 |
| Marital status (single is base) | | | | |
| Married | 0.045*** | 0.012 | 0.045*** | 0.012 |
| Widowed | -0.049 | 0.041 | -0.050 | 0.041 |
| Divorced | -0.024 | 0.031 | -0.021 | 0.030 |
| Separated | -0.042** | 0.018 | -0.043** | 0.018 |
| Years of schooling | -0.160* | 0.094 | -0.160* | 0.094 |
| Living outside municipal area | 0.056*** | 0.002 | 0.056*** | 0.002 |
| Surveyed month (November is base) | -0.024* | 0.013 | -0.024* | 0.013 |
| July | | | | |
| August | 0.013 | 0.017 | 0.009 | 0.018 |
| September | 0.040** | 0.016 | 0.037** | 0.018 |
| October | 0.016 | 0.018 | 0.005 | 0.022 |
| December | 0.022 | 0.016 | 0.016 | 0.018 |
| Year dummy (2011 = 1) | 0.003 | 0.016 | -0.004 | 0.017 |
| Constant | 0.024*** | 0.009 | 0.025*** | 0.009 |
| Flood | 8.647*** | 0.066 | 8.660*** | 0.067 |
| Number of observations | 28,135 | | 28,135 | |
| R-squared | 0.578 | | 0.5798 | |

Remarks:

1. *** indicates confidence level at 99%, **at 95%,and * at 90%

2. Control variables included in the estimation but are not shown in this table are dummy variables for occupations, industries, and provinces.

3. Gender, marital status, living outside municipal area, months, and year are dummy variables.

Table 3 shows an estimation of flood's impact on average wage rates of <u>permanent workers</u> based on a pooled OLS regression analysis. In contrast to temporary workers, results from both models suggest that the 2011 flood did not have a statistically significant impact on wage rates of permanent workers. In other words, permanent workers' wages did not change as a result of the flood. This could be explained by the fact that most permanent workers still received their wages during the flood period, even if they did not work during that time.

## 7. Conclusion and Discussion

This paper assessed the short-term impact of the 2011 flood on the employment sector in Thailand. The scope of analysis focused on the private sector in the 20 most affected provinces in the Northern and Central regions. This analysis is based on Labor Force Survey data collected from the third quarter of 2010 until the first quarter of 2012. Results based on econometric analyses suggest that the 2011 flood resulted in lower employment and lower wage rates for temporary workers. Considering the timing of the flood, results show that only during October did the flood have a statistically significant impact on the employment level, while during October and September 2011 did the flood significantly impact on temporary workers' wages. However, there is <u>no</u> evidence that this flood had a statistically significant impact on the wage of permanent workers. These findings suggest that the impact of the flood on workers in the private sector was merely temporary. Temporary workers appear to be negatively impacted, whereas permanent workers were hardly affected by the flood. The difference between the two groups can be explained by the fact that temporary workers are likely to be informal sector workers and/or lack of job security. On the contrary, permanent workers are more likely to enroll in the Social Security Scheme, and, in turn, have access to unemployment benefits in the event of unemployment termination.

For informal sector workers, descriptive statistics based on available data reveal that most affected workers are in the agricultural sector. In particular, the flood destroyed cultivated areas as well as equipments, resulting in a substantial loss of income. Information from the

interview also reveals that these workers, unlike formal sector workers, do not have access to credit. Interestingly, review of governmental measures shows that no measure or project addressed specific problems for informal sector workers, either in terms of relieving loss and damage from the flood or providing access to credit.[13] The main reason for lack of assistance for informal sector workers could be that no government unit is directly responsible for this, unlike formal sector workers who are handled by the SSO.

The 2011 flood's impacts on different groups of workers found in this study not only reflect their resilience to natural disasters, but they also demonstrate results from governmental relief measures for the employment sector. In particular, the finding that permanent workers were hardly affected by the flood could be because this group of workers is less vulnerable to natural disasters. Governmental measures, such as the unemployment prevention and the mitigation project, could help prevent employment terminations and to maintain almost the same income levels. By contrast, the finding that the flood has a significant and negative impact on wage rates of temporary workers can be explained by the fact that they do not have access to social protection, and are more vulnerable to natural disasters. Governmental measures do not benefit temporary workers as much as permanent workers, possibly because temporary workers are not enrolled the Social Security system.

Results shown in this paper are subject to a number of data limitations. First, due to the lack of panel data on labor, analyses are based on repeated cross-section data, and results could be biased due to some unobserved characteristics of households. Second, the information on the worker's employment status from LFS tells only the current status of the worker at the time of the survey but not employment status before it took place. Hence, it is possible that workers

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[13]The government approved additional budget for the Ministry of Interior Affairs to implement the OTOP occupations restoration project and the 'Work for food' project on December 9, 2011, to help restore and repair damage in the community by using workers from the agricultural sector. These two projects could benefit the informal sector workers, but they were still not the target groups of this project. (Information source: http://www.bangkokbiznews.com/home/detail/business/business/20111209/423768/กฟย.อนุมัติงบฟื้นฟูน้ำท่วมเพิ่ม1.9-หมื่นล.ช่วยเกษตรกร-แรงงาน.html)

unemployed during the flood could have already been unemployed, and were not laid off after the flood. Finally, due to lack of available data on the informal sector workers after the flood (at least at the time of this research), the author could not determine a net impact of the flood on labor in this sector.[14] Despite these limitations, this study provides at least two important lessons. The first lesson shows how governmental and private sectors managed natural disasters, particularly their impact on the employment sector. In the private sector, especially workers themselves, the ability to cope with the flood varied according to personal vulnerability. At the same time, governmental measures to alleviate the flood's impact were constrained by the difficulty in identifying the right target groups and in reaching informal sector workers. The second lesson shows that a large number of workers in Thailand still have problems in accessing job security and social protection. The impact of the 2011 flood proved that workers with no social protection are more vulnerable to any negative shocks in the economy and would be affected more by such shocks.

Based on the above lessons, this article proposes two policy implications. First, the government should construct more sustainable plans, rather than using ad-hoc policies to lessen immediate impacts. For instance, lowering the contribution to the Social Security Fund or giving loans to employers are short-term measures and might create negative consequences in the long run. Instead, regulations on natural disaster insurance funds could be a good alternative to reduce unexpected risk from natural disasters in the future. Secondly, the government must provide social security to informal sector workers in a systematic manner. Although informal sector workers were not the only group affected by the flood, the fact they are the most vulnerable group suggests that the Thai social security system needs to be reformed. Doing so would provide a means to lessen and protect against negative impacts of future natural disasters and/or labor crises in the future.

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[14]This analysis could be revisited by using the LFS data in quarter 3/2012, which have information on informal sector workers. However, in addition to the unobserved heterogeneity problem, this dataset is collected after the new minimum wage policy is imposed. As a result, estimates of the impact on informal sector workers based on this dataset could be confounded by the new labor policy.

# References

Bank of Thailand. (2011). 2011 *Thai Flood: Impacts and Restoration Trend Survey from Business Enterprises*. Retrieved from www.bot.or.th/Thai/EconomicConditions/Thai/BLP/Pages/index.aspx.(in Thai).

Belasen, A. R., & Polachek, S. W. (2008). How Hurricanes affect employment and wages in local labor markets. *American Economic Review: Papers and Proceedings*, 98(2), 49-53.

Belasen, A. R., & Polachek, S. W. (2009).How disasters affect local labor markets: The effects of Hurricanes in Florida. *Journal of Human Resources*, 44(1), 251-276.

Burrus Jr., R. T., Dumas, C. F., Farrell, C. H., & Hall Jr., W. W. (2002).Impact of low-intensity Hurricanes on regional economic activity. *Natural Hazard Review*, 118-124.

Chantapong, S. & Sirikanerat, A. (2011). TheFlood's impact on the Labor Sector: Vulnerability and Adjustment. Bank of Thailand, Focused and Quick (FAQ), Issue 62. Retrieved from http://www.bot.or.th/Thai/Economic / Conditions/Publication /FAQ_documents/FAQ_62.pdf. (in Thai).

Ewing, B. T., Kruse, J. B., & Sutter, D. (2007). Hurricanes and economic research: An introduction to the Hurricane Katrina symposium. *Southern Economic Journal*, 74(2), 315-325.

Ewing, B. T., Kruse, J. B., & Thompson, M. A. (2005). Empirical examination of the Corpus Christi unemployment rate and Hurricane Bret. *Natural Hazard Review*, 6(4), 191-196.

Ewing, B. T., Kruse, J. B., & Thompson, M. A. (2009).Twister! Employment responses to the 3 May 1993 Oklahoma City tornado. *Applied Economics*, 41, 691-702.

66

Garber, M., Unger, L.,White, J., & Wohlford, L. (2006). Hurricane Katrina's effects on industry employment and wages. *Monthly Labor Review*, 129(8), 22-39.

Groen, J. A., & Polivka, A. E. (2008).The effect of Hurricane Katrina on the labor market outcomes of evacuees. *American Economic Review: Papers and Proceedings*, 98(2), 43-48.

Guimaraes, P., Hefner, F., & Woodward, D. (1993). Wealth and income effects of natural disasters: An econometric analysis of Hurricane Hugo. *The Review of Regional Studies*, 23, 97-114.

McIntosh, M. F. (2008). Measuring the labor market impacts of Hurricane Katrina migration: Evidence from Houston, Texas. *American Economic Review: Papers and Proceedings*, 98(2), 54-57.

Ministry of Labor. (2012). *Important Labor Indicators, January - April 2012*. Retrieved from Retrieved from http://mol.go.th/academician/content/ข้อมูลสำคัญด้านแรงงาน.(in Thai).

Ministry of Labor. (2012). *Labor Market Warning Indicators, January 2012*. Office of the Permanent Secretary.Retrieved from Retrieved from http://warning.mol.go.th. (in Thai).

Skidmore, M., & Toya, H. (2002). Do natural disasters promote long-run growth? *Economic Inquiry*, 40(4), 664-687.

Suriyawongpaisarn, P. & NSO. (2012). *The 2011 Flood: Lessons from Experience*. Health Services Research Institute (HSRI). Retrieved from http://www.hsri.or.th/sites/default/files/hs1976.pdf.(in Thai).

United Nations International Strategy for Disaster Reduction (2012).*Reducing Vulnerability and Exposure to Disasters: The Asia-Pacific Disaster Report 2012*. Bangkok: United Nations. Retrieved from http://www.unisdr.org/files/29288_apdr2012finallowres.pdf.

Vigdor, J. (2008). The economic after math of Hurricane Katrina. *Journal of Economic Perspectives*, 22(4), 135-154.

World Bank. (2011). *Thai Flood 2011: Rapid Assessment for Resilient Recovery and Reconstruction Planning*. Bangkok: The World Bank. Retrieved from https://www.gfdrr.org/gfdrr/thaifloods2012.

Xiao, Y. (2011). Local economic impacts of natural disasters. *Journal of Regional Science*, 51(4), 804-820.