

**School of Economics and Finance
Curtin Business School**

Poverty, Vulnerability and Food Insecurity in Thailand

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made. This thesis contains no material, which has been accepted for the award of any other degree or diploma in any university.

.....
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List of Abbreviations and Acronyms

ADB	Asian Development Bank
AEC	ASEAN Economic Community
ASEAN	Association of Southeast Asian Nations
BAAC	Bank of Agricultural Cooperatives
BLUE	Best Linear Unbiased Estimator
BMI	Body Mass Index
BMR	Body Mass Rate
CEO	Chief Executive Officer
CGE	Computable General Equilibrium
cm.	Centimetre
Coef.	Coefficient
CSR	Corporate Social Responsibility
FGT	Foster, Greer and Thorbecke
FAO	Food and Agricultural Organisation
FGLS	Feasible Generalized Least Squares
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GHB	Government Housing Bank
GSB	Government Savings Bank
FGLS	Feasible Generalized Least Squares
gm	Gram
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
Kcal	Kilocalorie
Kg	Kilogram
MDGs	Millennium Development Goals
MOC	Ministry of Commerce
NGO	Non-Government Organisation
NESDB	National Economic and Social Development Board
NSO	National Statistical Office
OAE	Office of Agricultural Economics
Obs.	Observations

OECD	Organisation for Economic Co-operation and Development
OHCHR	Office of the High Commissioner for Human Rights
OLS	Ordinary Least Squares
PAL	Physical Activity Level
PPP	Purchasing Power Parity
SMEs	Small and Medium Enterprises
SES	Socio-Economic Survey
SSC	Social Security Card
TE	Technical efficiency
TMPTA	Thai Maize and Produce Traders Association
UHT	Ultra High Temperature
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNSDSN	United Nations Sustainable Development Solutions Network
UNU	United Nations University
US	United States
VLE	Vulnerability as Lack of Entitlements
VUW	Vulnerability as Uncertain Welfare
VIF	Variance Inflation Factors
WHO	World Health Organisation

Abstract

Poverty alleviation is the top priority of the Royal Thai Government's national development plans, as is the case in many other developing countries. Recently, policy makers have mainly focused on the static dimensions of well-being, such as "current poverty" and "current inequality" in analysing and developing poverty reduction strategies. In order to achieve sustainable development, policy makers should pay more attention to people who are not currently poor, but are at high risk of falling into poverty in the future. Household vulnerability to poverty status is considered as an *ex ante* measure of a household's well-being. While poverty is the *ex post* status of being poor, "vulnerability" can be viewed as the probability today, or current risk, of being poor or falling into poverty at some point in the future. In addition, besides measuring vulnerability in the context of poverty, it is increasingly acknowledged by many welfare economists and policy makers that food insecurity *ex ante* should be addressed in vulnerability analysis.

This thesis aims to identify the key determinants of household vulnerability to poverty and food insecurity, as well as measure household vulnerability levels. A vulnerability profile within the context of poverty and food insecurity in Thailand is constructed and the distributional impact of crisis-related shocks on household poverty is examined. The study on factors significantly affecting the probability of households being vulnerable to poverty and food insecurity shows that agricultural households, especially those supported by farm workers, with education lower or less than elementary level, are likely to be the most vulnerable groups. Recipients of pensions and assistance, and construction and manufacturing labourers are highly vulnerable to poverty and food insecurity. Highly vulnerable groups are concentrated in the rural Northeast, the rural North, and the rural South regions, while the share of highly vulnerable households in urban areas is relatively small.

Empirical results show that, even though the observed poverty rate has been declining, around 20.12 percent of the total population in 2010 was at risk of becoming poor in the near future. Approximately 8.97 percent of the total population is identified as "transient poor", with a possibility of escaping poverty in the future, whereas 13.31 percent of the total population is highly vulnerable to poverty. The proportion of the "transient poor" as compared with the "chronically poor" is higher

in urban than rural areas, indicating that urban households are more likely to move in and out of poverty. Non-poor households are found to face a high risk of becoming frequently poor if they live in urban areas, while those who live in rural areas are more vulnerable to chronic poverty. The study on household vulnerability to food insecurity profile shows that, while 20.12 percent of the total population is vulnerable to poverty, approximately 11.28 percent of the population is found to be vulnerable to food insecurity. The share of households that are highly vulnerable to chronic food insecurity is found to be nearly twice as much as the share of those who are currently chronically food insecure. This indicates that the government “pro-poor” programs implemented in the past have not successfully targeted households that face a high risk of becoming chronically food insecure.

Regarding the impact of crises on poverty, empirical results show that all crisis-related shocks have significant positive marginal effects on household probability of being poor. Urban households are more vulnerable to labour market shock than rural households, while the impact of climate shock and joint shock are greater among the food poor and extremely poor in rural areas. The impact of joint shock is relatively small. Education has a stronger impact on urban poverty than rural poverty, whereas land ownership is a crucial factor in reducing rural poverty.

Overall, the findings imply that education is an important factor in reducing poverty. Vulnerability is found to be highest among households headed by a person having only primary education. Additionally, land ownership is an important factor in reducing rural vulnerability to food insecurity, particularly among households mainly involved in agricultural activities. Furthermore, crises have the most serious effects on the “extremely-poor” group and those who live in rural areas. Therefore, policy makers should focus more on investment in the human capital of education, training and social protection, as well as agricultural and rural development programs, in order to alleviate poverty, vulnerability and food insecurity effectively in the long term.

Key words: poverty; vulnerability; food insecurity; financial crisis; shocks; Thailand

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Siraprapa Bumrunghit

Chapter 1

Introduction

1.1. Background of the Research

In the poverty literature examined, most empirical studies on the dynamics of poverty usually investigate the effects of risk and uncertainty in an individual's welfare assessment. The likelihood or the probability that an individual will reach an unpleasant or harmful position, such as poverty and deprivation, has been defined as the "vulnerability" level of an individual by various researchers (Guimarães 2007). While early studies have focused on assessments of observed poverty, which represents the current state of being poor, recent studies tend to focus more on assessments of vulnerability to poverty.

The main reason that vulnerability has become an important issue in development and economic empirical studies is because researchers have noticed a large number of households moving in and out of poverty under some circumstances and over a period of time in both developed and developing countries (Baulch and Hoddinott 2000). For instance, many empirical studies have found that there is a sharp increase in poverty rates in some years when a large number of the population is hit by financial crises (Datt and Ravallion 1997; Kakwani and Son 2001; Datt and Hoogeveen 2003; Breisinger et al. 2011). While some households have remained in poverty for a long time, others are more likely to fall into poverty only for a short period of time. As a result, researchers have developed various theoretical and empirical models to investigate and explain factors affecting the likelihood that an individual or household will fall below a minimum income or consumption level that satisfies basic needs. Being able to identify the vulnerable groups and key determinants of vulnerability would be beneficial for the government in ascertaining what coping strategies are appropriate for poverty reduction. Vulnerability is a dynamic concept and cannot be measured easily because it is impossible to directly measure the probability of becoming poor tomorrow. Instead, vulnerability is usually measured by analysing income and consumption variability. To measure and determine vulnerability related to poverty, a range of methods have been proposed and reviewed in the literature based on different disciplines (see, for example Alwang, Siegel and Jorgensen 2001; Hoddinott and Quisumbing 2003; Guimarães

2007). Various sources of risks (for example, idiosyncratic and covariate risks) are analysed by applying different techniques in measuring vulnerability, with choice of technique dependent on the main objectives of the study and the availability of data. Overall, according to Guimarães (2007), measurements of vulnerability can be categorised into two main groups: “Vulnerability as Uncertain Welfare” (VUW) and “Vulnerability as Lack of Entitlements” (VLE).

The first group of vulnerability assessments, namely an *ex ante* approach to vulnerability, is constructed based on microeconomic theory. This theory applies to the utility maximization of consumers on goods and services based on an individual’s exogenous preferences. That is, the VUW methodology defines vulnerability as the negative variability in an individual’s future welfare based on only one-dimensional welfare measures, such as income or consumption, and a certain poverty threshold. This monetary assessment of vulnerability examines the projection of an individual’s future welfare by taking into account risks or uncertainty events and the individual’s ability to cope with them. One of the most popular methods proposed by many authors in relation to the first assessment of vulnerability is the “Expected Poverty” approach (See, for example, Pritchett, Suryahadi and Sumarto 2001; Christiaensen and Boisvert 2000, Chaudhuri, Jalan and Suryahadi 2002). This approach adopts the standard Foster- Greer -Thorbecke (FGT) decomposable poverty measures to estimate vulnerability in terms of an expected value of poverty. Another well-known method in the first group of vulnerability assessments is the “Expected Low Utility” approach proposed by Ligon and Schechter (2002, 2003). Based on the assumption that each household’s utility function is weakly concave, this approach measures a total vulnerability for each household by distinguishing the influence of poverty on vulnerability from the influence of risk on vulnerability. While the technique used in the expected poverty approach requires less data and is easier to apply, the expected low utility approach offers a technique that seems to be more consistent with the foundations of microeconomic theory. Another group of vulnerability assessments is constructed based on the descriptive or holistic approach in which vulnerability is measured in terms of the ability of households to resist shocks or withstand risks. This assessment assumes that households are less vulnerable, or more resistant, to shocks if they have more tangible and intangible assets. In other words, this assessment believes that

household entitlements or asset ownership has an influence on households' behaviour in response to shocks. Therefore, instead of relying on the economic factors that affect vulnerability, VLE is concerned with social, political and financial influence on vulnerability. The poverty studies that apply the methods associated with this type of vulnerability assessment are, for example, Wisner et al. (2003), Glewwe and Hall (1998), Moser and McIlwaine (1997) and Sen (1983).

As a contributor to poverty, food insecurity has also become an important global issue in its own right since the World Food Summit declared a commitment in 1996 to achieve food security by reducing the number of undernourished people to one half by 2015 (FAO 1996). Poverty is closely related to food insecurity, but they are not the same. Households that are currently non-poor may not be food secure at the same time. For instance, all members in a household whose total consumption is greater than the minimum basic needs may experience food insecurity if they do not have access to safe, sufficient and nutritious food at all time. While there are numerous studies on measuring vulnerability to poverty, the studies on vulnerability in the context of food insecurity are very limited in scope, particularly in developing countries. Most studies on food insecurity only focus on the observed or current state of food insecurity. It is difficult to find studies that explore the likelihood of becoming food insecure as well as the inability to cope with it. A conceptual framework for the analysis of *ex ante* food insecurity is developed by Løvendal, Knowles and Horii (2004). Following the State of Food Insecurity in the World 2001 (FAO 2002), their study utilises four dimensions of food security: food availability, food access, food utilization and food stability. A sustainable livelihood approach is proposed by the authors for analysing vulnerability to food insecurity based on qualitative data such as personal interviews and focus group discussions. Their conceptual framework has led to a development of methods to measure household vulnerability to food insecurity using different instruments that link to more than one dimension of food security (Løvendal and Knowles 2005). However, more empirical studies are needed to ensure the reliability and consistency of this method.

There is no consensus in the current development and economic literature on how to define and measure vulnerability in the context of poverty and food insecurity. The outcomes of empirical studies on the assessment of vulnerability vary depending on

the analysis tools and survey types used in constructing the empirical models. As a result, the most appropriate method to measure vulnerability in one country may not always be applicable or precise in other countries. In Thailand, analysis of vulnerability in the context of poverty and food insecurity is very rarely conducted. Most studies conducted in the past only focused on the state of poverty and food insecurity at the time. None of these analysed vulnerability in both contexts or evaluated existing policies towards vulnerability reduction. Therefore, a comprehensive analysis of vulnerability is required to assist the government in developing national economic and social development plans that are more effective in targeting the high vulnerable households.

This thesis attempts to contribute to the research on vulnerability in the context of poverty and food insecurity. This forward-looking, comprehensive analysis of vulnerability provides empirical evidence for the measurements and determinants of both *ex ante* poverty and food insecurity. Additionally, the impact of various crisis-related shocks on household poverty, which has not been conducted in previous studies in Thailand, is examined in this study. The Expected Poverty approach is applied in this study to analyse both dimensions of vulnerability. Subsequently, a sensitivity analysis is conducted to ensure precise estimates of vulnerability in both contexts. Finally, the distributional impact of the crisis-related shocks on different types of poverty is estimated in order to provide policy options and suggestions for poverty alleviation.

1.2 Research Objectives

The main objective of this thesis is to examine the *ex-ante* outcomes of poverty and food insecurity, namely vulnerability to poverty and food insecurity, in Thailand. The detailed objectives are as follows:

1. to measure vulnerability in the context of poverty and food insecurity;
2. to identify the vulnerable households and distinguish the “high vulnerable” groups from the “low vulnerable” groups;
3. to examine the key determinants of vulnerability to poverty and food insecurity and create the most recent profile of vulnerability to poverty and food insecurity for Thailand;

4. to estimate the distributional impact of global and regional crisis on poverty by categorising crisis-related shocks and poverty into different groups;
5. to recommend relevant policies that aim to target poverty and food insecurity reduction in Thailand.

As previously mentioned, poverty and food insecurity alleviation are the main goals in many developing countries where a majority of the population are still living below or very close to the poverty line, particularly in remote rural areas. Being able to identify who is most vulnerable to poverty and food insecurity would assist the government implementing appropriate pro-poor policies and targeting the poor effectively. Furthermore, by categorizing crisis-related shocks and poverty into groups, policy makers could know what kind of coping strategies should be a priority for poverty reduction in that particular region or community area.

1.3 Research Methodologies

This thesis employs an econometric method based on the Expected Poverty approach attributed by Chaudhuri (2003) and Chaudhuri, Jalan and Suryahadi (2002), which adopts the FGT decomposable poverty measures to assess household vulnerability to poverty. This approach is considered to be the most appropriate method for vulnerability analysis in the case of Thailand and some developing countries where large panel data is rarely available at household level. Its flexible methodology allows the use of cross-sectional data in assessing vulnerability by assuming that cross-sectional variation reflects inter-temporal variation in the level of consumption. Similarly, the same approach is adopted to assess household vulnerability in the context of food insecurity by constructing a specific food security line for each household. Subsequently, probit models are constructed to examine the key determinants of vulnerability to poverty and food insecurity. Profiles of vulnerability in both contexts are created to provide overall pictures of poverty and food insecurity in all regions in Thailand.

Furthermore, this study adopts the econometric method proposed by Datt and Hoogeveen (2003) to estimate the distributional impact of economic crisis on poverty. Using the probit model, household poverty binary status is regressed against household demographics and other key characteristics of the poor, as well as crisis-

related variables. All crisis-related shocks are categorised into three main groups: labour market shock, climate shock and joint shock. Poverty is also categorised into three groups: general poverty, food poverty and extreme poverty. To examine structural differences, households are classified as either living in rural or urban areas. The probit regression model, using cross-sectional data, is run separately on each. Econometric diagnostic tests and sensitivity analyses are conducted to ensure precise estimates of vulnerability to poverty and food insecurity.

1.4 Significance of the Research

This thesis significantly contributes to the development of, and economic literature about, the assessment of vulnerability in two different dimensions: poverty and food insecurity. Firstly, in the case of Thailand, no previous studies have estimated and analysed vulnerability in both contexts using the same household survey data and similar approach. Poverty and food insecurity are not the same, but they are closely related and share some similar characteristics. Therefore, being able to identify the key determinants of vulnerability that are significant in both contexts would assist the government in implementing policies that could effectively mitigate poverty and food insecurity at the same time.

Secondly, most existing poverty profiles only provide the overall poverty picture in terms of poverty incidence and its annual percentage changes, namely an *ex post* outcome of poverty. In contrast, this study provides both the *ex post* and *ex ante* outcomes of poverty and food insecurity. In other words, the observed or current rates of poverty and food insecurity and average vulnerability levels are estimated in this study to investigate the link between these two dimensions of vulnerability. Furthermore, most previous studies have used only one standard reference or critical threshold to identify the poor or the food insecure households, such as the official national poverty line, regional poverty line, or provincial poverty line. In contrast, this study uses multiple poverty lines and vulnerability thresholds, and a sensitivity test is conducted to ensure precise estimation of household vulnerability.

Finally, this study provides more in-depth analysis of the distributional impact of major crises on poverty by categorising poverty into subgroups to examine whether the impact of each crisis-related shock varies according to poverty types and community areas. It would be greatly beneficial for policy makers to know which

poor groups or community areas tend to suffer more from a particular crisis-related shock. In Thailand, the failure of many pro-poor strategies, namely populist policies, in eradicating poverty and enhancing agricultural productivity in rural areas has caused substantial losses in state funds. Recently, these wasteful policies have led to a protest movement and serious political conflicts in Thailand. In December 2013, hundreds of thousands of Thais took to the streets in Bangkok to protest against an amnesty bill pursued by the Thai government. Many populist policies are being blamed for causing sharp increases in the public-debt level and corruption. Many poor rural farmers joined the protest movement because of the failure of the price-pledging program, one of the most famous pro-poor programs, which has substantially decreased Thailand's share of the world rice market recently. The wasteful subsidies have destroyed Thai rice exports and severely disadvantaged Thai rice farmers, particularly in rural areas. Hopefully, this study can assist the new government in coming up with better economic and development policies that are more appropriate and efficient in targeting the right groups of poor households, so that they may avoid the long-term consequences of budget blowout by inefficient populist policies.

1.5 Organisation of the Thesis

This thesis consists of six chapters. Background of the research, research objectives and research significance are presented in Chapter 1. An overview of vulnerability, poverty, and food insecurity in Thailand is provided in Chapter 2. Poverty incidence in Thailand since 1988 is presented to show its trends and movement before and after the Asian crisis. The general definitions and measurements of poverty and vulnerability are discussed. The ways in which poverty and vulnerability are measured in the case of Thailand and poverty and vulnerability profiles across various sub-groups pre-and post-crisis are reviewed. The policies implemented by the Thai government directed at poverty and vulnerability in the past, and their impacts, are summarised. Finally, the global food crisis in 2008 and Thailand's food security situation are discussed.

Chapter 3 provides an empirical analysis of vulnerability to poverty. Household vulnerability to poverty is estimated based on the Expected Poverty approach proposed by Chaudhuri (2003) and Chaudhuri, Jalan and Suryahadi (2002). The categorisation of poverty distinguishes between high and low vulnerability groups.

Econometric regressions are run to determine the key significant factors affecting household vulnerability to poverty. Structural differences between rural and urban areas are investigated by running regressions separately on each. Subsequently, Thailand's profile of vulnerability to poverty is constructed to illustrate poverty characteristics among a population. The current government's policies towards vulnerability to poverty are discussed with respect to their effectiveness in targeting the poor and vulnerable households.

Chapter 4 presents another dimension of vulnerability. It provides an analysis of household vulnerability in the context of food insecurity. This study adopts the Expected Poverty approach proposed by Chaudhuri (2003) and Chaudhuri, Jaland and Suryahadi (2002) to measure vulnerability to food insecurity. This is done by constructing a food security threshold for each household in a sample, using household Socio-Economic Survey (SES) data in 2010. Explanatory variables used in running the regression models to examine the key determinants of vulnerability to food insecurity are selected in accordance with the four facets of food security defined by the FAO during the World Food Summit (FAO 2002). Thailand's profile of vulnerability to food insecurity in 2010 is constructed to provide an overall picture of food insecurity and vulnerability in Thailand. Similarly, the government's policies towards poverty as discussed in Chapter 3 are re-examined in this chapter to investigate their effectiveness in targeting households at risk of experiencing food insecurity.

Chapter 5 attempts to examine the distributional impact of risk in terms of crisis-related shocks on household poverty. Following Datt and Hoogeveen (2003), various shocks are categorised into groups based on the problems reported by households during the Asian crisis period. The impact of the crisis is expected to vary across different poverty groups. Therefore, different types of poverty are considered in estimating the impact of the crisis on poverty. The specific household poverty line is estimated in accordance with the type of poverty. Apart from household and community characteristics, the groups of crisis-related shocks are included in the regression models to determine the key factors affecting poverty, particularly the distributional impact of the crisis-related shocks. The FGT poverty indices are used to illustrate different poverty indicators between the pre-and post-crisis periods.

Household responses and the government's reactions in terms of public policies during the crisis are presented in the poverty profile. The effectiveness of the government's policies in targeting the current poor is discussed in each category of poverty.

Chapter 6 is the last chapter, concluding all major findings obtained from the three empirical analyses. It provides important policy implications for policy makers and the government in mitigating poverty and food insecurity and lowering the risks of becoming poor and food insecure in the long-term. In addition, study limitations and suggestions for future research are presented in the end of this chapter.

Chapter 2

Poverty, Vulnerability and Food Insecurity in Thailand: An Overview

2.1 Introduction

Many East Asian countries have experienced a decline in the standard one dollar per day poverty due to the rapid growth that occurred prior to the Asian financial crisis, namely the Asian Miracle. However, poverty remains a major problem in many Asian developing countries under the two dollar a day poverty line. Thailand is considered to be one of the newly industrialised countries in Asia with an export-driven economic growth, namely a new rising Asian tiger. Unfortunately, the Asian financial crisis in 1997-1998 raised the poverty incidence and caused significant damage in the financial and export sectors in Thailand and other Asian countries.

After the crisis, the country began to recover and overall living standards of the population improved when economic growth began to rise in 2000. Economic growth continued to rise until the global financial crisis took place in 2008. The global crisis severely cut exports and caused a sharp rise in the unemployment rate again. This indicates that Thailand is highly vulnerable to macroeconomic shocks due to the country's high dependence on its export of goods and services accounted for approximately 75 percent of Thai GDP in 2012 (NESDB 2013).

Apart from financial and economic crises, natural shocks such as flooding, storms and crop pests can substantially increase the incidence of poverty, particularly among households working in the agricultural sector. For instance, natural disaster events such as the tsunami disaster in December 2004, the Thai political crisis in 2008 and the 2009 bird flu, caused a substantial decline in national revenues from the services sector, which mainly depends on tourism and contributed more than 40 percent of the country's GDP in 2012. As a result, GDP contracted by about 3.6 percent in 2005 and 2.2 percent in 2009 (World Bank 2013a). This decline caused many households to fall into poverty, particularly those households containing poorly educated residents in remote rural areas. In 2009, the percentage of population living below the poverty line slightly declined as the country began to recover from the global economic crisis. Even though the poverty rate has continued to decline after the recovery period, there is evidence that many poor rural households that rely on work

in fishing and other non-farm activities have been adversely affected by the higher food prices that followed the crisis (Khamman 2009). Furthermore, a large number of urban households are found to be hovering around the poverty line. This implies that many households are still at risk of falling back into poverty in the future.

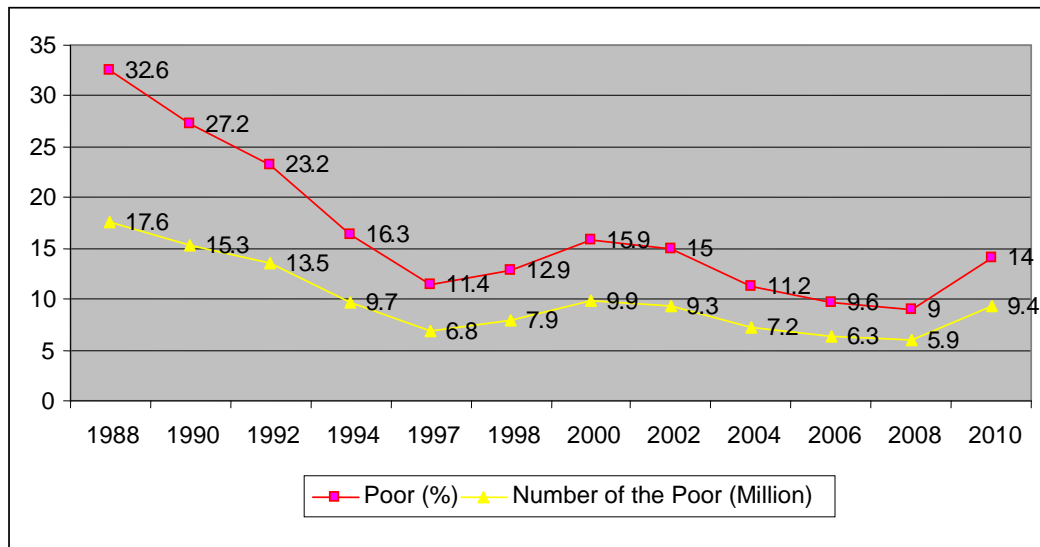
This chapter presents an overview of poverty, vulnerability and food insecurity in Thailand before and after the Asian financial crisis in 1997. In particular, this chapter discusses important factors affecting the incidence of poverty, vulnerability and food insecurity and the performance of public policies in targeting the poor and vulnerable groups in Thailand. The chapter is organized as follows: Section 2.2 presents a brief profile of poverty and vulnerability in Thailand, covering definitions and measurements of poverty and vulnerability; Section 2.3 discusses significant socio-economic characteristics that affect the incidence of poverty and vulnerability; Section 2.4 provides an overview of the country's economic and development policies targeting the poor and vulnerable groups in Thailand since 1997 and their performance; Section 2.5 discusses the effects of the global food crisis during 2007 – 2008; Section 2.6 presents an overall picture of food insecurity in Thailand; the causes of food volatility are provided in Section 2.7; and the effects of rising food prices on poor households are discussed in Section 2.8, followed by the concluding remarks in Section 2.9.

2.2 Poverty and Vulnerability

2.2.1 Poverty Profile in Thailand

Prior to the Asian financial crisis in 1997, the poverty rate in Thailand gradually declined every year due to high economic growth. Average household incomes and migration from the rural Northeast to Bangkok and Metropolitan areas for manufacturing and construction jobs were growing rapidly (Khamman 2009). However, this positive trend deteriorated when the Asian financial crisis took hold in 1998 and worsened in 1999. As shown in Figure 2.1, using the national income poverty line, poverty incidence increased from 12.97 percent in 1998 to 15.9 percent in 2000. Poor households were severely affected by the large fall in wages. Many of them were unemployed, particularly in construction and manufacturing sectors.

Figure 2.1: Thailand's Poverty Incidence over time



Source: National Economic and Social Development Board (NESDB), Thailand.

Even though the economy recovered slightly after the crisis in 1999, economic growth has not been strong enough to bring the economy back to the same level of output as before. This graph clearly shows that poverty incidence rises sharply every time a country faces an economic crisis or other shocks, such as the tsunami in 2004 and the bird flu in 2009. In addition, the global financial crisis and the political crisis, which took place at the same time in 2008, widened income inequality in 2009. According to the World Bank report, the Gini index increased from 41 in 1996 to 44 in 1999 and went up to 53.6 in 2009, which is the highest level it ever reached in Thai history (World Bank 2013b). Furthermore, poverty is found to increasingly concentrate in the Northeast region of the country where the majority of the population consists of very lowly productive and undereducated, small-scale farmers, particularly in rural areas. Traditional public policies towards poverty reduction implemented since the early 1980s have not successfully reached the persistently poor and highly vulnerable population. The government is having trouble targeting and assisting the extremely poor groups. To improve the pro-poor strategies, different perspectives of poverty should be considered in designing better targeting programs and dealing with rigidity and poverty traps. Definitions and measurements of poverty are important in determining who the “poor” and “vulnerable” are.

2.2.2 Definitions and Measurements of Poverty

Defining 'Poverty'

Poverty is a complex issue. It has been differently defined by various researchers and institutions based on the theoretical framework adopted in their studies or projects. For example, poverty can be defined based on an economic point of view in which economic welfare, measured in terms of income or consumption expenditure, and a critical threshold or poverty line are used. Some researchers may define poverty by focusing more on social and health factors, such as social exclusion, food insecurity, deprivation, education and incapability.

According to the World Bank, poverty is defined in the 1990 World Development Report as “being unable to attain a minimal standard of living and having insufficient money to purchase adequate food, clothing and housing” (World Bank 1990). This notion of poverty is widely used in many developing countries. The poverty line and an indicator of well-being, such as income or consumption, are used to determine the minimum standard of nutrition and other basic needs. In addition, the World Bank uses the common universal poverty line, namely a one dollar per day poverty line, for inter-country comparisons. In 2008, this international poverty line was changed to 1.25 dollars a day and in 2005 Purchasing Power Parity and the World Bank distinguished extreme poverty from other types of poverty. The “extremely poor” are defined as people who live on less than one dollar a day as per 1996 US prices, whereas those who live on less than two dollars a day are normally defined as “poor” (Ravallion et al. 2008). The World Bank reported that approximately 1.2 billion of the world’s total population are still extremely poor (UNSDSN 2012).

Apart from the economic factors, the United Nations Committee on economic, social and cultural rights defines poverty as “a human condition characterized by the sustained or chronic deprivation of resources, capabilities, choices, security and power necessary for an adequate standard of living and other civil, cultural, economic, political and social rights” (OHCHR 2001). Poverty is measured as a subjective term under this concept. In other words, according to the International Bill of Rights, poverty is defined as the state of being without or lacking the basic necessities - including economic resources and social capital- for daily living and quality of life.

Measuring 'Poverty'

Reliable poverty estimates have an influence on the effectiveness of poverty reduction. The government and policy makers need accurate estimates of the number of poor in the population in order to conduct poverty profiles over time and monitor poverty across regions or socio-economic groups. The impact of various government programs tends to be different across all poor groups. Therefore, an allocation of resources across the population or regions depends crucially on the precision of poverty estimates in targeting the right poor groups for poverty alleviation programs.

Quantitative measures of poverty are usually preferred to the qualitative ones by many economists. In other words, from an economic point of view, the monetary approach is more preferable. The monetary approach measures poverty in terms of having insufficient income to satisfy an individual's basic needs or not being able to consume sufficient amount of food and other necessities to meet the minimum standards of living. Poverty can be measured in either absolute or relative terms. Absolute poverty is measured in terms of a lack of resources or capacity to afford to buy basic necessities in order to enjoy the minimum standards of living. In contrast, relative poverty is measured in terms of having inadequate income or consumption to meet the basic requirements when compared to the average individual within a country. For example, households living on less than one dollar a day are considered to be in absolute poverty, while those living on less than 50 percent of country's average income are in relative poverty. Furthermore, poverty can be measured in "chronic" or "transient" terms. Chronic poverty refers to a state of poverty in extended duration or poverty that persists over a long period of time. In contrast, transient poverty is a state of poverty in the short term or being temporarily poor due to negative shocks under certain circumstances, such as economic crisis, flooding, drought or harvest failure.

Measures of poverty usually require an estimated poverty line. Using the monetary approach to measure poverty, a household is classified as poor if their income or consumption expenditure is below a poverty threshold. Different countries use different ways to estimate their own official poverty lines. For poverty comparisons across countries, purchasing power parity is used in constructing the poverty line to ensure that poverty outcomes do not vary with the exchange rates.

In many developing countries, the absolute poverty line is usually preferred to the relative poverty line because a large number of populations are still living at the subsistence level: consuming below or close to minimum food needs based on nutritional requirements and other necessities. Alternatively, the poverty line can be subjectively estimated using the self-reported method or by combining the absolute poverty line with the relative one. When qualitative data is combined with quantitative information (income or consumption data), the weight given to the combined poverty line should be taken into account. In addition, the elasticity of ownership of some basic needs that are specific goods should be considered when using the qualitative data (Madden 2000). Currently, there is no consensus on the choice of a poverty line. The poverty line for any particular country is usually determined in accordance with the country's social norms and the value of minimum standards of living. The definition of the minimum requirements is arbitrary. Some countries may estimate the minimum requirements according to the minimum wage, while others may focus more on nutritional requirements.

Measuring Poverty in Thailand

The first official poverty line in Thailand was determined by the World Bank in the early 1980s based on the average nutritional requirements of the Thai population. However, assuming that everyone has the same norm of 1978 calories per day, the poverty line proposed by the World Bank does not capture differences in age and gender. Subsequently, the method assumes no difference in prices of food and non-food items across regions and community areas. This assumption is considered to be irrelevant because the prices of commodities tend to be less expensive in rural than urban areas. As a consequence, the NESDB attempted to solve these weaknesses by revising the poverty line in 1998, taking into account differences in consumption patterns, nutritional requirements and commodity prices (NESDB 1998).

Recently, poverty incidence in Thailand has been measured using the head count ratio and the absolute poverty line revised by the NESDB based on the cost of basic needs (food and non-food items). This poverty line is developed based on the method proposed by Kakwani and Krongkaew (1998) with financial support from the Asian Development Bank (ADB). The new absolute poverty line is calculated by aggregating the daily caloric needs of each household member, which vary according

to age and gender, to obtain the per capita daily household calorie intake. The household calorie requirements are converted into money values, using the food and non-food baskets and spatial price indices across regions in 1992 as the base year. The household poverty line is the sum of the food and non-food household poverty lines. The Engel's food ratio method is applied for estimating food to total expenditure ratio. Therefore, the total household poverty line is measured by estimating the minimum amount of income required to obtain adequate calories of food and other necessary non-food goods, such as clothing, medicine and housing. Since the poverty line is estimated as the costs of basic needs, the poverty incidence is usually calculated in terms of the percentage of households whose per capita incomes are less than the "income" poverty line. The use of income as an indicator of welfare in poverty measures has been criticised by many analysts. Even though the use of income allows for a distinction of its sources, consumption expenditure is believed to be a better indicator of welfare than income for many reasons (Deaton and Zaidi 2002).

Firstly, according to Friedman's theory (1957), consumption indicates the present value of lifetime or permanent income, while income measured at any particular point in time tends to substantially fluctuate over time due to economic shock and other factors. Secondly, consumption expenditure is considered to be a better indicator than income in representing an actual level of an individual or a household's well-being. In other words, income cannot be used to determine whether an individual or a household has enough to meet their current basic needs because it does not represent what is actually consumed. In addition, consumption can reflect a household's access to credit markets and savings, which are used when current income is not enough to meet the basic requirements. Thirdly, in many developing countries, households in rural areas tend to engage in the agricultural sector. They rely more on their home-produced food or exchange food for other basic needs with their neighbours. As a result, their income levels depend highly on seasonal variation or the harvest cycle and may not include the value of some of their own production that cannot be priced. Fourthly, it is more difficult to collect accurate income data than consumption data because households are more likely to underreport their actual income, especially the income from self-employment and income in kind. However, poverty incidence estimated using both welfare indicators can be compared to

investigate the difference in results when both income and consumption data are available in a household survey.

Another important issue in constructing the poverty line, besides the welfare indicator, is the difference in calorie needs among households of different size and composition. Therefore, adjustments of basic needs for different age groups and gender, namely equivalence scales, as well as decreasing marginal costs with an additional household member, should be considered in deriving the household poverty line. In Thailand, the poverty line is calculated in terms of *per capita* household calorie requirements, which ignores the assumptions about equivalence scales and economies of scale. Generally, an additional member of a household does not proportionately increase a household's basic needs. For example, the use of electricity or water in a household with two members is not twice as much as the usage in a single-person household due to economies of scale in consumption. With equivalence scales, each household with different size and composition is assigned a different fraction of its basic needs. In other words, equivalence scales take into account the differences in needs among household members and economies of scale in consumption. Therefore, the choice of equivalence scales depends on the selected reference unit, such as a childless couple or a family of two adults and two children, the technical assumptions regarding economies of scale in household consumption, and priority given to the needs of adults, children and the elderly within a family. Taking equivalence of scales into account, poverty measures should estimate household calorie requirements in *per equivalent* terms instead of *per capita* when deriving the poverty line. Since there is no consensus on the most appropriate choice of equivalence scales, the use of different choices of equivalence scales in poverty measures should be tested by researchers to ensure precise estimates of poverty. Alternatively, analysts may calculate both per equivalent and per capita household calorie needs in constructing a poverty line and investigate the difference in results.

2.2.3 Definitions and Measurements of Vulnerability

Defining 'Vulnerability'

Several attempts have been made to define vulnerability by various researchers according to its causes. Topics on vulnerability analysis mostly cover risks due to environmental hazards, climate change and poverty. Since the early 1980s,

vulnerability has been expressed in terms of the likelihood of being exposed to hazards and the capacity to withstand such risks, depending on the socio-economic circumstances. According to the United Nations Development Programme (UNDP), vulnerability is defined as “A human condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard” (UNDP 2012). Different concepts of vulnerability have been introduced by many authors in existing studies on vulnerability. For instance, Morduch (1994) views vulnerability as a component of poverty, in which poverty is measured in terms of the mean and variance of consumption or the “certainty-equivalent” of consumption. Scaramozzino (2006) and Chaudhuri (2002) define vulnerability in terms of a likelihood that a non-poor household will fall into poverty or the probability that a currently poor household will fall deeper into poverty in the near future. According to Ligon and Schechter (2003), vulnerability is defined as the utility lost due to risks, which is the difference between the expected household consumption and the certainty-equivalent consumption. In addition, using this utility-based approach, the utility function is broken down into two distinct components measuring vulnerability: poverty and risk. Two types of risk are included in their analysis: an aggregate risk and an idiosyncratic risk. The World Bank (1999) conducted an empirical regression analysis to examine factors affecting consumption change in Peru in 1994-97. With this approach, vulnerability is defined as a household consumption volatility or household ability to smooth consumption over time through a financial crisis period or income shocks. In other words, household vulnerability refers to the conditional covariance between household income and consumption changes, subject to an asset constraint.

Measuring Vulnerability in Thailand

Vulnerability is a dynamic concept and not easily measured. It usually requires large panel data to capture and quantify the volatility of household income or consumption levels. Recently, while there have been several attempts to measure poverty, only a few methods of vulnerability measurement have been proposed and widely adopted. In addition, there is no consensus on vulnerability measurement in the literature. Vulnerability is differently defined and measured based on different approaches by analysts and economists.

In the case of Thailand, following the method proposed by Chaudhuri (2000), Bidani and Richter (2001) attempted to conduct the first vulnerability profile of Thailand. Unfortunately, there is no collection of panel data in Thailand for analysing vulnerability to poverty. As a result, the authors used cross sectional data obtained from the *Household Socio-Economic Survey* (SES) in 1997 - 99, collected by the National Statistical Office of Thailand. The SES usually contains a fairly large sample size that can represent the national population. A classification scheme of the poor and vulnerability is proposed in their analysis based on the consumption level. Households are classified as “chronic poor” if their present and expected consumption is less than a household poverty line. This household group is considered to have “high vulnerability” because their likelihood of falling into poverty is greater than 0.5.

Subsequently, currently poor households are classified as “transient poor” if their expected consumption (Y^*) is greater than a household poverty line. Households in this group are further categorised into two subgroups. The first subgroup refers to households with a likelihood of falling into poverty greater than 0.5, namely the “frequently poor”. The second subgroup refers to those with a likelihood of falling into poverty less than 0.5, namely the “infrequently poor”.

Table 2.1: Poverty and Vulnerability Before and After the Asian Crisis

	1996	1998	1999
Poverty:			
Chronic Poor	0.9	6	6.9
Transient Poor	8	9.4	7.9
Total poverty	8.9	15.4	14.8
Vulnerability:			
Low Vulnerability	7.5	7.9	5.9
High Vulnerability	2.6	11	11.6
- Low mean vulnerability	1.5	8.1	8.8
- High volatility vulnerability	1.1	2.9	2.8
Total vulnerability	10.1	18.9	17.5

Source: Bidani and Richter (2001).

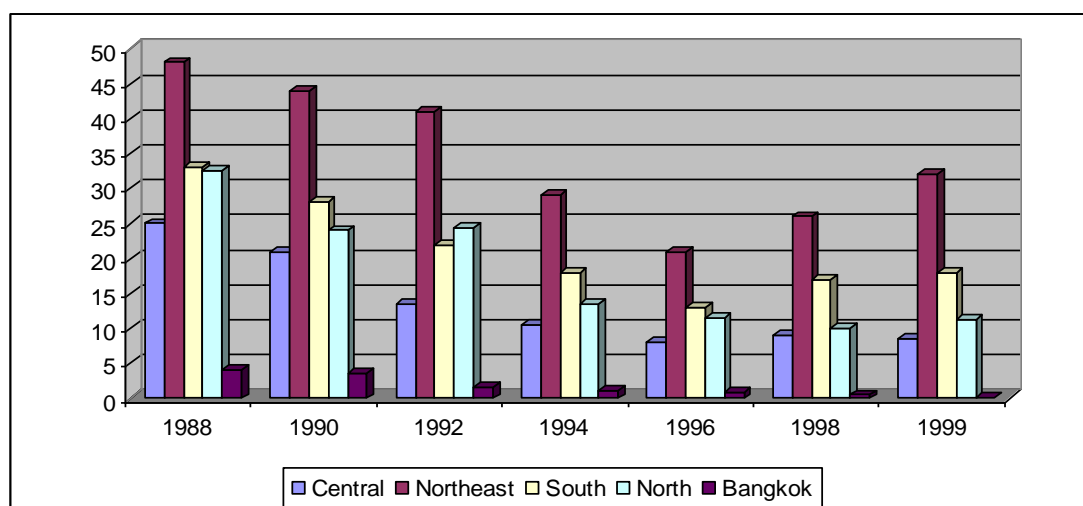
As shown in table 2.1, an increase in total poverty after the Asian Crisis in 1997 is largely due to a rise in the number of “chronic poor” rather than “transient poor”. The percentage of “high vulnerable” households in 1998, the end of the crisis period, is substantially larger than the share of “low vulnerable” households. Subsequently, an increase in the number of households with predicted mean consumption levels (Y^*) below the poverty line, namely the “low mean vulnerability” group, is substantially larger than an increase in the “high volatility vulnerability” group. The “chronic poor” and “low mean vulnerability” groups tend to share similar socio-economic characteristics after the crisis because these two groups both have predicted mean consumptions less than the poverty line.

2.3 Factors affecting Vulnerability and Poverty Incidence

The study by Bidani and Richter (2001) shows that “chronic poor” households and the “low mean vulnerability” group are highly concentrated in the rural Northeast, while the non-poor and less vulnerable reside in Bangkok. This indicates that geographical location has an influence on poverty. The Northeast region has been the country’s poorest region for many years. Poverty incidence in the Northeast had dropped during the period of rapid economic growth before 1996. However, as shown in Figure 2.2, poverty in this region began to rise sharply after the 1997 financial crisis and had jumped to nearly two-thirds of its 1988 level by 1999. The majority of households living in this poorest region are farmers whose educational attainment is less than secondary schooling.

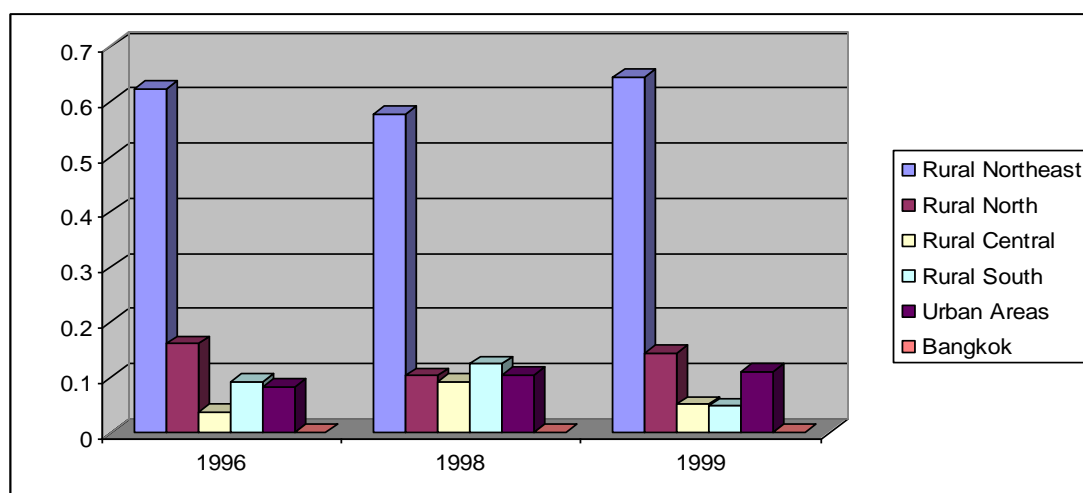
Similarly, vulnerability disparity among regions between 1996 and 1999 shows that the Northeast region is ranked the highest and Bangkok ranked the lowest. Figure 2.3 shows that vulnerability slightly increased in urban areas after the crisis, but remained high and increased more in the rural Northeast in 1999. In addition, vulnerability was found to be higher in the rural North after the crisis, while the South and Central regions experienced a decline in vulnerability. This indicates that rural residents in the North and Northeast were more sensitive to the crisis than residents in other regions. This is possibly because households in these two regions did not have sufficient resources to cushion the economic consequences of adverse shocks.

Figure 2.2: Poverty Disparity among Regions, Before and After the Crisis



Source: National Economic and Social Development Board (NESDB), Thailand.

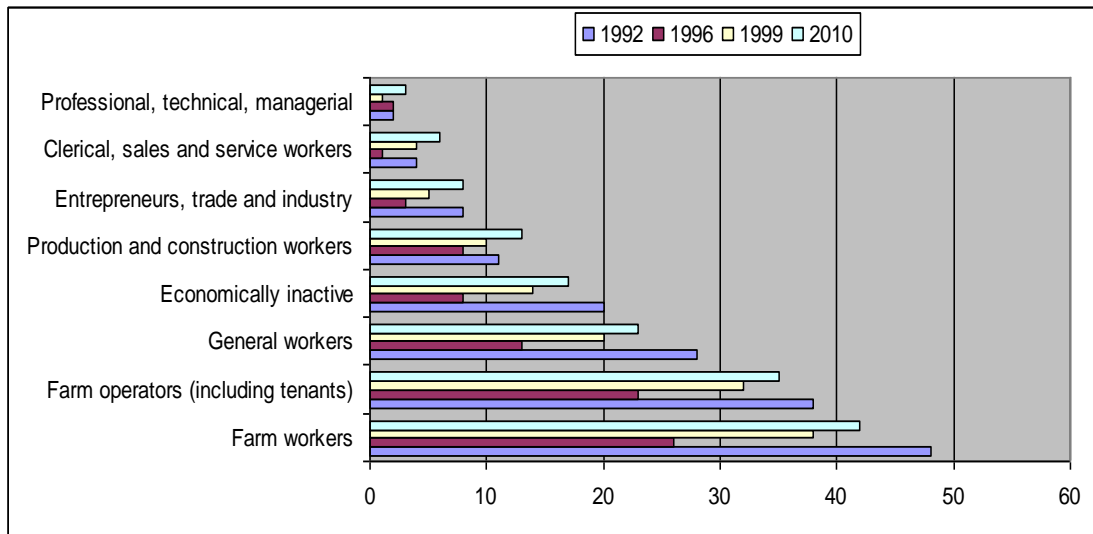
Figure 2.3: Vulnerability among Regions, Before and After the Crisis



Source: National Economic and Social Development Board (NESDB), Thailand.

As shown in Figure 2.4, another household characteristic that correlates with poverty and vulnerability in Thailand is the household head's occupation. Households headed by a person who mainly works in rice farming are found to be poorest. In 1992, nearly half of all farm workers and around 38 percent of farm operators, including tenants, were poor. In contrast, households headed by managers, professionals or technicians were less likely to be poor. Even though poverty in all occupational types dramatically declined from 1992 to 1996, it increased again in 1999 due to the crisis.

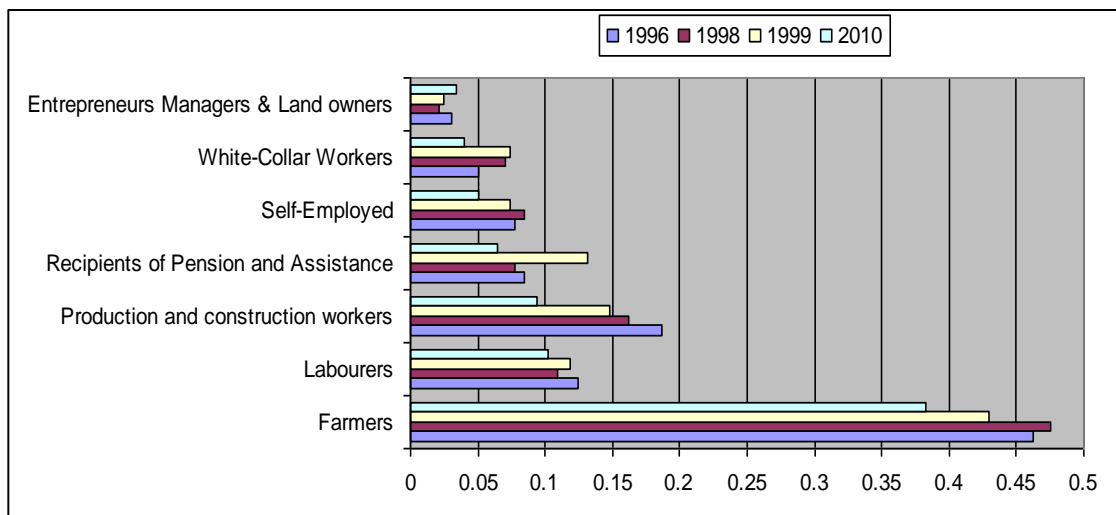
Figure 2.4: Poverty among Different Occupational Groups



Source: World Bank, Social Monitor (2001).

Similarly, Figure 2.5 shows that poverty incidence is consistent with the vulnerability ratio in which the majority of highly vulnerable households are farmers. In contrast, vulnerability is found to be lowest among entrepreneurs, managers and land owners. Other occupational types that are highly vulnerable to poverty are construction workers and recipients of pensions and assistance.

Figure 2.5: Vulnerability among Different Occupational Groups

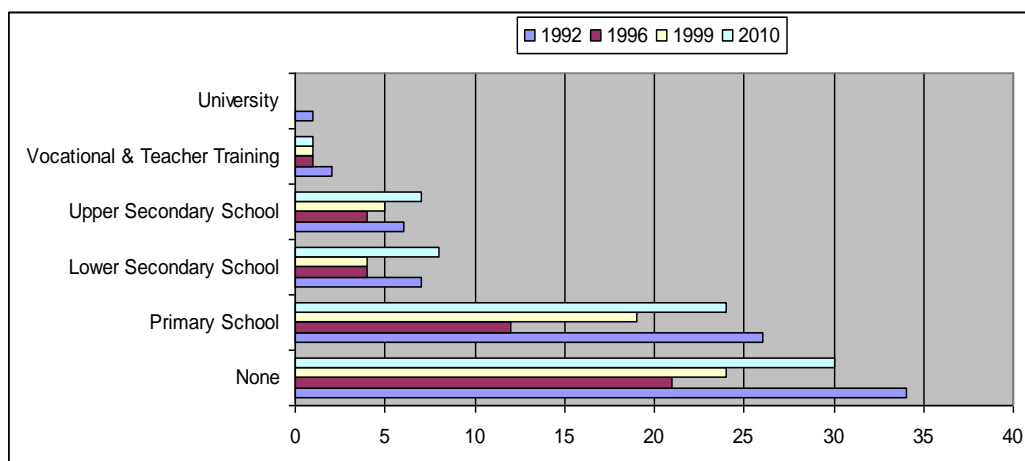


Source: National Economic and Social Development Board (NESDB), Thailand.

Subsequently, education is another key characteristic of the poor. Surprisingly, as shown in Figure 2.6 and 2.7, poverty and vulnerability do not share similar trends in education. The substantial expansion of education from 1992 to 1999 has reduced the

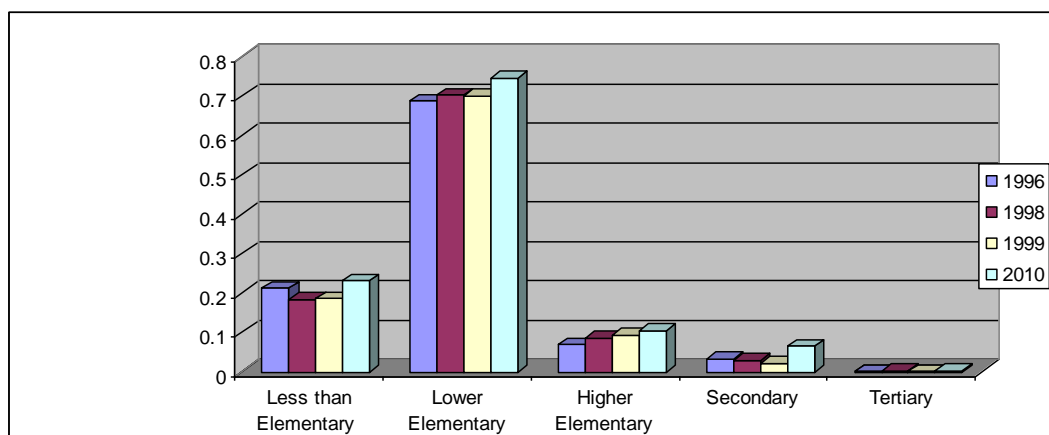
incidence of poverty across educational levels. While poverty is found to be highest among non-educated households, the most vulnerable group is households with “lower elementary” education, followed by the group with “less than elementary” education. Vulnerability and poverty are estimated to be lowest when household heads have received tertiary education. Moreover, while poverty substantially increases after the crisis, there is not much difference in vulnerability pre and post crisis. The impact of the financial crisis on vulnerability seems to be very small in the “tertiary education” group. This indicates that a higher level of education helps mitigate the adverse impact of the crisis on household vulnerability to poverty. In other words, human capital plays an important role in reducing vulnerability to poverty in both rural and urban areas.

Figure 2.6: Poverty in various Educational Groups (Pre and Post Crisis)



Source: National Economic and Social Development Board (NESDB), Thailand.

Figure 2.7: Vulnerability in various Educational Groups (Pre and Post Crisis)



Source: National Economic and Social Development Board (NESDB), Thailand.

Overall, the causes or determinants of poverty in Thailand mentioned by Bidani and Richter (2001) and other institutions in Thailand are the lack of education, arable land, skill, ability, financial support, access to basic sanitation and other elements necessary to generate income and prevent shocks. To analyse household vulnerability to poverty, both individual and structural factors that affect the conditions of the poor and the vulnerable in the current and next periods should be taken into account. Policy makers should consider factors affecting sustainable livelihoods, such as household consumption and saving behaviours, the allocation of natural and economic resources and the structure of public facilities, in designing poverty reduction strategies which can target the poor geographically.

2.4. Policies towards Poverty and Vulnerability Reduction and Impacts

2.4.1 Policies targeting Poverty and Vulnerability Reduction

Aggregate government expenditure on poverty reduction programs in Thailand increased from 4.5 billion baht in 1993 to 21.1 billion baht in 1999 (World Bank 2001). The number of poor in the population tends to decrease with an increase in public spending on poverty programs per poor person. For instance, while government spending on poverty reduction increased by 9.2 percent between 2008 and 2009, the poor population decreased by 31.8 percent over the same period. However, statistics show that the proportion of poor households eligible for the pro-poor programs is usually quite low. This indicates that better budget planning and management are required in targeting the poor efficiently.

All development strategies in the 8th National Economic and Social Development Plan (1997 – 2001), 9th Plan (2002 – 2006), 10th Plan (2007 – 2011) and 11th Plan (2012 – 2016) are relevant to poverty reduction (NESDB 2008). The Eighth Plan represented a new approach in improving people's living standards or quality of life. Public policies implemented under this approach helped achieve people-centred development. This plan focused more on the real needs of all elements of society and enhanced self-reliance for sustainable development. In addition, the plan coincided with advice from the UN Secretary General Ban Ki Moon, which stated that the government budget should reflect national priorities and meet the demands of the majority of people. As a result, restoring the economy from the financial crisis in

1997-98, which greatly affected numerous households and individuals in society, became the priority in the first year of this plan.

The Ninth Plan (2002 – 2006) adopted the *Sufficiency Economy* philosophy, a holistic approach bestowed by His Majesty the King. It proposed the path for economic recovery after the crisis in order to achieve a sustainable economy and solve the problems that arose from globalization and other extensive changes. The concept of “sufficiency economy” philosophy in the plan refers to the principle of moderation, namely a balance in the development approach. The term “sufficiency” involves three main components: moderation, reasonableness and self-immunity system to cope with shocks or extensive changes. In other words, sufficiency economy is a concept that incorporates self-reliance, sustainability, integrity and cooperation among people at different levels in a society in the long-term development to alleviate poverty. The performance of the 9th Plan was quite impressive. The economy began to gradually recover from the crisis with a growth rate of approximately 6 percent a year between 2002 and 2006. However, the economy remained vulnerable to external shocks, with the potential to push up the poverty rate in the new period of the crisis. Additionally, problems persisted over income inequality, land distribution, rural deprivation and transparency in the government budget mechanism.

The Tenth Plan (2007-2011) gave high priority to the economic recovery from the 2008 global economic crisis and the alleviation of the impact of the crisis on poverty. Poverty reduction strategies under this plan aimed to support the sectors that generate income for the poor, provide sufficient access to education and basic infrastructures and empower people at all levels in a community. The plan itself applies the philosophy of sufficiency economy as the holistic approach to continue promoting people-centre development, using risk management to build a self-immunity system into the economy. In other words, the plan takes into account all dimensions of development, which includes the human, economic, political, social and environmental issues. Under this plan, individuals in all communities were encouraged to not only participate but become the leaders in the local development projects initiated by the government or the NGOs, whereas the government took the supportive role. Additionally, a self-reliance system was expected to improve the

conditions of the poor, both economically and socially, and build stronger community ties. However, the plan did not favourably solve the extreme poverty, high vulnerability, drug problems, political unrest and income inequality in all regions. To successfully prevent the country from adverse shocks, the government needed to come up with more effective strategies and measurements to capture all aspects of exposure to risks and inability to cope with shocks, namely vulnerability.

The current plan, the 11th Plan (2012 – 2016), aims to continue enhancing the quality of life and the resilience of the economy through an implementation of public policy based on the sufficiency economy philosophy. In order to achieve a well-balanced and sustainable development, the country must be able to adjust to major domestic and global changes. The current plan involves improvements to international trade and environmental agreements, production processes and market competitiveness, as well as Corporate Social Responsibility (CSR). In addition, the new economic centres or economic cooperation among Asian countries, such as the ASEAN Economic Community (AEC) and Asia-Pacific Economic Cooperation (APEC) are considered important tools in mitigating external shocks by reducing social and economic development gaps between ASEAN countries. Furthermore, issues regarding climate change and the security of food and energy have critically affected the economic stability in Thailand. The global food crisis in 2008 has caused rising food prices and a shortage in the supply of raw materials, which substantially increases food insecurity at all levels of society. Climate change due to global warming has a strong influence on agricultural productivity and rural poverty. This problem is more severe among the persistent and structural poor, namely the chronic poor. The ineffective management of natural resources and the environment has negatively affected food security and long-term economic development. Development programs implemented in the past have not successfully tackled chronic poverty, particularly in rural areas. As a result, better government programs and measures are required to effectively reach the poor and bring down the number of highly vulnerable households at the same time.

2.4.2 Impacts of Poverty and Vulnerability Reduction Policies

Past national development plans only focused on eradicating poverty without fully targeting vulnerability. Some of the government interventions or anti-poverty

strategies did not directly help lower the risk to the highly vulnerable. Many of them have not adequately benefited the very poor groups. The performance of relevant government programs in response to the alleviation of poverty and vulnerability in Thailand are discussed below.

Public Employment Programs

Since the 1997 financial crisis, the government has introduced an employment-generating program to mitigate labour market shock for low-skilled workers, particularly in rural areas. The program is mainly financed by loans from the World Bank and the Japanese government called the “Miyasawa Initiative”. More than \$2000 million US with 25 years of repayment period has been loaned to the Thai government. The loans have been used to generate various public works programs that provide short-term employment for unskilled labourers, such as restoring water supply, roads and other infrastructures. In addition, part of the loans was financed by the Asian Development Bank (ADB) for assisting the agricultural sector, which is the main source of income and employment for rural poor households. The improvement of the agricultural sector, in terms of farm and water management, can assist small farm businesses to expand their production. It could help boost the exports of agricultural products and farm earnings as well. However, this rescue package has not successfully increased job opportunities and generated income for all unemployed workers as mentioned in the Miyazawa plan. Many unskilled or low-skilled workers did not fully benefit from the program in 1999 because of the failure of the government’s budget control mechanism.

Healthcare Programs

Recently, various forms of healthcare program have been provided in Thailand, such as the low income medical card program, the universal health coverage card program and the government medical benefit schemes for civil servants and employees in the formal sector. During the financial crisis in 1998, less than half of the population was eligible for free government health services. The beneficiaries were low income adults, children under twelve years of age, the elderly and the disabled. People who received the low-income medical card were poor residents aged from 13 to 59 years. However, a report from the World Bank Social Monitor (World Bank 2001) showed that people who were eligible for the low-income medical card accounted for

approximately 24 percent of the total population. Less than half of the beneficiaries were considered to be very poor or ranked in the poorest consumption quintile. In 2001, the government implemented a new health policy called the “30 Baht medical scheme” - under which public hospitals only charged their patients 30 baht per visit. The new healthcare program aimed to combine most of the government health insurance schemes into one program. However, the introduction of this new health coverage in the first year did not fully target the poor in the lowest income quintile. In addition, workers in the informal sector were not fully covered by the voluntary health insurance program under the Social Security Act. The government only partially subsidized this program and less than two percent of informal sector employees were eligible for it. To provide a more effective health care program, the Ministry of Finance offered a new pension program in 2011 through the National Saving Fund for people aged from 15 to 60 years who are not eligible for social security funds. People who join this program have to contribute monthly to the program and receive benefits according to the amount they pay.

Programs for the Elderly Poor

The elderly poor, who are 60 to 69 years of age and economically inactive, are eligible for the elderly pension of approximately 600 baht per month. In 2012, the government increased the pension to 800 baht for those aged from 70 to 79 years and 1,000 baht for those who are above 90 years of age. However, the amount of money they receive is not enough to meet their minimum needs. The monthly payment is still below the standard poverty line for the elderly at approximately 1,200 baht per month. Furthermore, the elderly poor who live in large households may not be eligible for the pension even though they have no one to take care of them. This case usually occurs in rural areas where many young adults have migrated to work in Bangkok and the metropolitan area. However, the government budget for this pension may be cut during a flood crisis, which has occurred more often recently. This is because the government has to allocate large funds for the government’s flood control projects.

School Feeding and Educational loan Programs

A school feeding program has been introduced by the government to provide free lunch and milk or a supplementary food at school for small children from

kindergarten to third grade level. Children who do not get enough healthy food usually experience stunted growth, illness and chronic malnutrition. The program targets children from poor households in rural areas because they are more likely to face higher risk of being undernourished. However, the self-selection by teachers of poor students to attend the program has not been sufficiently successful. In 1999, children in the poorest quintile accounted for less than half of the total beneficiaries in the milk program and approximately 54 percent of all participants in the free school lunch program (NESDB 2008). Statistical results indicate that these programs have failed to reach the group of poor children that are at the highest risk of hunger or malnutrition. As a result, the government needs to find a better way of identifying eligible groups of poor children before the programs are implemented in the next period.

The educational loan program is another public assistance program that aims to increase school enrolments for poor households. As previously mentioned, households with higher level education tend to be less vulnerable. The educational loan fund was introduced by the government prior to the crisis in 1996. This program offers loans to poor students from upper secondary level to tertiary education who cannot afford their educational fees in both private and public institutions. Households who are eligible for this program are those with monthly income less than 12,500 baht. However, this type of selection process is considered to be inappropriate in accurately targeting eligible groups of poor households. Statistical results show that less than one fifth of total beneficiaries are students in the poorest quintile. Most of them tend to be from households with incomes above the poverty line, namely “low vulnerable”. Furthermore, the share of poor households eligible for the program is relatively low in terms of total population. Apart from educational loans, government scholarships have also failed to reach the poorest households. In 1998, only 25 percent of total beneficiaries came from the poorest quintile. This indicates that the educational program has ineffectively targeted the chronic or persistent poor and the government budget for this program is not enough to reach the poor at all levels.

Micro Credit Programs

Another public policy targeting an increase in the capacity of the poor to manage risk has been the provision of access to micro credit, especially for small scale farmers in rural areas. Statistical results obtained from the 1999 SES data show that households mainly engaged in agricultural activities tended to borrow from the Bank of Agriculture and Agricultural Cooperatives (BAAC). The bank offers agricultural loans at fairly low interest rates for poor farmers. However, less than 5 percent of agricultural households borrowed from the BAAC in 1999. In addition, nearly 60 percent of people who borrowed were in the highest consumption quintile, while only 5 percent of them were in the poorest quintile (NESDB 2008). Furthermore, the Ministry of Interior has provided another small credit program, called ‘the Poverty Alleviation Project’, since 1993. This program aims to loan 280,000 baht without interest to poor households in each village for investing in their farming or other income-generating activities. Eligible households are selected by the community or village committees. In 1999, approximately 10 percent of the total population participated in the program, whereas the percentage of the total poor in 1999 was nearly 20 percent of the total population. This indicates that a large number of poor farmers were left in poverty. Furthermore, more than 80 percent of all beneficiaries use the loans for farm investments, but only 20 percent of them have been able to generate more income and pay off the debt in full.

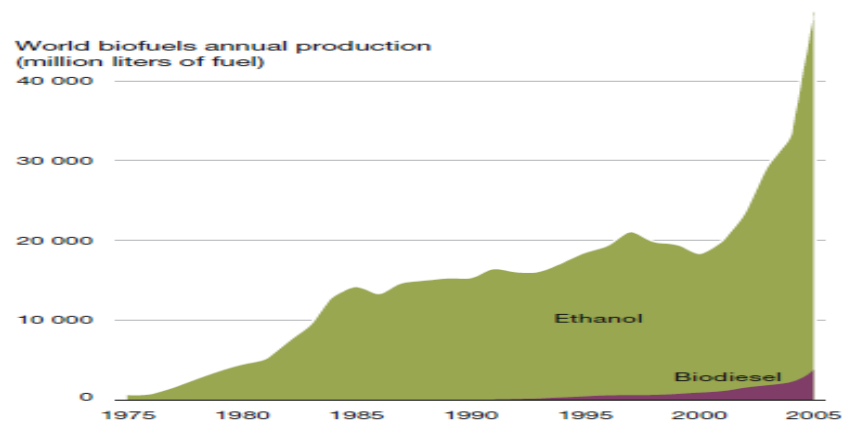
2.5 Food Insecurity: the Global Food Crisis during 2007 - 2008

Along with the poverty issue, food insecurity has become an important problem in Thailand and many developing countries. The sharp increase in food price in early 2007 led to the global food crisis in 2008, which affected many countries around the world. In Thailand, the food crisis had caused the price of rice to increase dramatically, around 50 percent higher than the previous year’s price. Breaking news around the world reported that many countries were experiencing protests against the massive increase in fuel prices between 2007 and 2008 in countries such as Mexico, Pakistan, India and African countries. Many people were injured and twenty people died in Cameroon during violent protests against a sharp rise in oil price. In India, numerous food stores were burned down by the protestors because they could no longer afford enough food for all their family members. As a consequence, the food crisis drew global attention to the impact of rising energy and food prices on national

food security. Recently, the balance between income distribution and the prices of energy and food have become priorities in many less developed and developing countries.

To reduce the impact of the food crisis on food security and promote resilience to both internal and external changes, it is first of all necessary to understand the causes and consequences of the food crisis. The 2008 global food crisis happened after the oil price sharply increased, reaching \$103 US per barrel. The price of fertilizer and the cost of transporting goods to local markets had been pushed up by higher energy prices, which resulted in rising food prices. In addition, Gangopadhyay and Chatterji (2009) point out that climate change since 2005 caused prolonged droughts in Australia and southern Africa, floods in West Africa, a deep winter frost in China and record-breaking warmth in Northern Europe and some major wheat-producing countries. As a consequence, food availability declined because of a serious disruption to harvests and rising food prices. A substantial increase in the demand for meat consumption in many developing countries where income growth was rising rapidly, especially in India and China, led to the food crisis. Furthermore, the sharp increase in world demand for bio-fuels to substitute for hydrocarbons put more pressure on the world food supply. As shown in Figure 2.8, the production of ethanol and biodiesel in the world market increased enormously after 1975. Farmers in many countries used more land for bio-fuel production. This production of bio-fuels distorted the global food market because major grains were used to produce fuel instead of food (IFPRI 2011).

Figure 2.8: Annual Production of World Bio-fuels, 1975 - 2005

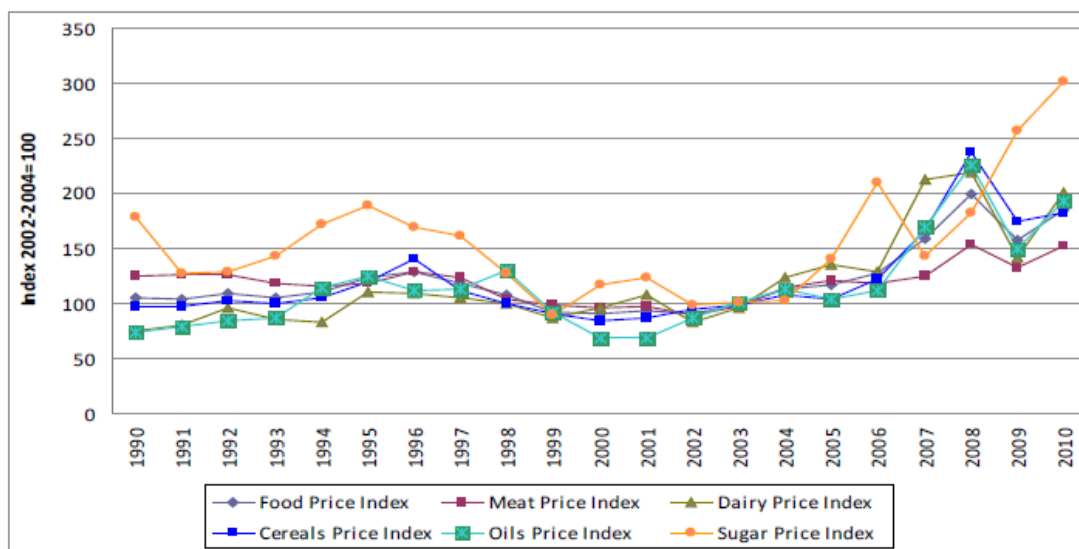


Source: United Nations Environment Programme (UNEP 2009).

In the United States, the prices of major grains have increased about 30 percent due to an increase in the demand for bio-fuels since 2007. Thousands of U.S. farmers have switched to growing more fuel crops because they receive large amount of subsidies from the government for producing ethanol. More than 30 percent of corn produced in the U.S. is used to produce ethanol. In Europe, approximately 50 percent of vegetable oils are used to produce bio-diesel and sold at a cheaper price than regular petroleum diesel in the EU market.

The World Bank (2008) reports that global food prices increased around 83 percent from 2005 to 2008. Wheat supply in the global market fell dramatically to a level it had never reached in the previous 50 years and the price of soybean oil rose almost 60 percent in 2008. Figure 2.9 shows that the world food price index sharply increased by approximately 54 percent in 2008. The prices of dairy products in 2009 were relatively high when compared with 2003 prices, particularly in many low income countries. Cereal prices, particularly Thai medium grade rice, reached its peak in mid 2008 and prices are expected to remain high through 2015.

Figure 2.9: Annual FAO Food Price Indices, 1990 - 2010



Source: Annual Real Food Price Indices (FAO 2011).

Poor and nearly poor households were greatly affected by a decline in their purchasing power due to high food inflation rates during the 2008 global food crisis. As a consequence, poverty rates in many countries increased, particularly in low-income countries. Approximately 130 million people were driven to hunger and fell

into extreme poverty during the food crisis (UNEP 2009). Many developing countries were unable to sufficiently support the poor. The food relief organisations had to provide hundreds of thousands meals and food cans for the poor to reduce their starvation. The food crisis finally caused massive food riots and protests against a surge in energy prices in many countries all over the world. The impact of food crisis tends to be higher among children than adults, which can result in a rapid increase in child malnutrition and infant deaths in poor countries. The global financial and economic crisis in 2008 has exacerbated the negative impact of food price shock in both developed and developing countries. As a result, the poor have to spend less on food in order to save their income for other non-food needs. A reduction in their food consumption affects their normal caloric requirements and long-term health, which pushes them into deeper food poverty. In addition, the non-poor households in developed countries can become undernourished and food insecure during a food crisis. Even though the non-poor are able to maintain their normal food consumption, they sometimes have to purchase substitutes that are cheaper but less nutritious. The consequences of food crisis in many countries significantly lead to a large number of people being highly vulnerable to food insecurity.

2.6 Food Insecurity in Thailand

More than five hundred million people in Asia were found to be undernourished between 2003 and 2005 (World Bank 2008). Many Asian countries are still facing problems regarding food insecurity even though they have been adequately successful in economic growth and poverty reduction. As a result, policy makers have to ensure the adequacy of food availability and increase food accessibility at all levels in society. In Thailand, the current government has only put more effort into increasing economic growth and expanding agricultural exports. Public policies on agricultural development implemented over the past few decades have not fully focused on improving food security at the micro level.

Thailand is a major exporter of agricultural products and one of the major food suppliers in the global market. Even though total food production in Thailand has exceeded domestic demand, a large number of households still lack access to nutritious food, particularly in rural areas. The global economic crisis, climate

change and a sharp rise in bio-fuel production have lowered the availability and accessibility of food in Thailand. Because food constitutes a large share of total consumption expenditure for the poor, high food prices strongly affect their well-being. Food prices and input prices of agricultural products have been increasing lately in Thailand, which has severely affected poor rice farmers. Rises in production costs have also substantially decreased net farm profits. Many small scale farmers have been in debt since 2008 because their farm expenses have exceeded the money they received from selling their food crops.

2.6.1 The Demand and Supply of Agricultural Products in Thailand

The share of agriculture in Thai GDP has been continuously declining as the country slowly shifts from an agrarian economy to an industrialised economy with higher growth in the non-agricultural sector. In 2013, the ranks of top ten export products from Thailand are cars, computers, oil, jewellery, chemicals, plastic pellets, rubber products, latex, integrated circuitry and machinery respectively (Ministry of Commerce 2014). Data obtained from the Office of Agricultural Economics shows that nearly 60 percent of cultivated areas in Thailand are allocated to rice (OAE 2013a). Another 40 percent of land is used to grow maize, cassava, palm oil, sugar cane and other grains. Rice is grown in all regions throughout the country, particularly in the Northeast, where the largest percentage of rice is produced. Most people who grow rice in this region are subsistence farmers. They only have small areas of land to grow rice once a year under the rain-fed ecosystem. Thus, they mainly grow rice for their own household consumption and sometimes sell little of their surplus. The Central and North regions account for more than 60 percent of total rice exports. Farmers who cultivate in these two regions tend to own large-scale land and can grow rice at least twice a year. The total cultivated area of rice has been gradually declining lately in the Northeast due to a lack of irrigation or coordinated water allocation, which results in low rice yields per annum. Many small farmers cannot afford fertilizer, seeds and equipment because of rising input prices. As a consequence, some farmers choose to abandon or sell their land and move to work in big cities. Subsistence farmers who still keep their land have to rely more on income from off-farm employment.

Apart from rice, other important crops are cassava, corn, sugar cane, soybean and palm oil. These crops are mostly used for domestic consumption and animal feed because annual production is lower than domestic demand. As a result, the country has to import some of these crops every year. For instance, more than 80 percent of soybeans used in the food and animal feed industries come from imports. In addition, poultry, pork, beef and aquatic animal products are the main source of protein in Thailand. Recently, the simultaneous expansion of the poultry farming business and development in the broiler industry has significantly increased the surplus in domestic poultry production. Large-scale poultry producers are able to expand their frozen chicken meat exports. The C.P. Group, a well-known company in the feed and livestock industry, has become the largest company in Thailand and one of the largest conglomerates in Asia. The company exports nearly 100,000 tons of poultry a year. The domestic price of chicken meat in Thailand has gone up since 2008 due to the rising cost of animal feed prices.

Subsequently, dairy products are important sources of nutrition, particularly calcium, for children. Even though Thailand can produce sufficient amounts of pasteurized and UHT milk for domestic consumption, the country still needs to import infant milk powder and dried skim milk from New Zealand and Australia. Powdered milk is widely used to produce the range of fresh dairy products, such as yoghurt, ice cream, condensed milk, cakes, cookies, bread and pastry products. Approximately 45 percent of all fresh milk produced in Thailand is used for the school milk project as part of the current government's pro-poor programs. The school milk project, fully subsidized by the government, aims to increase milk drinking and improve health conditions for poor children. However, the program has failed to successfully reduce child malnutrition due to the problem of corruption regarding the quality of milk used in this project. In 2009, the government was blamed for a corruption scandal in this project after the Department of Science Service found that school milk samples were all substandard. Some of the UHT milk samples had nearly expired and tasted very strange. In September 2013, a news report indicated that more than four hundred students in some provinces were sent to hospital because of severe vomiting and diarrhoea after drinking school milk. Many parents are afraid of its poor quality and do not want their children to drink the free school milk anymore.

According to the World Bank data (World Bank, 2013c), the population has been growing by approximately 0.2 – 0.3 million people annually. The Thai population has increased from 66.4 million people in 2010 to approximately 67.3 million in 2013. This results in an increase in the domestic rice demand. Rice is the main source of carbohydrate in Thailand. A total of nearly 7 million tons of rice is consumed by Thai households each year (Sombilla, Hossain and Hardy 2002). The total rice production slightly increases as the number of population rises each year. However, domestic rice consumption tends to fall as household income increases due to rising meat consumption. This indicates that low-income households are more likely to consume a large proportion of carbohydrates and less protein. Thai rice exports continuously increased between 2000 and 2005, but have remained almost unchanged since 2007. This is because the government has not been able to expand the share for Thai milled rice in the global market. Recently, the large excess domestic supply of rice has become one of the biggest problems in Thailand. The government has promised to buy rice from farmers at a price higher than the world rice market, as part of a rice pledging program. However, this policy has not successfully reduced the large rice surplus or boosted the country's rice exports as expected. In October 2013, many Thai newspapers reported that the program has caused huge budget deficits – approximately \$400 billion US in two years. The Ministry of Agriculture and Cooperatives has refused to reveal the actual amount of budget losses to the media. This situation eventually led to an accusation of corruption by anti-government protestors in Bangkok and many provinces recently. A large number of rural farmers have not received cash from selling all their milled rice cultivated in 2013 to the government. Some of them joined the protest in January 2014 to shut down Bangkok. Since most farmers are likely to be poor or nearly poor, this program has made them become even more vulnerable to poverty and food insecurity in the near future.

2.6.2 Thailand's Food Poverty Profile

In Thailand, the per capita household food poverty line is calculated based on the minimum calorie needs of Thai people as shown in Table 2.2. The official food poverty line is defined as the cost of the minimum amount of calories and protein needs (NESDB 1998). The calories and protein requirements for each household depend on the differences in age and sex of household members.

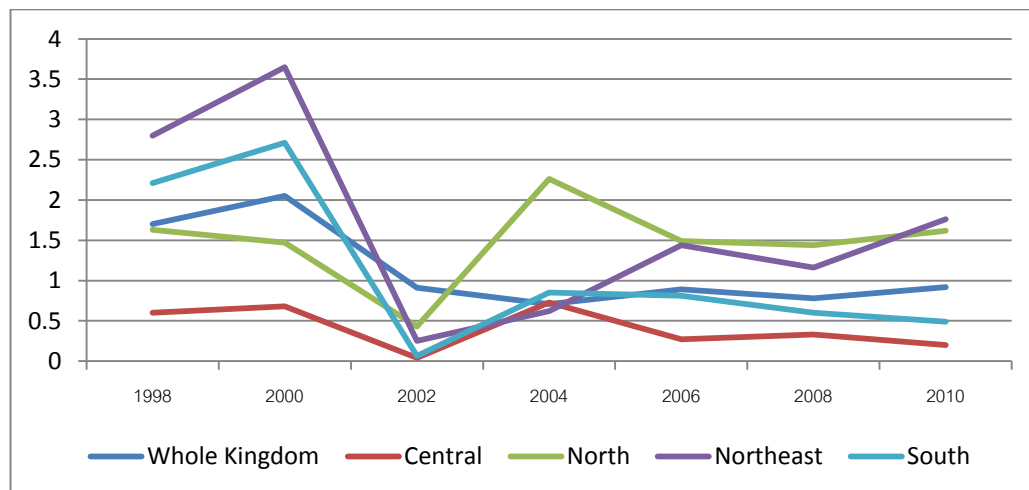
Table 2.2: Minimum Calorie and Protein Requirements of a Typical Thai

Minimum calorie requirement of a typical Thai (gm/day)			Minimum protein requirement of a typical Thai (gm/day)		
Age group	Male	Female	Age group	Male	Female
Less than 1 year	800	800	Less than 1 year	16	16
1-3 year	1000	1,000	1-3 year	19	19
4-5 year	1300	1,300	4-5 year	25	25
6-8 year	1400	1400	6-8 year	28	28
9-12 year	1700	1600	9-12 year	42	42
13-15 year	2100	1800	13-15 year	61	57
16-18 year	2300	1850	16-18 year	62	48
19-30 year	2150	1750	19 and over	57	52
31-50 year	2100	1750			
51-70 year	2100	1750			
71 and over	1750	1550			

Source: Nutrition Division, Department of Health, Ministry of Public Health (2003).

After the global food crisis, the 2009 household food poverty line was approximately 48 percent of the total poverty line. This indicates that the share of food expenses is nearly half of the total consumption expenditure. As shown in Figure 2.10, the share of food poor households in the Northeast substantially declined after the global food crisis, whereas the share of food poor in other regions has not changed that much. The finding implies that Northeast residents are highly sensitive to the food price shock, being more vulnerable to food insecurity than residents in other regions. Food poverty is highly concentrated in the Northeast and North because a large number of poor small-scale farmers live in these two regions. Additionally, the chronic malnutrition rate for children and child mortality rate are highest in the Northeast region.

Figure 2.10: Food Poverty Incidence by Region (% of population)



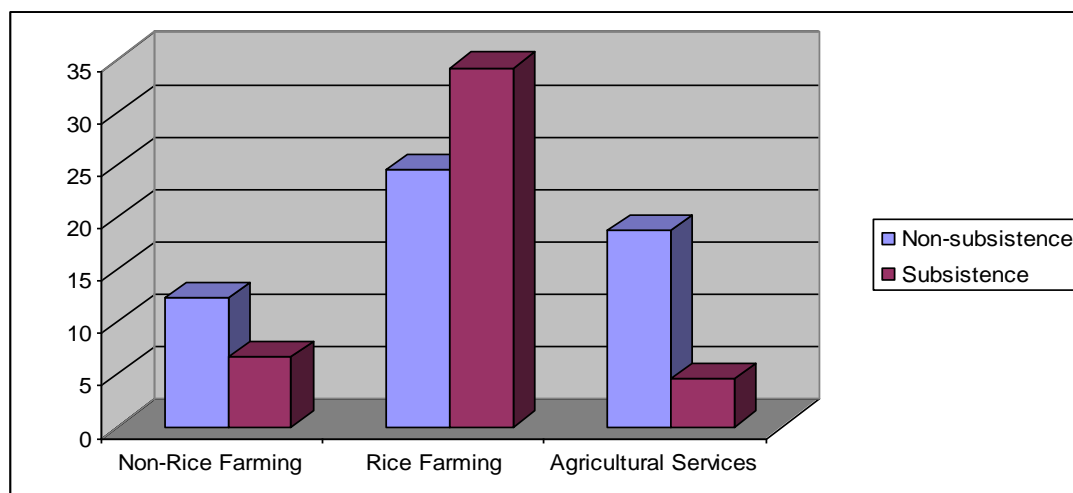
Source: National Economic and Social Development Board (NESDB 2012).

Poor subsistence farmers normally consume almost all of their total rice production and use the rest for animal feed in their farms. Even though these farmers have a sufficient amount of rice to consume, they may be vulnerable to food insecurity due to their high expenditure on the foods they cannot produce. For instance, low-income farmers, who use all of their land to grow rice and always purchase meat from the local market, are more likely to suffer when the prices of meat rise rapidly. In contrast, subsistence farmers who use the integrated farming system, where various crops and raise livestock are grown simultaneously, are less sensitive to food price shock. This integrated farming practice is part of the development strategies implemented according to the sufficiency economy philosophy. However, few farmers have applied this system recently. A large number of lowly-educated farmers still cling to traditional farming methods because they think it is difficult to adopt this method themselves. As a result, many poor farmers have not had sufficient food accessibility at all times even though food poverty has tended to decline over time.

Food poverty increased rapidly between 1998 and 2000 due to the 1997 financial crisis. Rising food prices in Thailand caused rising food poverty between 2004 and 2006. As shown in Figure 2.11, statistical data computed from the 2010 SES shows that nearly 70 percent of the food poor are agricultural households, particularly rice farmers. This is quite a surprising result since Thailand is a world leader in milled rice exports. The rural farm operator who mainly rents land less than 1.6 hectares in area and engages in fishing, agricultural services or forestry is most likely to be

vulnerable to food poverty. In addition, subsistence farmers tend to face a higher probability of falling into food poverty than non-subsistence farmers.

Figure 2.11: Agricultural Households affected by Food Poverty in 2010 (%)



Source: Computed from Thai Socio-Economic Survey (2010).

2.7 Causes of the Food Crisis in Thailand

Rice is the most important crop in the Thai economy, particularly in rural areas. The average annual consumption of milled rice per capita in Thailand is around 130 kilograms. Other major crops are wheat, soybean, maize and cassava respectively (Table 2.3). Milled rice accounts for approximately 30 percent of total household food consumption. Others foods include meat, fruits and vegetables. As a result, any change in rice prices significantly affects household food consumption pattern and food security in Thailand.

Table 2.3: Per Capita Food Crops Consumption per annual in Thailand

Type of food crops	Rice	Wheat	Maize	Cassava	soybean
Per capita consumption (kg)	130	25	6	4	8

Source: Computed from the Socio Economic Survey (2010).

Figure 2.12 shows that rice prices fluctuated substantially between 1960 and 1980. However, the rice prices seemed to decline in the late 1990s due to falling export prices of agricultural commodities. Rice prices began to rise in 2001 and sharply increased in early 2008 during the global food crisis. Rice exports were restricted or

banned by some Asian rice exporters at that time in order to protect their food security from rising food inflation.

Figure 2.12: Trends of Real Price of Rice and World Rice Production



Source: Pandey et al. (2010).

The food crisis and export reduction have stimulated domestic rice price volatility and food riots by rural poor households in some developing countries. In Thailand, an implementation of rice-pledging policy in 2011 by the government has pushed up rice prices to an uncompetitive level and exacerbated the country's food inflation as well as rice export reduction. Recently, the Thai Prime Minister was forced out of office by a million protestors, dissolving the parliament in November 2013. A large number of middle-class people in Bangkok and other provinces have joined the massive protest to shut down Bangkok. They are very disappointed and angry at the passing of an amnesty bill and the suspected corruption in many populist policies, particularly the rice pledging scheme. The violent clash in mid December 2013 between protestors and the police and a deadly bomb attack in January 2014 have caused some people to lose their lives and left many severely injured.

2.7.1 The Rise of Rice Production Costs

The cost of producing rice in Thailand has been continuously rising since 2007. The main factors in rice production are land, seeds, fertilizer and farming equipment.

The 2008 food crisis and domestic oil price hike in 2012 have caused increased prices in fuel, seeds and arable land rental. In recent times, farmers have tended to replace human labour with machinery in farm operations. This is because young adults in rural areas are more likely to work in the non-agricultural sector, which pays them a higher wage than working on the rice field. The sharp increase experienced in fuel prices has caused a rise in production costs. In addition, chemical fertilizer is extensively used by numerous Thai rice farmers in all regions. Thailand has imported a tremendous amount of chemical fertilizer annually. According to the Office of Agricultural Economics (OAE 2013b), the import of chemical fertilizer continuously increased from 3.79 million tons in 2008 to 5.17 million tons in 2010 and finally reached 5.58 million tons in 2012. As the country imports more chemical fertilizer, its prices have been rising annually. As shown in Table 2.4, the retail prices of all types of fertilizer dramatically increased between 2008 and 2012, which has exacerbated the rising cost of rice production recently.

Table 2.4: Retail Price of Chemical Fertilizer (baht/ton), 2005 – 2012

Type of Fertilizer	2005	2006	2007	2008	2009	2010	2012
46-0-0	12,349	12,383	12,712	21,104	13,946	12,906	17,211
15-15-15	11,912	12,954	13,069	22,752	21,250	17,865	18,884
21-0-0	7,455	7,547	7,673	12,782	10,612	8,149	10,730
16-20-0	9,485	10,024	10,705	19,386	16,023	14,200	16,576
16-16-8	9,839	10,326	10,935	19,921	17,810	15,957	17,435
13-13-21	11,959	12,926	12,979	22,383	22,994	19,555	19,813

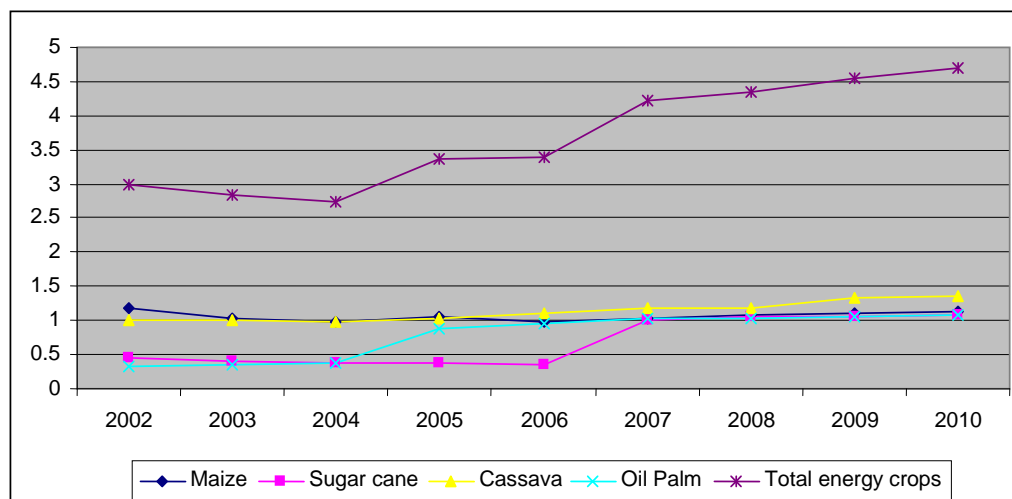
Source: Office of Agricultural Economics, Thailand (OAE 2013b).

2.7.2 Rising Demand for Bio-fuel

Recently, many countries have been trying to cope with rising energy prices by developing alternative energy sources or renewable energy. In Thailand, the government has subsidized the prices of gasohol and bio-diesel, which reduces the use of hydrocarbons and increases the demand for bio-fuel. The demand for fuel-crops, such as palm oil, sugar cane, corn and cassava, has been rising annually. As a result, farmers have used more land to grow fuel crops. As shown in Figure 2.13, the total cultivated areas for all fuel crops in Thailand have been continuously rising

from 2.98 million hectares in 2002 to 4.7 million hectares in 2010. This situation negatively affects the country's long term food security as more rice fields are used to grow these major fuel crops.

Figure 2.13: Cultivated Areas (million hectares) for Major Fuel Crops



Source: The Thai Maize and Produce Traders Association (TMPTA 2011).

2.7.3 The Problem of Climate Change

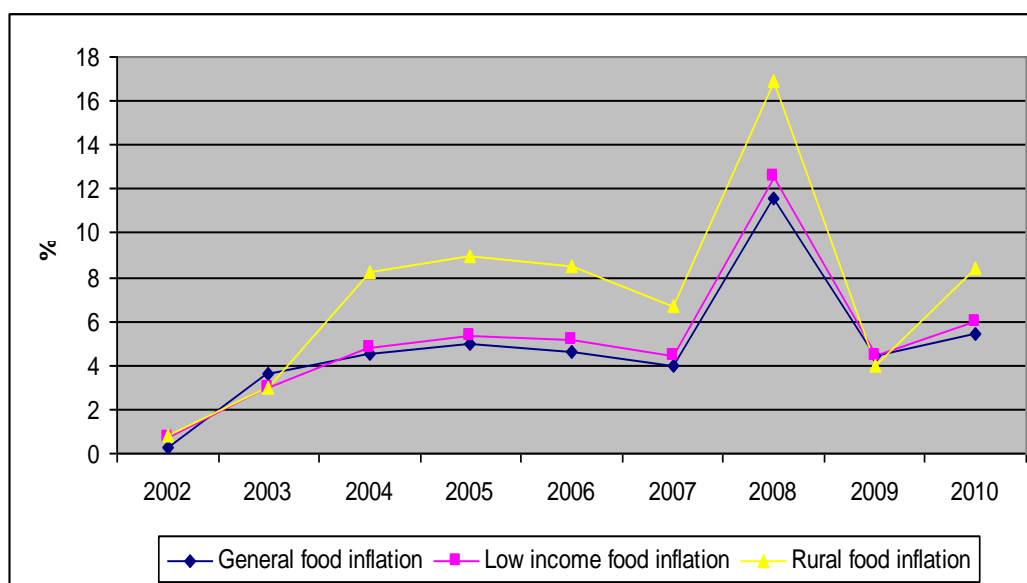
Climate change has become an important issue in many countries all over the world, particularly in an agrarian economy. The consequences of climate change, such as severe droughts and floods, significantly affect agricultural productivity and exacerbate food price volatility. In Thailand, the severe flooding in 2011 and 2013 dramatically reduced agricultural production, especially that of milled rice. Most farming and industrial land was completely devastated. Many fruit orchards, rice fields, corn, cassava and sugar cane went under water. The heavy floods caused a large drop in the country's GDP and a sharp rise in farming debts. The prices of many farm products increased tremendously in 2013.

2.8 Impact of the Food Crisis on Poor Households

In Thailand, as shown in Figure 2.14, food inflation in 2002 was below 2 percent. However, the 2008 food crisis caused a sharp rise in the food price index. The impact of rising food prices tends to be larger in rural than urban areas. While the overall 2010 food price index increased by 5.4 percent, the rise in the rural and low-income food price index was substantially higher. This indicates that the food crisis greatly

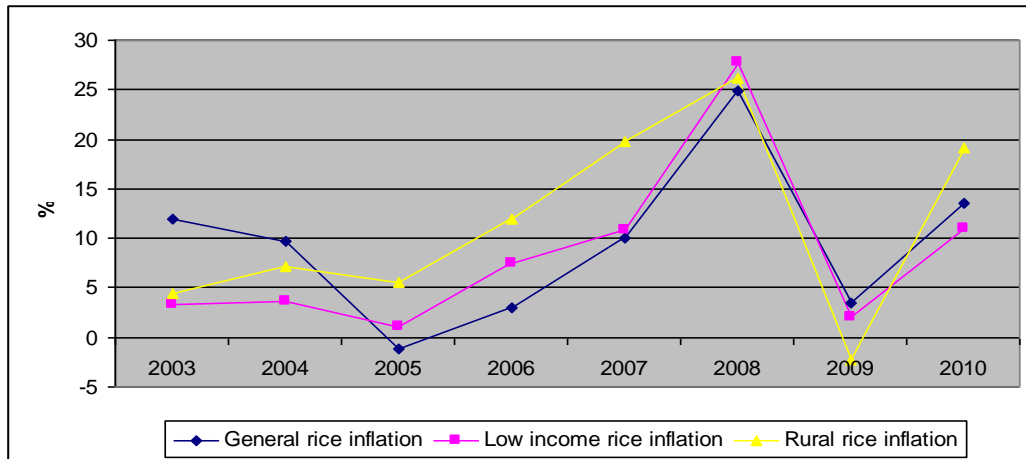
affects rural poor households. However, Figure 2.15 shows that low-income rice inflation in 2008 was slightly higher than rural rice inflation. This implies that low-income households in urban areas are more vulnerable to an increase in rice price than those who live in rural areas. This is because many rural households work in the agricultural sector and grow more rice than other grains. In other words, the rural agricultural households seem to be more insecure in the foods they produce in smaller quantities; not rice. In contrast, urban households are more likely to work in the non-agricultural sector. They do not grow much rice and other agricultural commodities for their own consumption. Statistical data computed from the SES collected in 2002 and 2010 shows that non-agricultural urban families usually purchase relatively large amounts of prepared food outside the home, nearly 60 percent of their total food consumption. As a result, urban households that own little arable land are more vulnerable to a peak in prices of farming products than rural households during a food crisis.

Figure 2.14: Food Inflation Rates in Thailand, 2002 – 2010



Source: Bureau of Trade and Economic Indices (2011).

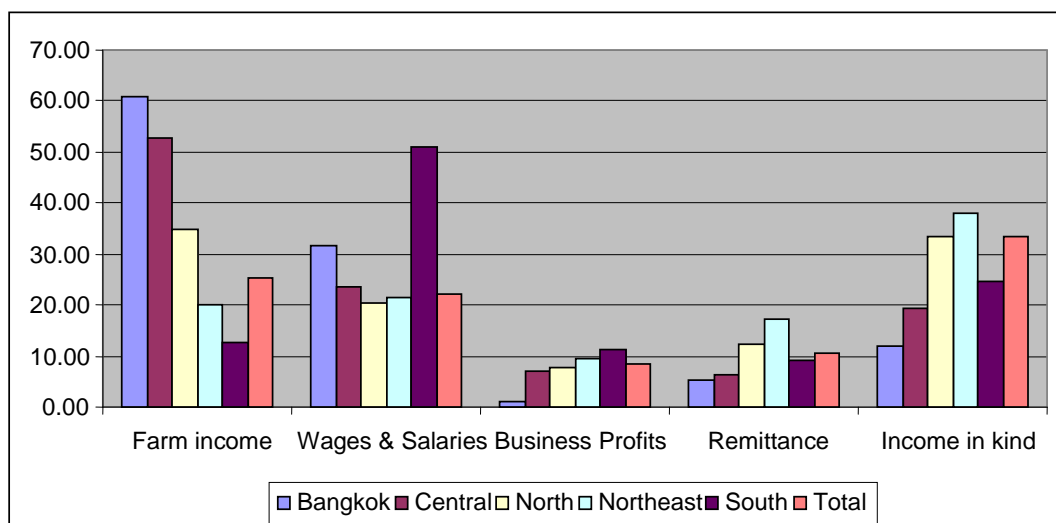
Figure 2.15: Rice Inflation Rates in Thailand, 2003 – 2010



Source: Bureau of Trade and Economic Indices (2011).

The impact of food crisis on rice farmers tends to be greater than on other farmers because they are found to be most vulnerable to food poverty (Figure 2.11). Among the rice farmers, statistical results obtained from the 2010 SES show that rice farmers in Bangkok and the Central region earn more farm income than farmers in other regions (Figure 2.16). In contrast, rice farmers in the Northeast and North regions tend to rely more on in-kind income and remittances. This significantly implies that farmers in the North and Northeast earn relatively low farm profits. They need non-cash payments or cash contributions, such as food stamps or free rental of land from the government or a transfer of money from family members living aboard, in order to survive.

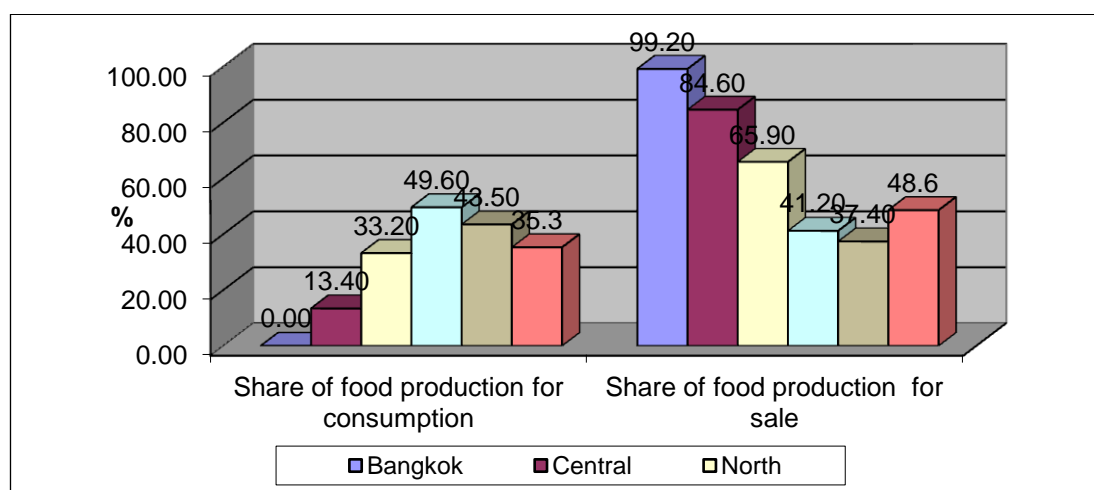
Figure 2.16: Various Income Sources of Rice Farmers by Region (%)



Source: Computed from Thai Socio-Economic Survey (2010).

As previously shown in Figure 2.11, subsistence farmers are more vulnerable to food poverty than non-subsistence farmers. Figure 2.17 confirms this finding by showing that farmers in some regions, such as the Northeast and South, where there is a relatively large amount of food produced for household consumption, face a higher risk of becoming food poor. In contrast, farmers in Bangkok sell most of their home-produced food and consume less than 1 percent of their total food production. This indicates that farm productivity and farm prices tend to be higher in urban than rural areas. Moreover, the share of off-farm income from working in the informal sector is found to be relatively large among urban farmers. As a result, urban farmers tend to be better off than rural farmers.

Figure 2.17: Share of Food Production for Household Consumption by Region

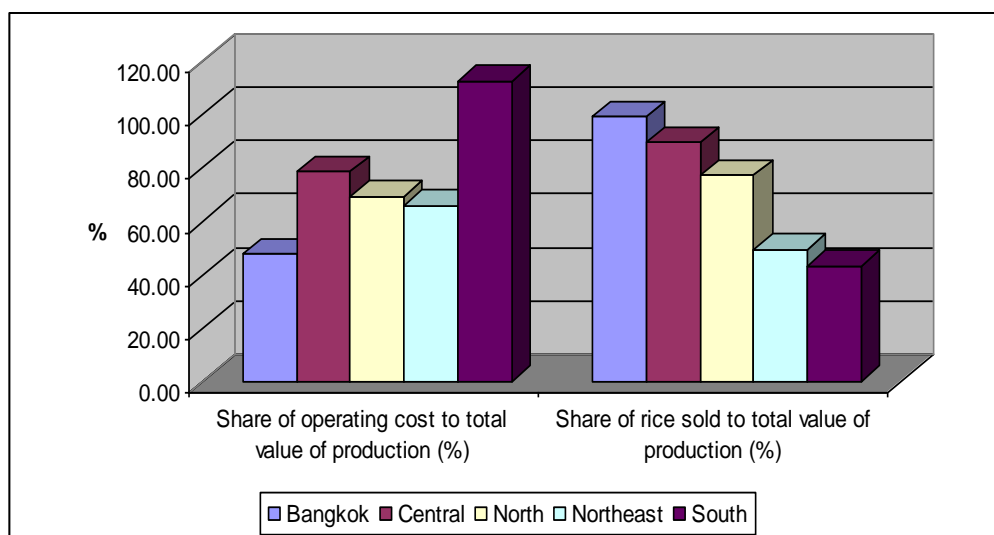


Source: Computed from Thai Socio-Economic Survey (2010).

The impact of rising costs of agricultural inputs is relatively high among rural subsistence farmers. This is because small-scale farmers in rural areas usually have high operating costs relative to the total value of rice sold. Statistical data computed from the 2010 SES data shows that total operating costs become lower as the size of arable land becomes larger. Subsistence farmers spend more than half of the value of their rice yield on operating costs. However, they only gain less than 20 percent of farm profits from their total rice sold at market. In other words, large-scale farmers tend to suffer less from a sharp rise in agricultural inputs during a food crisis than small-scale farmers. In addition, the impact of rising agricultural input prices seems to differ across regions.

Figure 2.18 shows that farmers in the South and Northeast regions suffer more from an increase in operating costs than farmers in other regions. Farmers in these two regions are relatively poor and many of them do not cultivate their own land. They always struggle to control their annual operating costs as their land rental rates continue to increase, while crop sale prices are likely to fluctuate over time. To solve this problem, farm productivity has to be improved and any government policy regarding rural land reforms should be effectively implemented, particularly in these two regions. In addition, water and soil are the crucial factors in increasing farm productivity. The soil quality can be improved through the use of organic fertilizer, innovative irrigation and crop rotation. Therefore, the government should train small-scale farmers to produce and use more local organic fertilizer on their farms to avoid the high price of synthetic fertilizer that has continued to rise every year.

Figure 2.18: Share of Farm Operating Costs and Rice Sold in 2010, by Region



Source: Computed from Thai Socio-Economic Survey (2010).

2.9 Conclusion

This chapter aims to provide an overview of poverty, vulnerability and food insecurity in Thailand. Poverty and vulnerability are both multi-dimensional concepts and are differently defined according to their causes. While poverty is defined as the observed state of shortage and deprivation, vulnerability refers to an *ex ante* exposure to the risk of being insufficient in amount of food and other necessities.

This chapter shows that many Thai households have been found to remain highly vulnerable to poverty and food insecurity, particularly in rural remote areas, since the Asian financial crisis took place in July 1997. As a result, vulnerability to poverty has become an important issue in implementing development strategies in Thailand. In Thailand, poverty and vulnerability seem to share some similar characteristics. They are found to concentrate most in the Northeast region, particularly among small scale farmers and households with low educational levels. Various economic and development policies have been implemented by the government to reduce poverty and food insecurity incidence by strengthening social safety nets, enhancing infrastructures and building stronger community and social networks. However, these policies have only achieved limited success and pro-poor programs have not been monitored closely after the implementation. Furthermore, most of these programs seem to be ineffective in reaching the poor and vulnerable. Therefore, better targeting programs and poverty measures are required to efficiently target the poor and be effectively implemented in all regions.

Apart from poverty and vulnerability, food insecurity is another challenging problem for the Thai government to cope with. According to the 11th National Economic and Social Development Plan (2012 – 2016), the government has planned to alleviate the risk of being food insecure in all regions. The declining trend in rice production in Thailand due to climate change and the shift of marginal land from rice to cassava and palm oil for alternative energy has caused poor households to become more vulnerable to food insecurity. Furthermore, a rise in production costs has pushed up the price of rice and has inevitably raised total household consumption expenditure. Poor rice farmers in rural areas tend to suffer more from this rise in production costs and major agricultural input prices than other groups of the population. Based on the 2010 SES data, rice farmers in the South and Northeast regions are more vulnerable to rising food prices than farmers in other regions. This is mainly due to the fact that these two regions are more vulnerable to natural disasters, such as flooding and drought, and average household incomes in these two regions are relatively low. The rate of child malnutrition is relatively high in the Northeast region. In addition, this region has a much lower quality of water supply and infrastructure utilities than other regions, particularly in rural areas. As a result, Northeast residents are more likely to be at high risk of experiencing food insecurity.

The aim of discussing the concepts, measurements and profiles of poverty, vulnerability and food insecurity in Thailand in this chapter is to identify the household and commodity characteristics that are relevant to the measurements and determinants of vulnerability in different dimensions in the latter chapters. An overview of development policies on poverty and food insecurity alleviation and their performance documented in this chapter provides a framework for discussing potential policy implications regarding future poverty prevention in the last chapter. These policies are necessary to mitigate the impact of various shocks on poverty and food insecurity among different vulnerable groups.

Chapter 3

Household Vulnerability to Poverty: Measurement and Determinants

3.1 Introduction

The concept of vulnerability has gained in importance in poverty literature for an analysis of poverty persistence. As discussed in the previous chapter, household poverty represents a household's current status of being poor. In contrast, household vulnerability to poverty refers to the current risk, or the probability today, that a household will be poor or fall into poverty at some point in the future. According to Chaudhuri (2003), household vulnerability to poverty in any period depends on how livelihoods and well-being evolve over time. In other words, a household's well-being status is determined by its future income and consumption prospects, its level of income volatility and its ability to smooth consumption under income shock and other socio-economic shocks. Being able to identify who are the most vulnerable and what characteristics are correlated with poverty movements would assist policy makers in their efforts to understand the key micro-level binding constraints to poverty reduction. In addition, it helps them devise a public policy to enhance the overall population's well-being and protect those who are at risk of poverty. Existing study on household vulnerability to poverty in Thailand is at best scant. Thus, there is a lack of a current vulnerability profile of Thailand. Vulnerability measurement usually requires long panel data. However, for some developing countries, including Thailand, reliable panel data is scarce. Only annual cross-sectional survey data is available. Therefore, more research with appropriate methods to measure household vulnerability to poverty and its determinants are required in order to implement better government policies that target the vulnerable group efficiently.

This chapter provides an empirical analysis of household vulnerability to poverty in Thailand based on the "Expected Poverty" approach. The standard Foster-Greer-Thorbecke (FGT) measures are adopted to estimate household vulnerability to poverty in terms of its expected value of poverty. This method is particularly designed for cross-sectional data, assuming that a household's cross-sectional

variability reflects its temporal variability (Chaudhuri, Jalan and Suryahadi 2002 and Chaudhuri 2003).

This chapter is organized as follows. The next section provides a review of existing studies on measurements and determinants of household vulnerability to poverty. In Section 3.3, a review of widely used approaches in measuring vulnerability to poverty in the literature is provided, followed by the methodology and data in Section 3.4. Empirical results and a sensitivity analysis are presented in Section 3.5. Section 3.6 provides the vulnerability to poverty profile of Thailand in 2010 and Section 3.7 concludes the chapter.

3.2 A Review of the Literature

This section provides a review of the literature on measurements and determinants of household vulnerability to poverty. As discussed earlier in Chapter 2, vulnerability to poverty is precisely defined as the probability of falling below a poverty threshold. This threshold represents the minimum needs in a society for a specified period of time. According to Guimarães (2007), a range of methods has been observed to measure and determine household vulnerability to poverty based on standard microeconomic theories, a monetary approach to poverty and entitlement theories. In this section, the literature on measurements of vulnerability to poverty is discussed first, followed by studies on determinants of vulnerability to poverty.

3.2.1 Measurements of Vulnerability to Poverty

Vulnerability to poverty has been precisely defined and measured in different disciplines by numerous researchers. Some approaches focus on the outcome of the risk in terms of a monetary approach to poverty. Other approaches focus on the maximization of utility based on the assumptions of rational self-interest and exogenous preferences (Guimarães 2007). In other words, vulnerability is measured in relation to the projection of future welfare, which is determined by an individual's characteristics and historical pattern of consumption or income. A few approaches focus more on individuals' entitlements instead of relying on the utility maximizing behaviour assumption to measure vulnerability. Taking into account households' tangible and intangible endowments, their demographic and socio-economic characteristics determine whether they are more or less resistant to risk.

The method that has been widely used in measuring vulnerability by many researchers is the “Expected Poverty” approach (See Christiaensen and Boisvert, 2000; Chaudhuri, Jalan and Suryahadi 2002; Chaudhuri, 2003). To solve the problem of an insufficient or limited data set, Chaudhuri, Jalan and Suryahadi (2002) and Chaudhuri (2003) develop a fairly flexible methodology to assess household vulnerability to poverty using cross-sectional data in Indonesia as a case study. Under this method, a household’s consumption distribution is estimated by assuming that the cross-sectional variation reflects inter-temporal variation in the level of consumption. The FGT measures used in poverty assessments are adopted to estimate vulnerability in terms of an expected value of poverty. This method is useful when panel data is rare, especially in poorer developing countries. The authors estimate vulnerability as expected poverty based on a household’s expected consumption level and its consumption variation, assuming that the household’s consumption is log-normally distributed.

According to Chaudhuri, Jalan and Suryahadi (2002), the choice of a vulnerability line is arbitrary. Two vulnerability thresholds are suggested by the authors for measuring vulnerability: the relative vulnerability line and the fixed vulnerability line of 0.5. The first threshold represents the mean vulnerability threshold estimated in terms of the current headcount poverty ratio. The latter represents the high vulnerability threshold. It indicates that a household whose vulnerability level is greater than 50 percent is more likely to be vulnerable to poverty or faces a high chance of becoming poor in the next period of time. Following a two period headcount model proposed by Chaudhuri, Jalan and Suryahadi (2002) and Christiaensen and Boisvert (2000), Pritchett, Suryahadi and Sumarto (2001) extend their method into a multi-period model to measure vulnerability. This measure determines whether households’ expected consumption levels, which are a function of their characteristics and exposure to risks or adverse shocks, are below or above the selected minimum welfare threshold. An application of bootstrap methods is used to calculate consumption distribution based on panel data.

Another widely known method is the “Low Expected Utility” approach introduced by Ligon and Schechter (2002, 2003). The authors propose a method to overcome the problematic structure of the expected poverty approach. Ligon and Schechter (2002)

point out that the poverty based measure of vulnerability using the FGT index has a contradictory implication. They argue that an increase in absolute risk would reduce the vulnerability level of risk averse households where the expected mean consumption is below the poverty line. Instead of using the FGT Index, they propose a utility-based measure of vulnerability. Under this approach, vulnerability is defined as the difference between the household's minimum utility, derived from the certainty equivalent of consumption at or above the poverty line, and the household's expected utility of consumption. This model contains two distinct measures: "random" and "non-random" parts of vulnerability. The first term corresponds to an exposure to aggregate or covariate and idiosyncratic risk. The latter represents a measure of poverty in terms of the difference in utility between a household's poverty line and its expected consumption level. This approach is useful in determining whether vulnerability is a result of covariate or idiosyncratic shocks or the factors underlying poverty. However, this method requires fairly large panel data to estimate the unobservable time-invariant individual effects, the time-effects across households and the observable effects on household's consumption.

A structural and dynamic model proposed by Elber and Gunning (2003) is developed in order to identify the reasons for being vulnerable. Their method can be used to identify whether households are vulnerable because of their exposure to shocks or their inability to cope with them. The authors argue that the estimated vulnerability based on the expected poverty approach cannot capture a large part of the impact of risk on household welfare. Using a stochastic Ramsey model, vulnerability is measured as a shortfall from the welfare attained when a household consumes permanently at the poverty line according to the method of intertemporal utility optimization under uncertainty. The authors find that vulnerability is very sensitive to the time horizon. In addition, the accuracy of existing regression-based vulnerability measures could be improved by including asset ownership in the regression. This method still requires more data exploration and feasibility tests since not many researchers are interested in adopting this model for their empirical analyses on vulnerability. This is possibly because the data required for their model is not normally available. It is quite difficult to collect such data, especially for developing countries where there is a problem with data availability.

All methods discussed above assess household vulnerability as a forward looking one-dimensional welfare measure. In other words, vulnerable households are defined as those who are sensitive to the adverse effect of risks or uncertainty on their current well-being, which causes them to fall below a minimum welfare threshold. According to Guimarães (2007), instead of relying on a specific measure of well-being to assess welfare, vulnerability can be defined as “inadequate material and immaterial conditions to cope with shocks”. In other words, vulnerable households are defined as those with a lack of basic function in life under the risk events or uncertainty. This alternative measure focuses on the exposure to risks and the ability to cope with shocks in terms of social and individual components. This assessment assumes that the behaviours and choices of households are affected by their socio-economic and social conditions. This method generally rejects the behavioural assumption regarding the utility maximization of self-interested individuals in vulnerability analyses. Measures of vulnerability under this conceptual framework are applied by some researchers from a different perspective (Guimarães 2007).

In accordance with this non-monetary measure, Wisner et al. (2003) apply the sustainable livelihood approach in their study from the holistic and dynamic perspective. Vulnerability under this approach is defined as an ability to avoid, endure and regain from shocks. Three components are included in the model under this approach: the risk of exposure; an inability to cope with shocks; and negative acute outcomes. This method goes beyond identifying the poverty status by focusing on the broader perspective of livelihood. However, it still lacks a clear explanation of the precise identification of the vulnerable groups. Moser and McIlwaine (1997) apply an asset-based approach to measure vulnerability to poverty based on household asset portfolios. Their study defines a household economic well-being in terms of asset accessibility. That is, it focuses on an accumulation of various kinds of physical and non-physical assets, such as infrastructure assets, labour assets and housing assets. In other words, vulnerable households are defined as those who lack sufficient assets and this in turn leads to higher exposure to shocks. However, their method does not clearly explain how the composition of households’ asset portfolios affects their probability of becoming poor. In addition, the estimated vulnerability of households using different asset categories can lead to very different conclusions.

Christensen and Boisvert (2000) propose a method to empirically measure household food vulnerability in Northern Mali based on the panel data set. The authors define food vulnerable groups as those who face the risk of becoming undernourished in the next harvest period. A theoretical model is constructed to reflect the impact of the socio-economic characteristics of households on their food vulnerability. Their method estimates households' *ex ante* distributions of future food consumption based on the heteroskedastic regression specification. Their empirical results show that the group of observed undernourished households and the group of vulnerable households, overlap but are not identical. This method is related to the underlying causes of vulnerability and can help in facilitating policies that target poor and vulnerable households. However, some findings obtained from this method still contradict the conventional belief. For instance, education is found to be insignificant in reducing food vulnerability, which seems to be very unusual in rural areas. As a result, more empirical studies are required to investigate vulnerability based on this approach.

Overall, each method proposed by different authors has its own advantages and limitations and requires different assumptions in assessing vulnerability. For example, the expected poverty approach developed by Chaudhuri (2003) and Chaudhuri, Jalan and Suryahadi (2002), which adopted the FGT poverty measures, is suitable for poverty assessments and forward-looking poverty reduction strategies. Even though it cannot capture households' behaviour towards risks, the method can be easily interpreted and is quite simple to apply in terms of techniques and data demand. The utilitarian approach developed by Ligon and Schechter (2002, 2003) can distinguish between households being vulnerable due to poverty and those who are vulnerable because of uninsured covariate and idiosyncratic risk. However, by measuring vulnerability in terms of utility, their estimated results are not easily interpreted by a non-specialist. In addition, the method itself is sensitive to the form of the utility function assumed in a regression model. Therefore, the most appropriate empirical method used in studying vulnerability in any particular country may vary due to different modelling assumptions, an availability of data, the study objectives and hypotheses of a particular research study.

3.2.2 Determinants of Vulnerability to Poverty

A vulnerability profile describes only the pattern of vulnerability, but does not explain its causes. To explain why some people are highly vulnerable to poverty, it is necessary to identify the key determinants of vulnerability. Regression analysis is commonly undertaken to determine the effects of demographic, socio-economic and institutional characteristics of households on their chances of falling deeper into poverty in the future. A number of regression techniques have been proposed and applied to find the causes of vulnerability related to poverty in the literature, based on various types of data available and concepts of vulnerability.

Jalan and Ravallion (1998) use probit regressions to analyse the determinants of household vulnerability in rural China. Their method measures vulnerability in terms of two poverty components: “chronic” poverty and “transient” poverty. The transient component represents inter-temporal variability in consumption or vulnerability due to covariate or idiosyncratic shocks. The chronic component represents expected values of consumption over time or vulnerability due to factors underlying poverty. In other words, an aggregate inter-temporal poverty measure for a particular household is the sum of the chronic and transient components. The authors examine the impacts of physical capital and demographic characteristics of households on each poverty component separately, using semi-parametric censored quantile regression methods. Their method has been replicated by Derkon and Krishnan (2000) and Cruces and Wodon (2007) in estimating vulnerability due to income variability. Similar results are obtained from both studies in which both types of vulnerability are reduced by an increase in the household’s average wealth and landholding. Their results show that household size and education levels and health conditions in households are the most important factors affecting chronic poverty. However, these factors only have limited influence on transient poverty.

Education and elderly occupants are found to be very significant determinants of household vulnerability to poverty. Gerry and Li (2002) apply quantile regressions to analyse the effects of household characteristics on household vulnerability during the 1998 Russian financial crisis, using changes in consumption as a proxy to measure vulnerability. They find that the less educated individuals who live in urban areas and those who live in households with a large number of pensioners are the most

vulnerable during a crisis. In addition, an increase in home production is found to be a significant factor in reducing vulnerability among those who suffer the largest changes in consumption.

Rural households seem to be more vulnerable to climate shocks. Christiaensen and Subbarao (2004) study vulnerability in rural Kenya based on pseudo panel data derived from repeated cross sections. Their methodology is similar to the method proposed by Chaudhuri (2003), which estimates vulnerability in terms of expected poverty. They find that rural households in Kenya face a probability of 39 percent of falling below the poverty line in the future. Large rainfall volatility is found to be a crucial factor that increases vulnerability of residents in arid areas, while malaria causes household vulnerability to rise in non-arid areas.

Furthermore, household income, number of children and the household head's occupation are found to significantly affect a household's vulnerability level. Corbacho, Garcia-Escribano and Inchauste (2007) use the panel data obtained from the Argentine Permanent Household Survey to identify which households are more vulnerable to the Argentine macroeconomic crisis between 1999 and 2002. Their study analyses the determinants of household vulnerability in terms of changes in household income variability over time. Their results suggest that the most vulnerable households are those whose household heads are male with low educational attainment and households with a high dependency ratio. The household head's occupation also has a strong influence on vulnerability. In the Philippines, household heads who are employed in the private sector are more likely to suffer from vulnerability than those who work in the public sector.

In Thailand, theoretical and empirical studies of determinants of vulnerability at household level are at best scant. There exists only one study, conducted by Bidani and Richer (2001) that analyses the vulnerability profile of Thailand. No study has been conducted to analyse the determinants of household vulnerability to poverty in Thailand. Bidani and Richer (2001) adopt the method of Chaudhuri (2000) to estimate household vulnerability in 1996, 1998 and 1999. Expected household consumption and its variance are estimated by the Feasible Generalized Least Squares (FGLS) method. Households are classified as high or low vulnerable if their likelihood of falling into poverty is greater or less than 0.5. Three different

vulnerability lines are used to investigate the sensitivity of estimation: a fixed threshold of 0.089 of poverty incidence in 1996; a poverty headcount ratio threshold; and a fixed threshold of 0.5. Their findings show that the household vulnerability level was very high in 1998, indicating that the number of vulnerable households dramatically increased after the financial crisis. Education of the household heads and geographic location of households are found to correlate with household poverty and vulnerability. Household heads with education at less than elementary level tend to suffer most from poverty and vulnerability. Vulnerable households and those who are currently poor are concentrated in the rural Northeast region, where most of the population is small-scale farmers.

Overall, most existing studies on determinants of vulnerability to poverty show that educational attainment, number of children and the elderly, household head's occupation, land ownership and geographic location are the key determinants of vulnerability to poverty. In Thailand, according to Bidani and Richer (2001), an increase in household vulnerability after the crisis is highly concentrated among the Northeast and rural North residents. Considering the household head's occupation, vulnerability is highest among farmers in the pre-crisis period, while pensioners are the most vulnerable in the post-crisis period. Regarding the regression techniques used in analysing the determinants of vulnerability, the quantile regression method and bivariate or ordered probit/logit regressions are broadly utilised by numerous researchers in the literature.

3.3 Approaches of Measuring Vulnerability to Poverty

This section provides a review of the major methods used in measuring vulnerability in the poverty literature. According to Hoddinott and Quisumbing (2003), three main approaches are widely used in existing studies as the *ex ante* measurement of vulnerability to poverty. Each approach is constructed based on different concepts of vulnerability.

3.3.1 Measuring Vulnerability as Expected Poverty

This method has been extensively used by many authors (See Pritchett, Suryahadi and Sumarto 2000; Chaudhuri, Jalan and Suryahadi 2002; Christiansen and Subbarao 2005). Under this approach, vulnerability is measured as expected poverty. Pritchett,

Suryahadi and Sumarto (2000) define vulnerability to poverty as the probability of falling into poverty in the future. According to Chaudhuri, Jalan and Suryahadi (2002), vulnerability to poverty is defined as the probability of being poor at time $t + 1$, given a household's socio-economic characteristics at time t . To measure vulnerability in terms of expected poverty, the poverty index for a household h at time t is defined by Chaudhuri (2003) as

$$p_{ht} = \frac{u(z) - u(C_{ht})}{|u(z)|} \quad (3.1)$$

where z is a pre-selected poverty line, C_{ht} is consumption of household h at time t and $u(\cdot)$ is an increasing function in the following form:

$$u(c) = z^\alpha - (\max\{0, z - c\})^\alpha \quad (3.2)$$

Based on the Foster-Greene-Thorbecke (FGT) poverty measure, equation (3.1) can be reduced as follows

$$p_{\alpha,ht} = \left(\max\left\{0, \frac{z - c_{ht}}{z}\right\} \right)^\alpha \quad (3.3)$$

where $\alpha = 0, 1, 2$, etc. When $\alpha = 0$, the poverty index indicates whether a household is poor. The poverty index represents the poverty gap ratio and the squared poverty gap when α is equal to 1 and 2 respectively.

Letting V_{ht} be the probability of expected poverty of household h at time t , the functional form of vulnerability can be written as

$$V_{\alpha,ht} = F(z) \int_c^z \left(\frac{z - c_{h,t+1}}{z} \right)^\alpha \frac{f(c_{h,t+1})}{F(z)} dc_{h,t+1} \quad (3.4)$$

where $c_{h,t+1}$ is the household's consumption level at time $t+1$ and $f(c_{h,t+1})$ is the density function of $c_{h,t+1}$

The household's inter-temporal consumption function, depending on household characteristics, can be generated as

$$c_{ht} = c(X_h, \beta_t, \alpha_h, e_{ht}) \quad (3.5)$$

where X_h is a set of observable household characteristics, β_t is a vector of parameters indicating the state of economy at time t , α_h is a time-invariant unobservable household effect, and e_{ht} is the error term which represents households' idiosyncratic shocks.

Substituting equation (3.5) into (3.4), a household's vulnerability can be expressed as

$$v_{ht} = E[p_{\alpha,h,t+1}(c_{h,t+1})|F(c_{h,t+1}|X_h, \beta_t, \alpha_h, e_{ht})] \quad (3.6)$$

The above equation implies that vulnerability is a non-linear function of a household's future consumption, which in turn depends on its expected consumption and variance. This model allows for heteroskedasticity by assuming the difference in the variance of the disturbance term. To address the problem of heteroskedasticity that may cause bias in the estimates of parameters, the variance of the disturbance term is allowed to depend on particular household characteristics as follows:

$$\ln \sigma_{\ln c_{h,t}}^2 = X_{ht}\gamma + Z_h\delta \quad (3.7)$$

where X_{ht} represents the observable time-varying household characteristics and Z_h is the time-invariant household characteristics. The parameters γ and δ are estimated from the following equation:

$$\ln \hat{e}_{ht}^2 = X_{ht}\gamma + Z_h\delta + u_{ht} \quad (3.8)$$

Assuming that household consumption is log-normally distributed, vulnerability to poverty of household h at time t is generated as

$$\begin{aligned} \hat{v}_{0,ht} &= \widehat{Pr}(\ln c_{h,t+1} < \ln z | \hat{\mu}_{\ln c_{h,t+1}}, \hat{\sigma}_{\ln c_{h,t+1}}^2) \\ &= \Phi\left(\frac{\ln z - \hat{\mu}_{\ln c_{h,t+1}}}{\hat{\sigma}_{\ln c_{h,t+1}}}\right) \end{aligned} \quad (3.9)$$

where $\Phi(\cdot)$ denotes the cumulative density of the standard normal of $\hat{v}_{0,ht}$, $\hat{\mu}_{\ln c_{h,t+1}}$ being the mean of log consumption at time $t+1$ and $\hat{\sigma}_{\ln c_{h,t+1}}^2$ is its variance at time $t+1$.

Chaudhuri (2003) claims that, by utilizing Foster-Greer-Thorbecke (FGT) poverty measures as the base for measuring vulnerability, this approach produces results which are “more easily interpreted and explicated than the utility-based measures”. Subsequently, this method benefits the implementation of pro-poor targeted policy by identifying the vulnerable households that will tend to fall below the poverty line in the near future. However, Ligon and Schetcher (2003) argue that this approach based on the FGT poverty index is problematic. They point out that increasing risk when $\alpha = 1$ would result in no change in household vulnerability. On the other hand, increasing risk when $\alpha = 0$ shows a decline in household vulnerability. This perverse outcome may lead to the fallacy of poverty policy. To overcome this drawback, the authors propose an alternative model based on the “ Expected Low Utility” approach for measuring vulnerability.

3.3.2 Measuring Vulnerability as Expected Low Utility

This method, proposed by Ligon and Schechter (2003), defines household vulnerability in the following form:

$$V_i = U_i(z) - EU_i(c_i) \quad (3.10)$$

where U_i is a strictly increasing and weakly concave function, z is some certainty-equivalent consumption, which is analogous to the pre-selected poverty line, and c_i is consumption expenditure of household i .

According to Ligon and Schechter (2003), household i is considered to be vulnerable if its consumption expenditure, c_i , is below the certainty-equivalent consumption, z . Household vulnerability under this model depends on the mean of household consumption and its variance. To illustrate the risk that household i faces in falling into poverty, this equation is re-written as:

$$V_i = [U_i(z) - U_i(Ec_i)] + [U_i(Ec_i) - EU_i(c_i)] \quad (3.11)$$

That is, household vulnerability is measured as the difference between utility z and household i 's expected utility, c_i , plus the risk that a household faces. The second

term on the right of equation (3.11), which represents household poverty risk, can be further derived in terms of the aggregate and idiosyncratic risks as follows:

$$\begin{aligned}
V_i &= [U_i(z) - U_i(Ec_i)] \quad (\text{poverty}) \\
&+ \{U_i(Ec_i) - EU_i[c_i|\bar{x}]\} \quad (\text{aggregate risk}) \\
&+ \{EU_i[E(c_i|\bar{x})] - EU_i(c_i)\} \quad (\text{idiosyncratic risk}) \quad (3.12)
\end{aligned}$$

where $E(c_i|\bar{x})$ is the expected value of consumption conditional on a vector of aggregate variables x_t . According to Hoddinott and Quisumbing (2003), an estimate of aggregate vulnerability can be generated by aggregating all households as follows:

$$\begin{aligned}
V_i &= (1/N) \sum_i^N \{ [U_i(Z) - U_i(Ec_i)] + [U_i(Ec_i) - EU_i[E(c_i|x_t)]] \} \\
&+ \{ EU_i[E(c_i|x_t)] - EU_i(c_i) \} \quad (3.13)
\end{aligned}$$

Equation (3.13) can be used to assess the impact of factors underlying poverty, covariate shocks and idiosyncratic shocks on household vulnerability. Since household vulnerability is measured in terms of utility under this method, the results vary according to the form of the utility function. Ligon and Schechter (2003) assume that the following form of utility function is used in their study:

$$U_i(c) = \frac{c^{1-\gamma}}{1-\gamma} \quad (3.14)$$

The function U_i becomes more sensitive to both risk and inequality when the parameter γ , which represents the household's coefficient of relative risk aversion, increases. Based on the microeconomic literature, the authors take $\gamma=2$ in their estimation. To estimate risks by relying on variation over time, they assume that

$$E[c_i^i | \bar{X}_t, X_t^i] = \alpha_i + \eta_t + X_t^{i'} \beta \quad (3.15)$$

Where c_t^i is household i 's consumption at time t , α_i denotes the unobservable household's time-invariant effects, η_t represents the household's time effects and β is the effects of observable household characteristics on its consumption. These

parameters are estimated using panel data. According to Ligon and Schechter (2003), to avoid possible measurement error, idiosyncratic risk can be broken into two components: the risk due to variation in observable time-varying household characteristics and the risk due to variation in unobservable household characteristics, namely the measurement error in consumption. The breakdown is written as follows:

$$\begin{aligned}
V_i &= [U_i(Ec) - U_i(Ec_t^i)] && \text{(Poverty)} \\
&+ \{U_i(Ec_t^i) - EU_i[c_t^i|\bar{x}_t]\} && \text{(Aggregate risk)} \\
&+ \{EU_i[E(c_t^i|\bar{x}_t)] - EU_i(c_t^i|\bar{x}_t, x_t^i)\} && \text{(Idiosyncratic risk)} \\
&+ \{EU_i[E(c_t^i|\bar{x}_t, x_t^i)] - EU_i(c_t^i)\} && \text{(Unexplained risk} \\
&\quad \text{and measurement error)}
\end{aligned} \tag{3.16}$$

Since this method measures vulnerability based on a specific functional form of utility, vulnerability is measured in terms of the difference between the average household's utility and what it would be if all inequality and risks in household consumption were eliminated. Hoddinott and Quisumbing (2003) argue that this expression of vulnerability in utility units may be difficult to understand for policy makers who are "not used to the language of economics." Subsequently, Elbers and Gunning (2003) point out that this model relies on a very strong homogeneity assumption of consumption distribution and does not capture the effects of risk on household saving and investment.

Furthermore, according to Christiansen and Subbarao (2005), this method proposed by Ligon and Schechter (2003) only makes sense if individual risk attitudes can be estimated empirically and risk aversion should not be overestimated by standard risk analysis. They suggest that vulnerability should be measured by determining the depth of consumption shortfalls across households regardless of their risk preference. In addition, the focal axiom of poverty measurement proposed by Sen (1976) states that any information related to income/consumption of the non-poor should be disregarded. As a result, Ligon and Schechter (2003) opt out the states of the world, where the household's expected consumption level at time $t+1$ is greater than the

certainty equivalent consumption, to avoid underestimation of vulnerability due to violation of the focal principle in their study.

3.3.3 Measuring Vulnerability as Uninsured Exposure to Risk

The third approach which defines vulnerability as uninsured exposure to risk has been applied to empirical analysis of vulnerability by many researchers (See Glewwe and Hall 1998; Jacoby and Skoufias 1998; Dercon and Krishnan 2000; Hoddinott and Kinsey 2001). This method defines household vulnerability as their inability to deal with shocks by smoothing consumption over time. According to Hoddinott and Quisumbing (2003), several models have been constructed by many authors to measure vulnerability as uninsured exposure to risk. The general form given in Hoddinott and Quisumbing (2003) is:

$$\Delta \ln c_{htv} = \sum_i \lambda_i S(i)_{tv} + \sum_i \beta_i S(i)_{htv} + \sum_{tv} \delta_v (D_v) + \gamma X_{htv} + \Delta \varepsilon_{htv} \quad (3.17)$$

where $\Delta \ln c_{htv}$ denotes per capita consumption growth rate of household h at time t , $S(i)_{tv}$ is covariate shocks, $S(i)_{htv}$ is idiosyncratic shocks, D_v is a set of community dummies and $\Delta \varepsilon_{htvt}$ is a household-specific error term. Lastly, λ , β , δ and γ , are vectors of parameters to be estimated.

The focal point is the estimated parameters of λ and β , which represent the effect of covariate and idiosyncratic shocks respectively. To quantify and combine the total effect of both shocks, Tesliuc and Lindert (2002) generate the following equation:

$$\Delta \ln c_{htv} = \alpha + \beta \Delta \ln y_{htv} + \gamma \Delta (\overline{\ln y_{vt}}) + \delta X_{htv} + \Delta \varepsilon_{htv} \quad (3.18)$$

where $\Delta (\ln y_{htv})$ denotes the household income growth rate and $\Delta (\overline{\ln y_{vt}})$ represents the average community income growth rate which replaces $\sum_i \lambda_i S(i)_{tv}$ and $\sum_i \beta_i S(i)_{htv}$ in equation (3.17).

An increase in the estimated of β implies a higher level of consumption vulnerability to income risk. The prediction of complete risk sharing when $\beta = 0$ is empirically verified and found to be very low or close to zero and frequently rejected in the literature. This indicates that the growth rate of household consumption is related to the growth rate of its income, but less than what it would be under the no risk-sharing

hypothesis (Hoddinott and Quisumbing 2003). Jadott (2011) argues that this approach may contain misleading results under some conditions. For instance, the non-poor households that own a large share of stocks in the market may be considered vulnerable by this method because of their accumulated wealth in risky assets. Furthermore, when there is a low fluctuation in the lower tail of the distribution, the poor with high probability of adverse shocks may be considered non-vulnerable. To precisely estimate vulnerability, Hoddinott and Quisumbing (2003) point out that this approach requires a large panel survey data, which includes at least three or four repeated observations. The data also has to contain information on both income and consumption of households. However, this type of data is not easily collected and usually unavailable in developing countries.

3.4 Methodology and Data

This section explains the approaches to measure vulnerability to poverty and analyse determinants of vulnerability to poverty, using three years of household Socio-Economic Survey data collected by the Thailand National Statistical Office.

3.4.1 Measuring Vulnerability to Poverty

This study utilizes the method proposed by Chaudhuri, Jalan and Suryahadi (2002) and Chaudhuri (2003) for measuring household vulnerability to poverty because the only available data set is a cross-sectional survey for a relatively large sample of households. The household vulnerability at time t is defined as the probability of its consumption being below poverty line (z) at time $t + 1$ which can be written as

$$V_{it} = \Pr(\ln c_{i,t+1} < \ln z) \quad (3.19)$$

The consumption (c_i) function is estimated as:

$$\ln c_i = \beta_0 + \beta_1 X_i + e_{it} \quad (3.20)$$

where $\ln c_i$ is log of *per capita* household consumption; X_i is a set of household characteristics, β is a vector of parameters, and e_i is a disturbance term which captures the idiosyncratic shocks on household consumption. The variance of e_i can be defined as

$$\sigma_{e_i}^2 = \theta_0 + \theta_1 X_i + \eta_{it} \quad (3.21)$$

where β and θ are estimated using a three-step FGLS.

The expected log consumption and the variance of log consumption are computed as

$$\widehat{E}[\ln c_i | X_i] = \widehat{\beta}_0 + \widehat{\beta}_1 X_i \quad (3.22)$$

$$\widehat{V}[\ln c_i | X_i] = \widehat{\sigma}_{e_i}^2 = \widehat{\theta}_0 + \widehat{\theta}_1 X_i \quad (3.23)$$

Assuming that consumption is log-normally distributed, the estimates of vulnerability are generated as

$$\widehat{V}_i = \Pr(\ln c_{i,t+1} < \ln z | X_i) = \Phi\left(\frac{\ln z - X_i \widehat{\beta}}{\sqrt{X_i \widehat{\theta}}}\right) \quad (3.24)$$

where \widehat{V}_i is vulnerability to poverty of household i at time t , $c_{i,t+1}$ is the consumption of household i at time $t+1$, z stands for the poverty line of household consumption and $\Phi(\cdot)$ denotes the cumulative density of the standard normal distribution. This equation implies that \widehat{V}_i represents the probability that the per capita consumption level will be lower than the poverty line conditional on household characteristics X_i .

Estimation of household vulnerability to poverty under this approach depends on the choice of poverty thresholds, the expected log of household consumption, the expected variability of log household consumption and the distributional assumption of normality of log household consumption. In other words, the lower the level of expected consumption and variability of expected consumption the higher the level of household vulnerability to poverty.

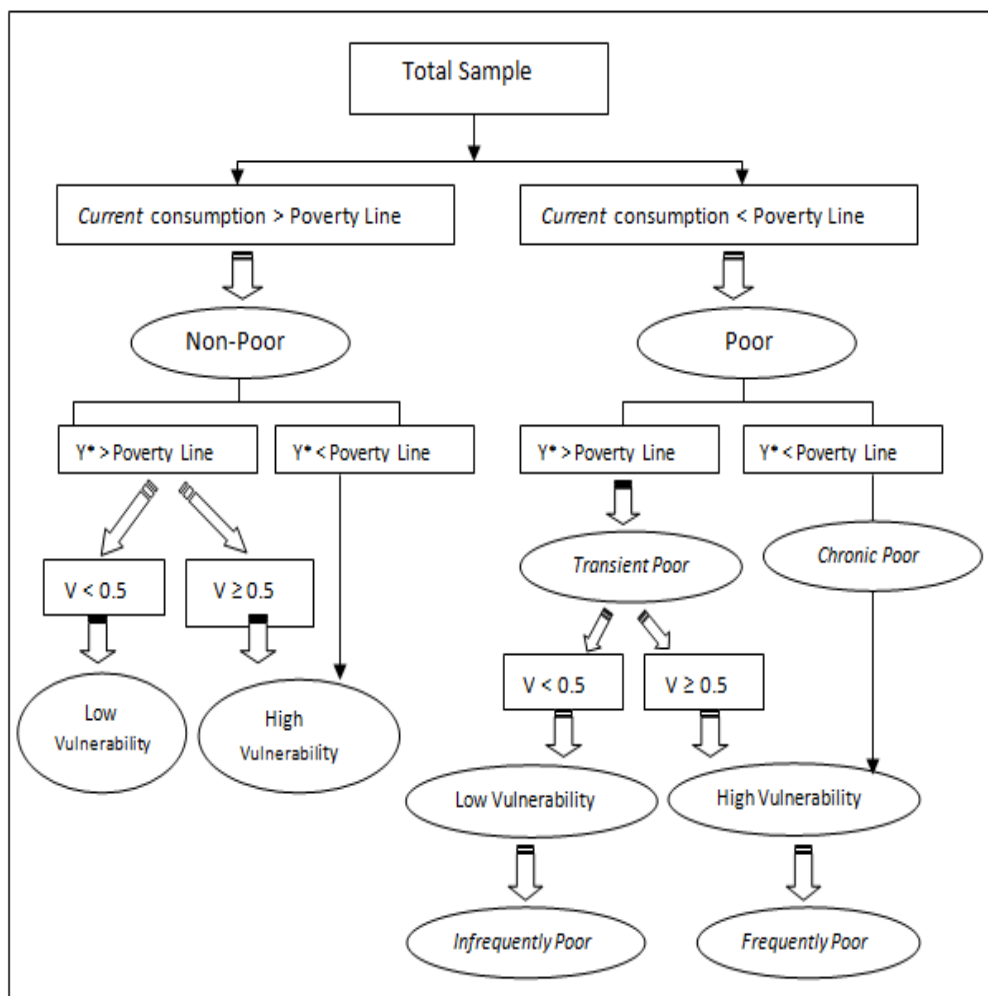
3.4.2 The Classification of Poverty and Vulnerability

The classification scheme of poverty and vulnerability in this study is based on the studies on vulnerability to poverty proposed by Bidani and Richter (2001) and Suryahadi and Sumarto (2003). A threshold of 0.5 represents a 50 percent likelihood of falling into poverty each year. This threshold is widely used as a common vulnerability threshold in most empirical studies. As shown in Figure 3.1, a household is classified as “chronic poor” if its present and expected consumption is less than the poverty line. The current poor household is classified as “transient poor” if its expected consumption (Y^*) is greater than the poverty line. This group is

further divided into two subgroups. The first subgroup refers to those who face high vulnerability, a greater than 0.5 likelihood of falling into poverty, namely the “frequently poor”. The second subgroup refers to those who face low vulnerability, a lesser than 0.5 likelihood of falling into poverty, namely the “infrequently poor”.

Non-poor households with a likelihood of falling into poverty equal or greater than 0.5 are considered to be highly vulnerable to poverty. On the other hand, those who have a likelihood of falling into poverty less than 0.5 are defined as low vulnerable.

Figure 3.1: Classification of Household Poverty and Vulnerability



Source: Adopted from Bidani and Richter (2001) and Suryahadi and Sumarto (2003).

3.4.3 Determinants of Household Vulnerability to Poverty

Poverty is distinct from, but closely related to vulnerability. Two regression models are constructed to examine whether the factors that significantly affect poverty also

affect vulnerability. Firstly, an OLS regression model is used to estimate the causes of vulnerability to poverty as follows:

$$\hat{V}_{it} = X_i\delta + \mu \quad (3.25)$$

where \hat{V}_i is the estimated vulnerability to poverty for household i by equation (3.24), X_i is the vector of household idiosyncratic characteristics, δ is the vector coefficient and μ is the error term.

The next step is to examine the determinants of poverty, using a probit regression model. A binary variable, which represents whether household consumption per capita is below the poverty line, is regressed on a set of explanatory variables as shown in equation (3.26). The regression estimates allow us to see how change in each explanatory variable affects a household's probability of being poor, holding all other influences constant. The model is expressed in the following form:

$$y = \Phi(\alpha + \sum \beta_i X_i + e) \quad (3.26)$$

where

$y = 0$ if household is non-poor; $y = 1$ if household is poor

Φ = Cumulative density function for the standard normal curve

β_i = Regression coefficient of each explanatory variable

X_i = Independent variables

e = Error term

A comprehensive list of explanatory variables is grouped into the following categories in the model of determinants: “property-related”, such as land ownership and fixed assets; “household characteristics”, such as household size, dependency ratio, age and gender of household head and educational attainment; and “others”, such as geographic location. Most of these explanatory variables are qualitative. The education variable is divided into categories, which are “university”, “high school”, “secondary school”, “primary school” and “less than primary school”.

This study carries out separate probit regressions for urban and rural areas. Using dummy variables for urban and rural areas as a method to deal with structural

differences can be limited. It forces a similar coefficient on all other variables and only allows for differences in level. The patterns of correlation between poverty and specific characteristics are not always ‘structurally’ the same for different groups. For example, the impact of education and land ownership might be different between rural and urban areas. In this case, we need to carry out separate regressions for the different groups. This allows us to have ‘structurally’ different regressions.

3.4.4 Sensitivity Analysis: Estimating vulnerability with different thresholds

This study assesses the sensitivity of estimated household vulnerability to poverty, using various choices of poverty threshold in Equation (3.24). To examine the sensitivity of the vulnerability estimator, two vulnerability lines and four poverty lines are used in this study. Even though the choice of vulnerability lines is arbitrary, a vulnerability line of 0.5 and a relative vulnerability line are suggested by Chaudhuri, Jalan and Suryahadi (2002) as the most possible and appropriate thresholds in estimating vulnerability to poverty. The first one represents the high vulnerability threshold in which a household whose vulnerability level greater than 0.5 is considered as highly vulnerable. The latter represents the mean vulnerability, which is simply the observed poverty headcount.

Regarding the choice of poverty lines, this study uses two different official poverty lines and two common international standard poverty lines of US\$1.08 PPP (Purchasing Power Parity) and US\$2 PPP, established by the World Bank in a supplement to the World Development Indicators (1993). The two official poverty lines are the “national poverty line” and the “household specific poverty line”. They are calculated according to the method proposed by the National Economic and Social Development Board of Thailand (NESDB 1998). The national poverty line represents the country’s average basic minimum needs in terms of baht per person per month. The household specific poverty line is calculated in terms of baht per month of each household and depends on occupant age, gender composition and region.

3.4.5 Data Sources

This study uses the ‘*Household Socio-Economic Survey*’ (SES) collected by the National Statistical Office of Thailand in the years 1996, 2002 and 2010 (NSO 1996a, 2002, 2010). More than 30,000 households in rural and urban areas are

interviewed each year from all regions of the country. The survey contains various kind of information on household and community characteristics, such as age, gender, household size, education, employment, health, assets and liabilities, income, consumption, mobility, geographic location and government support programs. The SES is conducted based on a two-stage stratified random sampling process. The primary sampling units are blocks for municipal areas and villages for non-municipal areas. The secondary sampling units are private households. In the SES, households are distributed over two sectors: municipal areas (urban) and non-municipal areas (rural). The survey is designed to give each household an equal probability of being selected within each sector, but not between them. Since municipal households are less expensive to survey, they are over-represented. On the other hand, households in villages are under-represented (Deaton 1989). Regarding the adjustment of sample weights, the following weight is calculated by the NSO:

$$\text{Weight} = \frac{1}{m_{hki}} \cdot \left(\frac{N_{hkij}}{n_{hkij}} \cdot \frac{1}{P_{hkij}} \right) \cdot \frac{H''_{hki}}{H'_{hki}} \cdot \frac{1}{1000} \quad (3.27)$$

where

N_{hkij} = Number of all households in block/village

n_{hkij} = Number of sample households

P_{hkij} = Probability of household being chosen

H' and H'' = Projections of households

There are five standard regions: Bangkok, Central, North, Northeast and South. Tables 3.1, 3.2 and 3.3 provide the weight characteristics of Thai household data by areas in 1996, 2002 and 2010 respectively. Definition and statistical description of variables included in the regression models in 1996, 2002 and 2010 are given in Appendix 3.1, 3.2 and 3.3 respectively. The explanatory variables are chosen based on the key determinants found in the literature review on the determinants of poverty and vulnerability to poverty. Most selected variables are qualitative data called dummy variables, such as education level and regional location. The raw data is converted from plain ACII text files into CSV (Comma Separated Values) formats. The parameters are estimated by STATA software package version 11.

Table 3.1: Weight Characteristics of Thai Household data by Area in 1996

Variable Description:	SES 1996		
	National	Urban	Rural
Sample size (households)	25,226	14,067	11,159
Monthly Expenditure per capita (Mean)	2,627.6	4,027.6	1,906.9
Household size (Mean)	3.80	3.42	3.91
Age of head of household (Mean)	47.23	43.95	48.72
Head of household is female	10,625	5,533	5,092
Household head's highest education is primary school	18,765	10,642	8,123
Household head's highest education is secondary school	3,206	1,955	1,251
Household head's highest education is high school	2,782	1,669	1,113
Household head's highest education is university	2,071	1,725	346
Household's fixed asset values in million baht (Mean)	0.014	0.018	0.012
Cultivated land owned by households in Rai* (Mean)	2.55	2.46	3.82
Socio-economic class is a very small farm operator - mainly own land from 5 to 19 Rai	645	156	489
Socio-economic class is a small farm operator - mainly own land from 20 to 39 Rai	2,476	794	1,682
Socio-economic class is a medium farm operator - mainly own land more than 40 Rai	349	142	207
Socio-economic class is a farm operator, mainly rent land	1,113	218	895
Socio-economic class is a landless farm worker or general labourer	2,105	571	1,534
Socio-economic class is a professional, technician & manager	3,814	2,836	978
Socio-economic class is an entrepreneur	2,285	1,306	979
Household living in Bangkok	1,905	1,905	-
Household living in Central	6,575	3,266	3,309
Household living in North	5,608	2,984	2,624
Household living in Northeast	7,031	3,706	3,325
Household living in South	4,107	2,205	1,902
Household Living in rural areas	11,159	-	-
Household Living in urban areas	14,067	-	-

Note: * 1 Rai = 0.34 acre

Table 3.2: Weight Characteristics of Thai Household data by Area in 2002

Variable Description:	SES 2002		
	National	Urban	Rural
Sample size (households)	34,785	21,565	13,220
Monthly Expenditure per capita (Mean)	3,419.30	4,045.93	2,397.11
Household size (Mean)	3.41	3.29	3.62
Age of head of household (Mean)	48.94	48.16	50.21
Head of household is female	10,452	6,830	3,622
Household head's highest education is primary school	21,830	11,927	9,903
Household head's highest education is secondary school	4,875	3,617	1,258
Household head's highest education is high school	3,218	1,930	1,288
Household head's highest education is university	3,135	2,730	405
Household's fixed asset values in million baht (Mean)	0.026	0.031	0.022
Cultivated land owned by households in Rai* (Mean)	2.27	2.03	3.65
Socio-economic class is a very small farm operator - mainly own land from 5 to 19 Rai	872	281	591
Socio-economic class is a small farm operator - mainly own land from 20 to 39 Rai	2,252	648	1,604
Socio-economic class is a medium farm operator - mainly own land more than 40 Rai	608	139	469
Socio-economic class is a farm operator, mainly rent land	1,218	349	869
Socio-economic class is a landless farm worker or general labourer	1,868	609	1,259
Household head is a professional, technician & manager	4,857	3,093	1,764
Household's socio economic class is an entrepreneur	3,014	1,975	1,039
Household living in Bangkok	1,946	1,946	-
Household living in Central	10,367	6,036	4,331
Household living in North	7,971	4,657	3,314
Household living in Northeast	9,043	5,931	3,112
Household living in South	5,458	2,995	2,463
Household Living in rural areas	13,220	-	-
Household Living in urban areas	21,565	-	-

Table 3.3: Weight Characteristics of Thai Household data by Area in 2010

Variable Description:	SES 2010		
	National	Urban	Rural
Sample size (households)	44,273	27,448	16,825
Monthly Expenditure per capita (Mean)	4,351.57	5,148.48	3,050.65
Household size (Mean)	3.26	3.08	3.45
Age of head of household (Mean)	48.75	49.82	49.35
Head of household is female	13,302	8,693	4,609
Household head's highest education is primary school	23,784	15,180	8,604
Household head's highest education is secondary school	6,204	4,603	2,904
Household head's highest education is high school	3,726	2,293	1,433
Household head's highest education is university	3,232	1,758	1,474
Household's fixed asset values in million baht (Mean)	0.038	0.042	0.028
Cultivated land owned by households in Rai* (Mean)	2.15	1.94	3.47
Socio-economic class is a very small farm operator - mainly own land from 5 to 19 Rai	945	230	715
Socio-economic class is a small farm operator - mainly own land from 20 to 39 Rai	2,635	842	1,793
Socio-economic class is a medium farm operator - mainly own land more than 40 Rai	846	177	669
Socio-economic class is a farm operator, mainly rent land	1,750	543	1,207
Socio-economic class is a landless farm worker or labourer	2,235	775	1,460
Socio-economic class is a professional, technician & manager	5,096	3,143	1,953
Socio-economic class is an entrepreneur	5,163	3,754	1,409
Household living in Bangkok	2,676	2,676	-
Household living in Central	11,195	7,483	5,512
Household living in North	10,145	5,927	4,218
Household living in Northeast	12,509	7,548	4,961
Household living in South	7,748	4,814	2,934
Household Living in rural areas	16,825	-	-
Household Living in urban areas	27,448	-	-

3.4.6 Diagnostic Tests for Regression Analysis

In the first stage, several regressions are modelled and examined by removing and adding a few selected variables until the final model is found. To obtain the best-fit model, the following diagnostic tests are utilised to examine multicollinearity, model specification error, goodness of fit and heteroskedasticity in the probit and OLS determinant models:

Multicollinearity

The Variance Inflation Factor (VIF) for selected quantitative explanatory variables is computed to examine multicollinearity in the determinant models of vulnerability. Multicollinearity occurs when two or more predictor variables in a linear regression model are highly correlated, leading to unreliable or insignificant estimates of regression coefficients. According to Wooldridge (2000), the variance of the OLS estimator for a typical regression coefficient, β_i , is defined as:

$$Var(\hat{\beta}_i) = \frac{\sigma^2}{S_{ii}(1-R_i^2)} \quad (3.28)$$

where $S_{ii} = \sum_{j=i}^n (X_{ij} - \bar{X}_i)^2$ and is the unadjusted R_i^2 when X_i is regressed against all other quantitative explanatory variables. If there is no linear relation between X_i and other quantitative explanatory variables, R_i^2 will be zero and the variance of $\hat{\beta}_i$ will be $\frac{\sigma^2}{S_{ii}}$. The VIF and tolerance are obtained by dividing the above expression for $Var(\hat{\beta}_i)$ as follows:

$$VIF(\hat{\beta}_i) = \frac{1}{(1-R_i^2)} \quad (3.29)$$

$$\text{Tolerance}(\hat{\beta}_i) = \frac{1}{VIF} = 1 - R_i^2 \quad (3.30)$$

According to O'Brien (2007), the VIF and tolerance are the most widely used measure of multicollinearity with a lower boundary of 1 and no upper boundary. The VIF of 10, or the tolerance of 0.10, are the most common rule of thumb that reflects a cut-off point of serious multicollinearity. The higher the VIF, or the lower the tolerance, the greater the chance that β_i becomes insignificant. For example, a VIF of 1.6 implies that the variance of a particular coefficient is 60 percent larger than it

would be if that predictor was not completely correlated with all other explanatory variables. With a very large sample size, multicollinearity should not be a serious problem when the model is correctly specified. In this study, using the STATA software package, the mean VIF for the probit determinant model (known as the “collin” command) and the mean VIF for the OLS determinant model (known as the “vif” command) are estimated to be approximately 4.75 and 3.62 respectively. This indicates that there is no sign of severe multicollinearity in either model.

According to Mitiku, Fufa and Tadese (2012), multicollinearity among qualitative variables is detected by computing the Contingency Coefficients for dummy variables from the following equation:

$$C = \sqrt{\frac{\chi^2}{n+\chi^2}} \quad (3.31)$$

where C denotes the contingency coefficients, χ^2 is a chi-square random variable and n is the number of observations.

The computed contingency coefficients of dummy variables included in the determinant models in this study are around 0.543. A pair of qualitative variables with contingency coefficient value below 0.75 indicates weak association of variables (Mitiku, Fufa and Tadese 2012). Therefore, the association among selected dummy variables in the model does not show signs of strong multicollinearity. The next step is testing for a model specification error.

Model Specification Error

Model specification errors can occur due to omitted variables, incorrect functional form or including an irrelevant variable in a regression model. There are several tests to detect a model specification error, such as a standard F-test, the Ramsey’s RESET Test, the likelihood Ratio Test, the Lagrange Multiplier (LM) Test, the Wald Test and the Hausman Test. In this study, using the STATA software package, the link Test and the Ramsey’s RESET Test are used to detect model specification error. The Link Test (known as the “linktest” command) is a specification test of the dependent variable. This test generally creates two new variables, which are the variable of prediction and the variable of squared prediction. If the model is correctly specified, when the dependent variable is regressed on the prediction and the prediction

squared, the prediction squared should have no explanatory power and the prediction should be significant.

The Ramsey's RESET Test (known as the "ovtest" command in STATA) normally performs a regression specification error test for omitted variables. If the model is specified properly, the null hypothesis that the model has no omitted variables should not be rejected. In this study, the "linktest" on the final determinant models is found to be insignificant because the p-values of the squared predictions in both models are greater than 0.10. This implies that the test has failed to reject the assumption that the model is specified correctly at the 1% level. In addition, the p-values obtained from the ovtest are greater than 0.05 in both models. This implies that the test has also failed to reject the assumption that the final models have no omitted variable at the 5% level.

Heteroskedasticity

The problem of heteroskedasticity occurs when the error terms do not have constant variance due to several reasons, such as measurement errors, model misspecifications and an increase in the size of errors when the value of an independent variable becomes larger. For an OLS model of determinants, assuming that other assumptions are met, heteroskedasticity does not lead to biased parameter estimates. However, OLS estimates are no longer BLUE. That is, they do not provide the estimate with the smallest variance and the standard errors are biased. For the probit model of determinants, heteroskedasticity would cause the estimated parameters to be biased and misleading for categorical data. Several methods can be used to detect heteroskedasticity, such the White's General Test, the Breusch-Pagen/Cook-Weisberg test and the Goldfield-Quandt test.

In this study, using the STATA software package, the Breusch-Pagen/Cook-Weisberg test (known as the "hettest" command) is used to detect heteroskedasticity in the OLS model according to the null hypothesis of homoskedasticity, which states that error variances are all equal. That is, error variance does not increase as the predictive values of the dependent variable increase. For the probit model, the STATA software package applies the Likelihood Ratio test (known as the "hetprob" command) to detect heteroskedasticity. The p-values estimated by the Breusch-Pagen/Cook-Weisberg test and the Likelihood Ratio test are around 0.089 and 0.12

respectively. The results imply that heteroskedasticity is probably not a problem here since the p-values obtained from both tests are not very small. In other words, the two tests have failed to reject the null hypothesis that the variance of the residuals is homogenous at the 5% level.

3.5 Estimation Results and Sensitivity Analysis

This section explains the results obtained from estimated regressions of vulnerability to poverty by FGLS, the determinants of poverty, the determinants of vulnerability to poverty and the sensitivity of vulnerability to poverty estimator.

3.5.1 Estimation of Vulnerability Equations

The regression results from equations (3.22) and (3.23) estimated by the Feasible Generalized Least Squares (FGLS) method in 1996, 2002 and 2010 are shown in Table 3.4, 3.5 and 3.6 respectively. The log of per capita consumption in 1996, 2002 and 2010 and variance of the disturbance are estimated using household and socioeconomic characteristics. The estimated coefficients of household size, elderly inhabitants and dependency ratio are negative and significant in all three years. This indicates that per capita household consumption declines as household size or the number of dependents in a household becomes larger. The dependency burden on children has a stronger negative influence on household consumption than the dependency burden on the elderly. The coefficient of age of household head is negative and highly significant, which implies that household consumption declines as the household head's age increases.

The coefficients of the square of household size and the square of the age of household heads are both positive and highly significant as expected. This confirms the non-linearity relationship between household consumption per capita and these two explanatory variables. The coefficient of a household headed by a female member is negative and significant in 1996 and 2002, but insignificant in 2010. About 46 percent of women who were the household heads in 2010 were single mothers aged 25-42 with secondary schooling or higher (NSO 2010a). Many of them were self-employed or white collar workers with good monthly income. In 1996, about 65 percent of female headed households only had elementary education or lower (NSO 1996a). Many of them were farm workers with low income. Therefore,

female headed households nowadays are not typically poorer than male-headed households.

Education of household head has a strong impact on household welfare. All four dummy variables on the educational attainment of household head give highly significant and positive coefficients. The coefficient size of these dummy variables becomes larger at a higher level of education. In other words, having illiterate households as the base case, households headed by a person with higher level of education are more likely to have higher consumption per capita. The coefficients of a household's value of fixed assets and the total cultivated land are positive and significant. However, the size of landholding coefficient is found to be much larger and more significant than the size of fixed assets coefficient. All dummy variables of the amount of land owned by households containing farm operators give significantly positive coefficients. In addition, the impact of these landholding dummy variables becomes larger when the amount of cultivated lands increases. The coefficients of households that contain farm tenants or farm labourers are negative and significant. However, the negative impact of working as a landless farm worker on household consumption is larger than the impact of working as a farm tenant. The results confirm that land ownership has a very strong positive effect on household consumption in all periods. The dummy variables of households headed by people working in non-agricultural sectors, such as professionals, technicians, managers and entrepreneurs, give positive and highly significant coefficients. This implies that households headed by a person who engages in non-agricultural activities tend to have higher consumption per capita, especially those headed by workers in trade and industry.

Furthermore, the results show disparities among regions within the country. Not surprisingly, households in Bangkok and the Metropolitan area tend to have an increase in household consumption per capita. In contrast, residents in the North and Northeast regions face a significant decline in their consumption per capita. The dummy variable of the Northeast region gives the largest negative and highly significant coefficient for all periods. This indicates that the vast majority of low consumption per capita households have been concentrated in this region for over a decade.

Table 3.4: Estimation of Vulnerability to Poverty Equations in 1996

Variables	SES 1996			
	Log consumption		Variance	
	Coef.	t-stat.	Coef.	t-stat.
Size	-.152	(-21.11)**	.156	(19.34)**
Size-square	.0001	(3.19)**	-.0002	(-9.40)**
Age	-.008	(-17.25)**	-.014	(-2.94)**
Age-square	.000	(9.83)**	.000	(4.75)**
Elderly	-.023	(-7.62)**	.035	(2.95)**
Dependency	-.231	(-9.80)**	.345	(15.76)**
D_female	-.142	(-2.44)**	.084	(3.15)**
D_primary	.124	(9.75)**	-.132	(-11.73)**
D_secondary	.195	(15.62)**	-.247	(-14.43)**
D_highschool	.322	(17.66)**	-.362	(-14.85)**
D_university	.534	(22.82)**	-.567	(-24.63)**
Assets	.013	(2.12)*	-.040	(1.65)
Land	.745	(27.18)**	-.723	(-24.02)**
D_land5_19rai	.152	(6.33)**	-.186	(-12.94)**
D_land20_39rai	.124	(2.32)*	-.215	(-2.68)**
D_land40more	.283	(25.94)**	-.389	(-24.12)**
D_tenant	-.135	(-20.57)**	.262	(24.40)**
D_landless	-.251	(-30.89)**	.398	(21.15)**
D_professional	.083	(9.35)**	-.212	(-8.74)**
D_entrepreneur	.070	(7.54)**	-.143	(-7.27)**
D_bangkok	.153	(20.21)**	-.262	(-29.32)**
D_central	.128	(1.10)	-.132	(-1.65)
D_north	-.273	(-14.50)**	.424	(17.11)**
D_northeast	-.320	(-20.35)**	.451	(22.73)**
constant	6.95	(284.87)	1.59	(13.26)
Obs.	25226		25226	
Prob (F)	0.000		0.000	
R-squared	0.437		0.013	

Note: * and ** denote significance at 5% and 1% levels, respectively.

Table 3.5: Estimation of Vulnerability to Poverty Equations in 2002

Variables	SES 2002			
	Log consumption		Variance	
	Coef.	t-stat.	Coef.	t-stat.
Size	-.135	(-18.26)**	.138	(12.17)**
Size-square	.0002	(6.25)**	-.0003	(-12.62)**
Age	-.009	(-13.18)**	-.011	(-9.25)**
Age-square	.000	(10.35)**	.000	(10.42)**
Elderly	-.016	(-5.35)**	.030	(2.89)**
Dependency	-.245	(-11.72)**	.291	(6.23)**
D_female	-.134	(-2.12)*	.062	(1.79)
D_primary	.112	(4.99)**	-.124	(-8.75)**
D_secondary	.184	(13.95)**	-.210	(-12.43)**
D_highschool	.295	(15.21)**	-.345	(-19.20)**
D_university	.502	(20.14)**	-.543	(-22.45)**
Assets	.018	(2.17)*	-.058	(1.89)
Land	.822	(24.02)**	-.835	(-24.61)**
D_land5_19rai	.146	(4.99)**	-.179	(-10.12)**
D_land20_39rai	.101	(2.05)*	-.198	(-3.12)**
D_land40more	.265	(19.25)**	-.373	(-22.47)**
D_tenant	-.120	(-18.13)**	.255	(22.57)**
D_landless	-.233	(-17.21)**	.370	(19.44)**
D_professional	.091	(6.78)**	-.238	(-6.86)**
D_entrepreneur	.072	(5.99)**	-.145	(-5.25)**
D_bangkok	.149	(18.40)**	-.242	(-27.10)**
D_central	.120	(2.12)*	-.127	(-1.18)
D_north	-.265	(-12.02)**	.390	(15.44)**
D_northeast	-.298	(-19.17)**	.402	(20.62)**
constant	8.32	(316.21)	2.61	(11.12)
Obs.	34785		34785	
Prob (F)	0.000		0.000	
R-squared	0.449		0.012	

Note: * and ** denote significance at 5% and 1% levels, respectively

Table 3.6: Estimation of Vulnerability to Poverty Equations in 2010

Variables	SES 2010			
	Log consumption		Variance	
	Coef.	t-stat.	Coef.	t-stat.
Size	-.124	(-14.38)**	.148	(28.26)**
Size-square	.0002	(12.16)**	-.0003	(-17.25)**
Age	-.013	(-10.58)**	-.015	(-12.32)**
Age-square	.000	(7.42)**	.000	(11.36)**
Elderly	-.021	(-2.17)**	.038	(3.45)**
Dependency	-.310	(-11.20)**	.357	(16.09)**
D_female	-.120	(-1.62)	.053	(1.03)
D_primary	.098	(2.36)*	-.048	(-4.39)**
D_secondary	.162	(7.59)**	-.086	(-15.76)**
D_highschool	.258	(12.36)**	-.122	(-16.04)**
D_university	.457	(17.38)**	-.210	(-20.61)**
Assets	.012	(2.05)*	-.045	(2.16)*
Land	.998	(20.13)**	-.921	(-20.45)**
D_land5_19rai	.128	(3.74)**	-.156	(-7.18)**
D_land20_39rai	.185	(2.17)*	-.226	(-4.56)**
D_land40more	.232	(12.12)**	-.324	(-20.51)**
D_tenant	-.116	(-15.09)**	.224	(19.24)**
D_landless	-.229	(-21.86)**	.358	(17.22)**
D_professional	.092	(4.64)**	-.243	(-7.39)**
D_entrepreneur	.080	(2.12)*	-.161	(-5.83)**
D_bangkok	.136	(13.89)**	-.223	(-24.32)**
D_central	.098	(1.10)	-.117	(-1.79)
D_north	-.231	(-7.16)**	.362	(12.36)**
D_northeast	-.274	(-15.24)**	.378	(14.82)**
constant	7.85	(252.04)	1.94	(9.67)
Obs.	44273		44273	
Prob (F)	0.000		0.000	
R-squared	0.465		0.011	

Note: * and ** denote significance at 5% and 1% levels, respectively.

3.5.2 Categories of Poverty and Vulnerability to Poverty

Table 3.7 illustrates the share of poverty and vulnerability to poverty at the national level in 1996, 2002 and 2010. Poverty and vulnerability are categorised based on the classification scheme discussed previously in Section 3.2. Although the observed poverty rate declined from 14.75 percent in 1996 to 7.75 percent in 2010, poverty still remains a problem in Thailand since approximately 20 percent of the population was found to be vulnerable to poverty in 2010. Around 13.3 percent of the vulnerable population in 2010 was considered as “highly vulnerable”. The percentage of the

transient poor, which includes the frequently poor and infrequently poor, is greater than the percentage of the chronic poor in all periods. This implies that the share of poor households that move in and out of poverty is larger than the share of those who remain poor over an extended period of time.

However, the decline in poverty after the 1997 crisis was largely due to a fall in the number of the chronic poor rather than the transient poor. Similarly, a continuous decline in total vulnerability to poverty after the crisis was due to a fall in the percentage of vulnerable households with “low expected consumption” – the chronic poor and chronically vulnerable non-poor, rather than the percentage of vulnerable households with high volatility in consumption – the frequently poor and frequently vulnerable non-poor. In other words, the estimated results show that observed high poverty rates during the crisis period of 1997-98 are mainly due to an increase in chronic or extreme poverty. After the crisis, there was quite an impressive fall in the proportion of chronic poor, while the percentage of transient poor slightly increased from 19.74 percent in 1996 to 19.92 percent in 2002.

The percentage of transient poor (frequently poor and infrequently poor) is higher than the percentage of “high vulnerable non-poor” (the non-poor who are vulnerable to chronic and frequent poverty) in all periods. In 2010, around 9 percent of the total population was transient poor with a possibility of escaping poverty in the future, while 3.21 percent of the population was non-poor with a high risk of becoming poor sometime in the future. The share of the high vulnerable poor was larger than the share of the high vulnerable non-poor in all periods. However, surprisingly, the share of non-poor households highly vulnerable to chronic poverty was found to be greater than the share of the frequently poor. Therefore, in spite of an impressive fall in the poverty rate, the problem remains in the number of non-poor households at high risk of falling below the extreme poverty line in the near future. Recently, none of the pro-poor policies in Thailand has been directly implemented to reduce the number of people in this vulnerable group.

Table 3.7: Classification of Vulnerability to Poverty (% of population)

Vulnerability to Poverty Category	1996	2002	2010
Total Poor: (Chronic poor + Transient poor)	35.31	32.64	16.91
- Chronic Poor	15.57	12.72	7.94

- Transient Poor (Frequently poor + Infrequently poor)	19.74	19.92	8.97
- Frequently Poor	4.51	4.79	2.16
- Infrequently Poor (low vulnerable poor)	15.23	15.13	6.81
High vulnerable Poor (Chronic poor + Frequently poor)	20.08	17.51	10.10
Total Non-poor:			
- Non-poor & high vulnerable to Chronic poverty	5.25	4.38	2.52
- Non-poor & high vulnerable to Frequent poverty	1.46	1.19	0.69
- Non-poor & low vulnerable	57.98	61.79	79.88
High vulnerable Non-poor	6.71	5.57	3.21
Total High vulnerability (High vulnerable poor + High vulnerable non-poor)			
	26.79	23.08	13.31
Total Low vulnerability (Infrequently poor + Low vulnerable Non- poor)			
	72.21	76.92	86.69
Total Vulnerability to Poverty (Total High vulnerability + Infrequently poor)			
	42.02	38.21	20.12
Mean Vulnerability to Poverty			
	37.89	31.64	17.25

Source: Author's calculation, based on Socio-Economic Survey (NSO 1996a, 2002, 2010).

Table 3.8 shows the percentage of poverty and vulnerability to poverty by location. The proportional reduction in poverty over the years from 1996 to 2010 is greater in rural than urban areas. The difference between the share of the transient poor and the share of the chronic poor is higher in rural than urban areas for 1996 and 2002. Surprisingly, this percentage difference substantially declines and becomes lower in rural than urban areas in 2010. This indicates that the crisis caused more people to remain in poverty for a few more years after the recovery period. In other words, the number of the chronic poor has substantially risen in both rural and urban areas since the crisis took place in 1997. However, chronic poverty seems to be less severe in urban than rural areas. Nearly half of the total rural poor in 2010 have remained poor for the next few years, in chronic poverty, whereas the share of the chronic poor to total poor is relatively lower in urban areas.

Approximately 12.27 percent of the rural population in 2010 was transient poor, while 5.02 percent of the rural non-poor were at high risk of becoming poor in the future. The difference between the share of the non-poor who are vulnerable to frequent poverty and the share of those who are vulnerable to chronic poverty is

relatively lower in rural areas in all periods. For instance, in 2010, around 3.89 percent of the rural non-poor were more likely to remain in poverty for the next few years. However, only 1.14 percent of the urban non-poor population were highly vulnerable to chronic poverty. In other words, the non-poor face higher risk of becoming frequently poor if they live in urban areas. On the other hand, the non-poor are at higher risk of becoming chronically poor if they live in rural areas.

Table 3.8: Classification of Vulnerability to Poverty by Location (%)

Vulnerability Category	1996		2002		2010	
	Urban	Rural	Urban	Rural	Urban	Rural
Total Poor:	19.19	42.29	17.09	40.41	9.03	23.09
- Chronic Poor	9.02	16.41	8.13	19.06	3.52	10.82
- Transient Poor	10.17	25.88	8.96	21.35	5.51	12.27
- Frequently Poor	2.45	5.83	2.17	5.16	1.23	2.95
- Infrequently Poor	7.72	20.05	6.79	16.19	4.28	9.32
High vulnerable Poor	11.47	22.24	10.30	24.22	4.75	13.77
Total Non-poor:	80.81	57.71	82.91	59.59	90.97	76.91
- Vulnerable to Chronic poverty	3.19	5.63	2.90	6.14	1.14	3.89
- Vulnerable to Frequent poverty	1.07	1.45	0.82	1.75	0.42	1.13
- Low vulnerable	76.55	50.63	79.19	51.70	89.41	71.89
High vulnerable Non-poor	4.26	7.08	3.72	7.89	1.56	5.02
Total High vulnerability	15.73	29.32	14.02	32.11	6.31	18.79
Total Low vulnerability	84.27	70.68	85.98	67.89	93.69	81.21
Total Vulnerability to Poverty	23.45	49.37	20.81	48.30	10.59	28.11
Mean Vulnerability to Poverty	22.29	40.75	17.21	41.40	10.06	24.09

Source: Author's calculation, based on Socio-Economic Survey (NSO 1996a, 2002, 2010).

3.5.3 Determinants of Poverty and Vulnerability to Poverty

The regression results, which examine the difference between the determinants of poverty and the determinants of vulnerability to poverty in 2010, are shown in Table 3.9 and Table 3.10 respectively. Two separate regressions are carried out for urban and rural areas to observe the structural differences in analysing the determinants of

poverty and vulnerability to poverty. The household specific poverty line defined by the NESDB is used in estimating the OLS and probit regression models. That is, each household is assigned its own poverty line based on its size, age and sex composition. The probit model, which is applied to examine the determinants of poverty, gives the coefficients in terms of marginal effects. The results clearly show that both models tend to give similar signs of coefficients and significance.

Regarding the effects of the demographic variables, the results show that households with larger families are more likely to be vulnerable and face higher probability of being poor in both rural and urban areas with significant non-linear effects. In addition, an increase in poverty and vulnerability from having an additional member in the household in rural areas is greater than urban areas. The age of household heads has a very small positive impact on household poverty and vulnerability. However, it is important to note the high level of statistical significance of this age variable between rural and urban areas. The results show that households headed by an older individual in rural areas tend to be poorer and more vulnerable than those who live in rural areas. One possible explanation would be the differences in the nature of economic activities between urban and rural areas. The urban household heads are more likely to have a high level of education. Their salaries are relatively high because they have more experiences as they become older, working as CEOs or marketing consultants, for example. In contrast, older household heads in rural areas are more likely to work in the agricultural sector. These older heads are at an economic disadvantage when undertaking a job requiring heavy physical labour if they have insufficient labour to draw on within their households.

In addition, having more elderly people and children within a household significantly increases household poverty and vulnerability. Regarding the gender of the household head, the marginal effect of having a female household head has a positive effect on increasing poverty and vulnerability. However, the effect is only significant in rural areas. One possible explanation is that urban female-headed households seem to have better education and more employment opportunities to earn higher income to protect their household's consumption than those who live in rural areas.

Considering the education dummy variables, the marginal effect of the household head's education gives a negative sign as expected for all education levels of the

household head. The significant negative marginal effect means that an increase in education level of the household head significantly reduces household poverty and vulnerability, particularly in rural areas. In addition, an increase in the value of household's fixed assets and the expansion of cultivated landholdings are found to significantly reduce household poverty and vulnerability. However, the effect of landholdings tends to be larger and more significant than the effect of a household's fixed assets, particularly in rural areas where most households participate in agricultural activities.

Turning to occupations of the household head, the probit results show that a household-head whose socio-economic class is a farm operator tends to be less poor and vulnerable when the amount of landholdings increases. However, the effect is much stronger among the rural population. The marginal effects of being a tenant cultivator and a landless farm worker are highly significant and positive in both rural and urban areas. This indicates that household poverty and vulnerability increases among these groups, as opposed to among land-holders. In addition, the marginal effect of being a landless farm worker is significantly greater than the marginal effect of being a tenant cultivator. This implies that a farm worker is more vulnerable to poverty than a tenant cultivator in both rural and urban areas.

For households that do not engage in agricultural activities, the marginal effects show a significantly negative sign in both rural and urban areas. This means that a household headed by a professional, technician, manager or entrepreneur is less poor and vulnerable than one whose head is engaged in agricultural activities. Finally, regional difference has a significantly strong impact on household poverty and vulnerability in both rural and urban areas. Households who live in Bangkok and the Metropolitan areas are more likely to be less vulnerable than those who live in the North and Northeast regions, in comparison to being a resident in the South region. In addition, the marginal effects of being vulnerable are greatest in the rural Northeast. The results confirm historical evidence that the rural Northeast has been the poorest region in the country, followed by the South, North, Central and Bangkok (World Bank 2001).

Table 3.9: Determinants of Poverty in 2010

Variable	Probit Model: whether household is poor			
	Urban		Rural	
	dy/dx	z- values	dy/dx	z- values
Size	.082	(8.56)**	.094	(6.45)**
Size-square	-.0045	(-5.38)**	-.0047	(-6.04)**
Age	.0051	(2.24)*	.0073	(2.88)**
Age-square	-.0005	(-3.95)**	-.0002	(-1.98)*
Elderly	.0105	(5.51)**	.0126	(6.23)**
Dependency	.281	(7.24)**	.311	(3.14)**
D_female	.084	(1.16)	.095	(2.32)*
D_primary	-.052	(-2.38)*	-.063	(-3.46)**
D_secondary	-.087	(-3.89)**	-.094	(-5.77)**
D_highschool	-.125	(-4.21)**	-.132	(-4.43)**
D_university	-.223	(-2.47)*	-.298	(-4.18)**
Assets	-.006	(-2.32)*	-.009	(-2.44)*
Land	-.428	(-6.31)**	-.498	(-9.47)**
D_land5_10rai	-.074	(-7.43)**	-.095	(-8.82)**
D_land10_29rai	-.090	(-2.21)*	-.123	(-2.43)*
D_land30more	-.125	(-5.42)**	-.132	(-7.23)**
D_tenant	.058	(3.82)**	.062	(5.98)**
D_landless	.104	(2.59)*	.119	(4.46)**
D_professional	-.043	(-3.62)**	-.051	(-3.59)**
D_entrepreneur	-.039	(-5.98)**	-.045	(-7.14)**
D_bangkok	-.074	(-3.78)**	-	-
D_central	-.045	(-2.45)*	-.051	(-1.89)
D_north	.128	(5.56)**	.131	(8.54)**
D_northeast	.134	(7.33)**	.152	(11.67)**
Number of households:	27,448		16,825	
Pseudo R ² :	.1859		.1599	
R ² :	-		-	
Log Likelihood Ratio:	-12675.8		-8925.2	
Wald chi-square:	6134.93		4741.27	
Prob(F):	0.000		0.000	

Note: * and ** denote significance at 5% and 1% levels, respectively.

Table 3.10: Determinants of Vulnerability to Poverty in 2010

Variable	Probit Model: whether household is poor			
	Urban		Rural	
	dy/dx	z- values	dy/dx	z- values
Size	.085	(17.82)**	.097	(15.37)**
Size-square	-.0046	(11.73)**	-.0049	(13.20)**
Age	.005	(4.31)**	.006	(5.65)**
Age-square	-.0007**	(-10.58)**	-.0004	(-3.72)*
Elderly	.0106	(13.69)**	.0128	(15.14)**
Dependency	.292	(5.56)**	.325	(9.38)**
D_female	.082	(1.98)	.094	(2.10)*
D_primary	-.058	(-5.96)**	-.067	(-9.71)**
D_secondary	-.089	(-10.23)**	-.096	(-14.02)**
D_highschool	-.128	(-14.02)**	-.134	(-13.37)**
D_university	-.312	(-4.46)**	-.328	(-11.05)**
Assets	-.019	(-5.78)**	-.024	(-6.61)**
Land	-.532	(-13.15)**	-.614	(-21.42)**
D_land5_10rai	-.085	(-15.18)**	-.098	(-18.36)**
D_land10_29rai	-.114	(-5.75)**	-.137	(-4.75)**
D_land30more	-.138	(-15.92)**	-.141	(-17.54)**
D_tenant	.065	(10.43)**	.073	(13.42)**
D_landless	.145	(8.77)**	.160	(12.55)**
D_professional	-.062	(-15.44)**	-.074	(-8.28)**
D_entrepreneur	-.053	(-9.69)**	-.059	(-13.65)**
D_bangkok	-.079	(-8.33)**	-	-
D_central	-.038	(-5.48)**	-.055	(-4.20)**
D_north	.139	(10.12)**	.142	(15.61)**
D_northeast	.165	(15.19)**	.174	(33.36)**
Number of households:	27,448		16,825	
Pseudo R ² :	-		-	
R ² :	0.69		0.62	
Log Likelihood Ratio:	-		-	
Wald chi-square:	-		-	
Prob(F):	0.000		0.000	

Note: * and ** denote significance at 5% and 1% levels, respectively.

3.5.4 Sensitivity Analysis of Estimated Vulnerability to Poverty

The precision of vulnerability estimates depends on the choice of poverty and vulnerability lines. Table 3.11 presents the estimated vulnerability to poverty in 2010 and the overlap between the percentage of households vulnerable to poverty in 2010 and the percentage of those vulnerable who actually become poor in 2011. The results clearly show that, based on the same poverty line, the use of vulnerability threshold of 0.5 is more accurate than the use of headcount ratio vulnerability line.

For example, based on the poverty line of US\$2 PPP, the vulnerability line of 0.5 gives the percentage of overlap around 23.46 percent. In contrast, using headcount ratio as a vulnerability threshold gives lower percentage of overlap, approximately 19.82 percent. In addition, the percentage of overlap tends to increase when a higher poverty line is used in estimating household vulnerability to poverty. In other words, the results suggest that using the vulnerability line of 0.5 together with a household specific poverty line gives the most accurate estimate of household vulnerability to poverty. Therefore, the vulnerability line of 0.5 and the household specific poverty line are chosen to construct the vulnerability to poverty profile of Thailand in the next section.

Table 3.11: Estimated Vulnerability to Poverty by Different Choices of Thresholds

Poverty line	Estimated Vulnerability in 2010 (Number of households)	Observed Poverty in 2011 (Number of households)	Number of vulnerable households fell into poverty in 2011	Percentage of Vulnerable households being below the poverty line in 2011
Fixed Vulnerability threshold = 0.5				
US\$1.08 PPP	1076	64	39	3.62
US\$2 PPP	942	385	221	23.46
National poverty line	710	462	235	33.10
Household poverty line	658	554	307	46.66
Vulnerability threshold = Varying threshold headcount ratio				
US\$1.08 PPP	1523	64	45	2.95
US\$2 PPP	1105	385	219	19.82
National poverty line	859	462	262	30.50
Household poverty line	728	554	316	43.41

Source: Author's calculation.

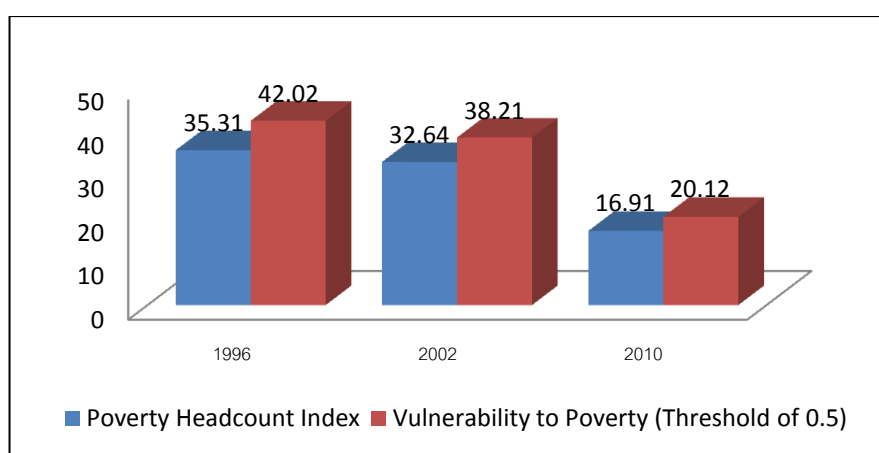
3.6 Vulnerability to Poverty Profile in Thailand

This section uses the results obtained from the previous section to construct the most recent vulnerability to poverty profile in Thailand, based on the 2010 SES data (NSO 2010a). This profile identifies vulnerable households and shows how vulnerability to poverty varies across subgroups of a population. In addition, it compares the key characteristics of the vulnerable with the non-vulnerable. The profile assists the government and policy makers to appropriately formulate poverty reduction strategies and monitor poverty changes.

3.6.1 Trends in Household Poverty and Vulnerability

Thailand measures poverty incidence at the household level in absolute terms. That is, the official poverty line is estimated in terms of the minimum standard of consumption expenditure on food and some necessary non-food items, such as clothing, shelter, medicine and transportation. Vulnerability incidence is measured as the proportion of households having a 50 percent or higher chance of falling into poverty in the future.

Figure 3.2: Poverty and Vulnerability to poverty Incidence

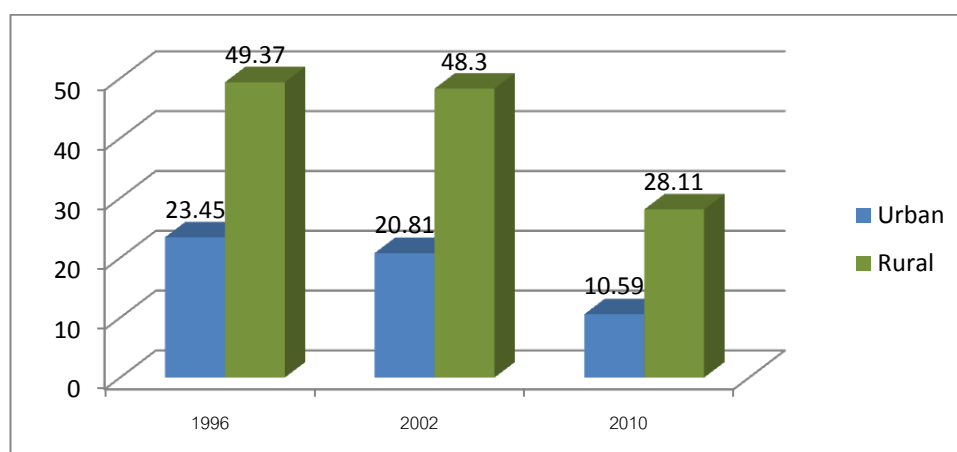


Source: Author's calculation.

As shown in Figure 3.2, poverty incidence continuously increased from 1996 to 2000 as a result of the Asian financial crisis, and from 35.31 percent in 1996 to 42.63 percent in 2000. The poverty rate dropped to 32.64 percent in 2002 after the recovery period and declined further to 16.91 percent in 2010. The declining trend in poverty after the crisis is consistent with the trend in vulnerability. However, the incidence of vulnerability is higher than poverty. While 16.91 percent of the population was estimated to be poor in 2010, around 20.12 percent of the population was vulnerable. This indicates that, even though poverty has continued to fall over a decade, many non-poor households are still at high risk of falling into poverty.

As shown in Figure 3.3, rural households are more likely to be vulnerable to poverty than urban households. For instance, in 2010, around 10.59 percent of the urban population was vulnerable, while the share of the rural vulnerable was 28.11 percent.

Figure 3.3: Vulnerability to poverty Incidence by Area



Source: Author's calculation.

Not only is the severity of poverty and vulnerability higher in rural areas, rural households also suffer from social and economic inequality. As shown in Table 3.12, the top 20 percent of households shared the total income of 51.8 percent in 2010, while the bottom shared only 5.5 percent of the total income. The share of the poorest quintile was much higher in rural than urban areas. While the richest quintile of urban households shared 70.2 percent of total income, the top 20 percent of rural households shared only 36.7 percent of the total income. Additionally, averaged vulnerability levels are shown to be consistent with income inequality between rural and urban areas. That is, the poorest households in rural areas are almost three times more vulnerable than the poorest urban residents.

Table 3.12: Share of Household Income by Quintile, 2010

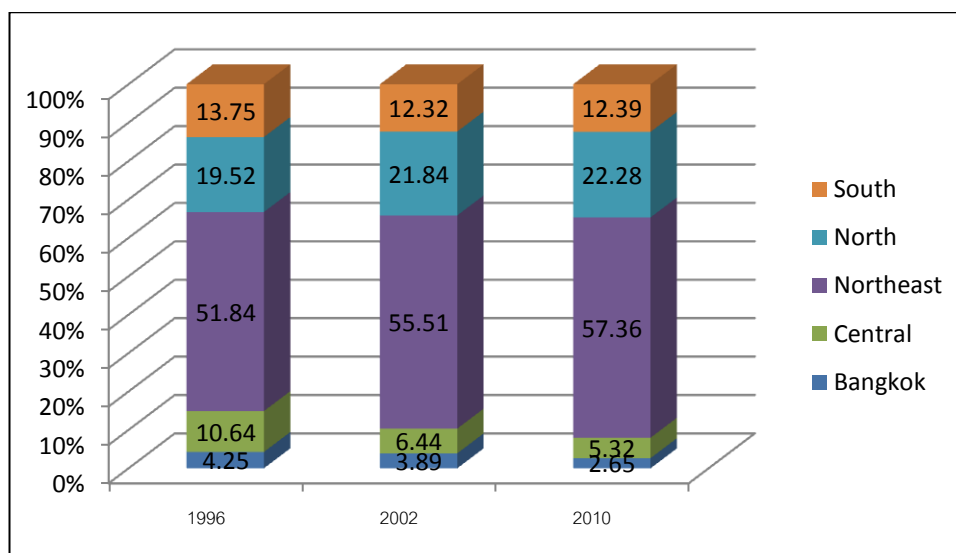
Group	Share of income (%)			Averaged Vulnerability level		
	Total	Urban	Rural	Total	Urban	Rural
Quintile 1 (poorest)	5.5	1.1	8.9	0.423	0.216	0.604
Quintile 2	8.1	3.4	13.3	0.352	0.137	0.482
Quintile 3	13.2	7.2	17.6	0.218	0.104	0.397
Quintile 4	21.4	18.1	23.5	0.084	0.022	0.153
Quintile 5 (richest)	51.8	70.2	36.7	0.019	0.004	0.082

Source: Author's calculation.

Apart from a large difference in averaged vulnerability between rural and urban areas, there are persistent disparities among regions within the country. As shown in

Figure 3.4, vulnerability is highly concentrated in the Northeast region. In 2010, more than 50 percent of the total vulnerable households lived in the Northeast region, followed by the South, the Central and Bangkok respectively. The vulnerability ratio in the Northeast continuously increased from 51.84 percent in 1996 to 57.36 percent of the total vulnerable households in 2010. The share of vulnerable population slightly increased in the North and South regions, but substantially decreased in Bangkok and the Central region in the post-crisis period. While vulnerability has fallen or only slightly increased over a decade in many regions, vulnerability has become more concentrated in the Northeast. This finding is consistent with the poverty ratio calculated by the NESDB. The Northeast accounts for one third of the total population, but more than half of the total poor are concentrated in this region. There was an increase in the share of vulnerable households in the Northeast from 1998 to 2002, mostly due to a rise in the number of chronic poor households in rural areas. The share of vulnerable and chronic poor households is largest in the agricultural sector. Because most rural householders residing in the Northeast are farm operators and farm workers, these people suffered most from the crisis in 1997-1998.

Figure 3.4: Vulnerability to Poverty Ratio by Region

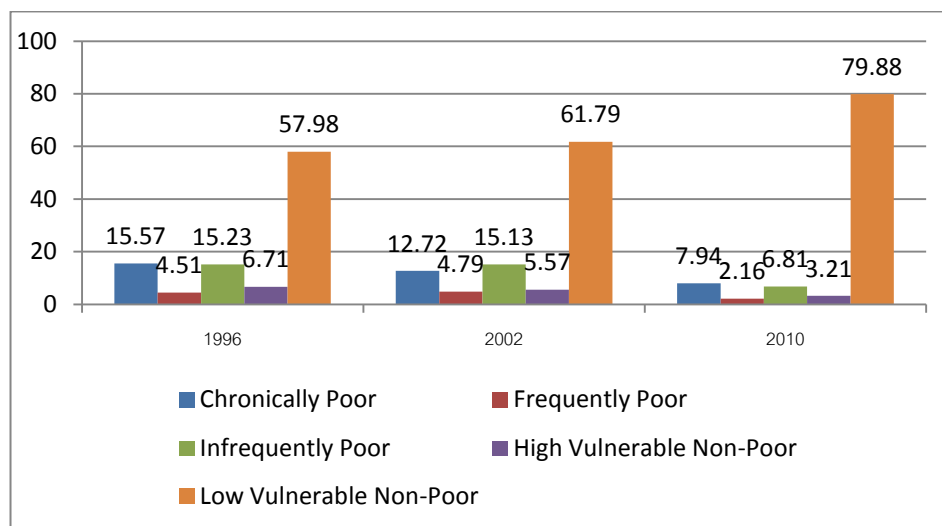


Source: Author's calculation.

As shown in Figure 3.5 below, the vast majority of poor people are the chronic poor and the infrequently poor. Even though the number of poor and high vulnerable households has been declining over a decade, reducing the high vulnerable group

remains a challenge. The results show that the share of high vulnerable population is even greater than the share of the frequently poor. In addition, households within the high vulnerable and non-poor groups are concentrated in rural areas and relatively vulnerable to chronic poverty.

Figure 3.5: Poverty and Vulnerability to Poverty by Groups (% of population)



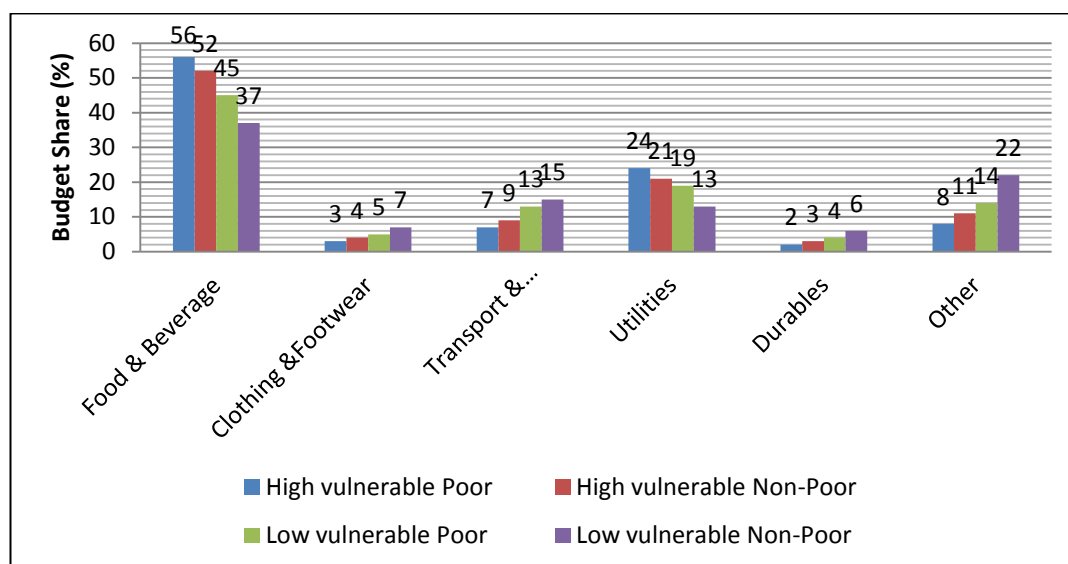
Source: Author's calculation.

To effectively reduce chronic poverty and high vulnerability among non-poor households in rural areas, policy makers should understand their consumption patterns before implementing any new government program that gives them more economic opportunities. There is a disparity in household consumption expenditure patterns among the vulnerable groups. As shown in Figure 3.6, “high vulnerable poor” households spend most of their budget on food and beverages, approximately 56 percent of the total budget, followed by the “high vulnerable non-poor”, “low vulnerable poor” and “low vulnerable non-poor” respectively.

Apart from their budget expenses on food, the high vulnerable poor spend more money on utilities, such as gas, electricity and water, than the high vulnerable non-poor. On the other hand, the high vulnerable non-poor spend more on clothing, fuel, internet services, durable goods (cars, shelters, home appliances, furniture) and other non-durable goods (cleaning products, medication, personal care, tobacco and alcohol). Comparing urban and rural areas, the high vulnerable non-poor in rural areas spend more on food and health care than those in urban areas. In contrast, the high vulnerable non-poor in urban areas spend a greater share of their budget on

transportation, shelter and reading or education than those in rural areas. This implies that, to reduce vulnerability among the high vulnerable non-poor, better medical services need to be provided for rural residences that are highly vulnerable, while mortgage lending and education funds are necessary for those living in urban areas.

Figure 3.6: Expenditure Patterns of Vulnerable Poor and Vulnerable Non-Poor, 2010



Source: Author's calculation.

3.6.2 Characteristics of Household Vulnerability to Poverty

As previously discussed in Section 3.5.4, the coefficients obtained from the regression estimates of the determinants of poverty and vulnerability to poverty tend to give similar signs of coefficients and significance. In other words, poverty and vulnerability share similar socio-economic characteristics after a crisis, particularly between the non-poor, who are vulnerable to chronic poverty, and the chronic poor.

Household size is an important household characteristic that affects poverty and vulnerability. As shown in Table 3.13, poverty and vulnerability tend to increase with household size. For instance, the average vulnerability among households with two members is only 0.038, but it increases to 0.116 among the households with four persons. In other words, an additional household member requires more resources to meet basic needs. Thus, the likelihood of falling below the household poverty line is increased. Subsequently, the relationship between household vulnerability level and household size appears to be non-linear. This implies that the probability of falling into poverty becomes lower as household size declines over time.

Table 3.13: Poverty and Vulnerability to Poverty by Household Size, 2010

	Household Size					
	1	2	3	4	5	6 or more
Poverty Incidence	4.2	4.5	5.3	8.7	9.6	14.3
Averaged Vulnerability to Poverty	0.027	0.038	0.099	0.116	0.204	0.312

Source: Author's calculation.

The age of the household head has some influence on poverty. As shown in Table 3.14, poverty and vulnerability are very high among household heads aged less than 20 years and among those who aged 60 years or older. Poverty incidence and average vulnerability are quite evenly distributed among households headed by people aged 30 to 59 years. Households that are headed by an elderly person are more likely to fall into poverty because they earn less income after retirement. In contrast, households headed by a very young person aged less than 20 are more likely to have lower income and be highly vulnerable. In addition, although the coefficients of this variable are significant in both rural and urban areas, its impact is slightly higher in rural areas. This indicates that rural households headed by an older person are relatively more vulnerable. This finding is consistent with the fact that elderly people living in rural areas earn lower average income after retirement than those who live in urban areas.

Table 3.14: Poverty and Vulnerability to Poverty by Age of Household Head, 2010

	Age of Heads of Households						
	≤ 20	21 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 or more
Poverty Incidence	13.7	4.2	8.4	8.2	7.9	11.6	15.2
Vulnerability to Poverty	0.320	0.091	0.148	0.136	0.114	0.178	0.443

Source: Author's calculation.

Education of the household head, the main income earner, plays an important role on a reduction of poverty and vulnerability. The coefficients of all education dummy variables are highly significant and negative. This confirms that education of the household head is closely related to the chance of falling into poverty and

vulnerability. As shown in Table 3.15, households headed by a person with a higher level of education are more likely to be less vulnerable. The share of the poor is largest among household heads with primary education. In contrast, those who are headed by a person with tertiary education face the lowest risk of falling below the poverty line in the future. In addition, most household heads with secondary education or lower live in rural areas. More than half of them are considered to be either chronically poor or vulnerable to chronic poverty. Therefore, the results suggest that an increase in human capital is essential in reducing poverty and vulnerability.

Table 3.15: Poverty and Vulnerability to Poverty by Education, 2010

Level of Education	Poverty (Headcount Ratio)	Vulnerability to Poverty (Headcount ratio)	Average Vulnerability level
Primary	24.3	27.2	0.672
Lower Secondary	8.1	11.0	0.049
Upper Secondary	7.2	9.4	0.026
Tertiary	1.1	3.2	0.001

Source: Author's calculation.

Occupation of the household head is another household characteristic that is closely related to poverty and vulnerability. As shown in Table 3.16, nearly 42 percent of households headed by a person who works as a farm worker are estimated to be poor, with the highest average vulnerability of 0.532. Approximately 35.3 percent of households headed by a person who works as a farm operator, including a tenant cultivator, are poor and vulnerable to poverty. Poverty and vulnerability are lowest among households headed by a person who works as an entrepreneur, manager or land-owner. Therefore, poverty and vulnerability tend to be higher among households headed by a person who participates in agricultural activities. In addition, the results show that poverty and vulnerability among rural farmers are higher than urban farmers.

Table 3.16: Poverty and Vulnerability to Poverty by Occupation, 2010

Occupation	Poverty (Headcount Ratio)	Vulnerability to Poverty (Headcount ratio)	Average Vulnerability level
Farm workers	41.8	44.6	0.532
Farm operators (including tenants)	35.3	38.7	0.383
Labourers	22.7	26.2	0.102
Production and construction workers	12.6	15.1	0.094
Recipients of Pension and Assistance	17.1	18.8	0.065
Self-Employed	14.3	16.3	0.050
White-Collar Workers	8.9	11.2	0.040
Entrepreneurs , Managers and Land owners	6.7	8.1	0.034

Source: Author's calculation.

Agricultural land ownership is closely associated with both poverty and vulnerability because most chronic poor and high vulnerable households rely on farming. The results indicate that an increase in a household's landholdings reduces poverty and vulnerability in both rural and urban areas, but the effect is stronger in rural areas. As shown in Table 3.17, agricultural households in possession of land of less than 5 rai have the highest probability of becoming poor in the future. Approximately 32.6 percent of households with land of less than 5 rai are poor and around 34.3 percent of them are vulnerable to poverty. Surprisingly, in the rural Northeast, farmers who own more land are found to be more vulnerable than those who own less land. This finding is different from the results found in other regions, where large landholders are better off than small landholders. This could be explained by the fact that most farmers in the rural Northeast have lower productive assets. They are less efficient in the use of land than farmers in other regions. In addition, they lack support in seed and soil quality management, irrigation and farming technology. Their poor farming practices have led to excessive borrowing. Therefore, an increase in the amount of landholdings is more likely to reduce vulnerability among rich farmers, while poor farmers need more productive assets besides land, such as irrigation pumps, milling machine, feed and barns, to improve their farm productivity and efficiency.

Table 3.17: Poverty and Vulnerability to poverty by Land Ownership, 2010

Land Owned	Poverty (Headcount Ratio)	Vulnerability to Poverty (Headcount ratio)	Averaged Vulnerability level
Land < 5 rai	32.6	34.3	0.398
Land 5 -19 rai	21.4	23.2	0.354
Land 20 – 39 rai	7.8	9.5	0.220
Land > 40 rai	1.2	2.4	0.127

Source: Author’s calculation.

3.6.3 Government Programs towards Poverty and Vulnerability Reduction

In Thailand, as already discussed in Chapter 2, many pro-poor programs have been launched by the government with the objective of improving the well-being of Thai people and alleviating poverty. As shown in Table 3.18, four main pro-poor programs have been implemented since 2001 in order to improve access to health services, increase income stability and income-generating assets, encourage school enrolment of the rural poor and enhance productive assets for poor farmers. To examine the effectiveness of each program in targeting poor and vulnerable households, Table 3.8 presents the share of the poor and the non-poor who benefit from these programs across different vulnerable groups. More than half of the total households eligible for the pro-poor programs are classified as the low vulnerable non-poor. Only 8.55 percent of them are considered as high vulnerable non-poor. Surprisingly, only 28.17 percent of the population who benefits from these programs is poor and 20.3 percent of them are considered as high vulnerable non-poor. This implies that most pro-poor programs cannot efficiently target the poor and vulnerable households. For instance, around 73.4 percent of the total population receives the “30 baht health coverage card”, entitling bearer to universal health services for 30 baht per visit. Around 56.42 percent of households receiving these health cards are poor, while 9.62 percent of them are the high vulnerable non-poor. Even though this health coverage scheme seems to target the chronic poor quite well, it has not successfully reached the highly vulnerable non-poor groups.

Apart from better medical services, the government has launched the “Village Fund” – a new microcredit program, which allocates funds to poor households in rural remote areas, particularly for farmers who need interest-free loans for investment in farms. However, in 2010, the Village Fund has largely been given to the frequently

poor who do not mainly engage in the agricultural sector. In addition, the fund is somewhat equally distributed among the non-poor instead of targeting the rural non-poor who are highly vulnerable to chronic poverty. Thus, this program does not effectively target the majority of chronically poor households in rural areas.

As previously discussed in Section 3.5, education is a key to reduce poverty and vulnerability in both rural and urban areas. The government has run a “Free school lunch” program since 1966, which encourages poor families to send more children to school. However, only 21.7 percent of the total population is eligible for the program (NSO 2010a). In addition, only half of the households that join this free lunch program are poor. The low vulnerable non-poor tend to benefit more from this program than the high vulnerable non-poor. In other words, not only does this program fail to reach the chronic poor, but also the high vulnerable chronic non-poor who are in the bottom income quintile.

Finally, one of the government programs that aims to help poor farmers is the moratorium on farmers’ debt. The program gives a three year debt moratorium to poor farmers who are in agricultural debt. In 2010, around 18.5 percent of the total population was eligible for the program (NSO 2010a). However, only one third of them were the high vulnerable poor, chronically poor or frequently poor. In addition, the share of low vulnerable non-poor farmers who participated in the program was larger than the share of those who were highly vulnerable. Until now, the government has not successfully lowered the agricultural debt of most farmers. The outstanding debt of the farmers who borrow from the Bank for Agriculture and Agricultural Cooperatives (BAAC) is still high in 2013. Their average total debt has declined at less than 10 percent since their first moratorium rights were given.

Table 3.18: Structure of the Pro-Poor Programs by Vulnerability Category, 2010

Pro-Poor Programs	%	Vulnerability to Poverty Level					
		Non-Poor (% of population)			Poor (% of population)		
		Low vulnerable (< 0.5)	Vulnerable to chronic poverty (>0.5)	Vulnerable to frequent poverty (> 0.5)	Infrequent poverty (< 0.5)	Frequent Poverty (> 0.5)	Chronic poverty (> 0.5)
Households joined these programs	100	63.28	4.82	3.73	7.87	8.36	11.94
Universal health coverage card	73.4	7.36	5.28	4.34	12.78	14.54	29.10
Borrowed from the Village Fund	34.6	5.34	5.62	5.15	6.35	9.25	6.59
Received Free school lunch	21.7	4.22	2.90	3.45	3.40	4.24	3.39
Received debt moratorium for farmers	18.5	2.98	2.67	2.23	3.94	3.65	3.03

Source: Author's calculation , based on the 2010 SES

3.7 Conclusion

This chapter aims to estimate household vulnerability to poverty and determine factors influencing the risk of being vulnerable to poverty in Thailand. Vulnerability has increasingly become a more serious problem than current poverty. The results clearly show that the observed poverty rate has declined since the 1997 financial crisis from 38.72 percent in 1998 to 16.91 percent of the total population in 2010. However, approximately 20.12 percent of the total population is still at high risk of becoming poor in the future. Household demographics and socioeconomic characteristics, such as household size, age and occupation of occupants, dependency ratio, education level of the household head and regional differences are found to be highly associated with poverty and vulnerability. In addition, rural households are more highly vulnerable than urban households, particularly in the Northeast and the North regions.

The classification of household vulnerability to poverty is useful in distinguishing between chronic poverty and transient poverty. Since the causes of these two types of poverty are not the same, the categorisation of poverty in this study assists policy makers in implementing proper treatment of poverty reductions between rural and urban areas. For example, some financial services, such as micro-credit programs and the moratorium to decrease the farmer debt, should be offered as a priority to rural chronic poor households that lack economic assets and mainly engage in agricultural activities. On the other hand, government funds, such as mortgage lending and Small and Medium Enterprises (SMEs) loans, should be offered as a priority to the transient poor or high vulnerable non-poor households. In addition, this study finds that households that rely on employment in the agricultural sector are more vulnerable than non-agricultural households. Land ownership is found to be highly significant in reducing vulnerability in rural areas, particularly among poor rice farmers.

Vulnerability is estimated to be highest among households headed by a person with primary education. This indicates that education is an important factor in reducing poverty. In addition, social safety nets, such as pension payments, child benefit payments, medical services and government funds, are vital in preventing vulnerable households from falling into poverty. Therefore, investment in human capital in

terms of education, training and social protection and promotion programs could efficiently alleviate poverty and vulnerability in the long term.

The failure of the government's pro-poor programs in targeting the poor and high vulnerable non-poor could put the economy at risk. The provision of loans by the government to the wrong vulnerability groups can exacerbate the poverty situation and lead to a rise in public debt, which would eventually destroy the economy in the long term. Therefore, before launching any new pro-poor policy, policy makers should make sure that the right groups of vulnerable people in the population are eligible for the programs. In other words, it is important that each development project should be appropriately designed for a specific group of vulnerable households.

The official poverty line in Thailand is based on the "absolute" concept, which represents the cost of basic needs for food and non-food items. Developing countries usually rely on this absolute definition of poverty rather than the term "relative". This is because a large proportion of the population usually lives off the minimum or less. Household consumption and income are not the only measures of human well-being. Poverty can be measured using non-monetary indicators, such as health, nutritional status and education. People who are unable to buy enough healthy food are more likely to become undernourished or more vulnerable to food poverty. Having enough food or an increase in food supply within the country does not guarantee a long-term reduction in food poverty. Food security takes into account both quantity and quality of food consumption. The production, consumption and distribution of food also contribute to a decline in hunger and poverty rates as well as an increase in food sustainability. The next chapter focuses on this issue by measuring household vulnerability to food insecurity and examining the key factors affecting household food security status.

Chapter 4

Household Vulnerability to Food Insecurity: Measurement and Determinants

4.1 Introduction

Food security has become a major global issue since the global food crisis of 1972-74. Food security was originally discussed during the World Food Conference of 1974, regarding the global food crisis caused by food supply problems (UN 1975). In 1986, the World Bank distinguished “chronic” food insecurity from “transitory” food insecurity. The former is closely related to continuing poverty and malnutrition, while the latter is associated with natural disasters or economic crisis (World Bank 1986). In 1994, the UNDP Human Development Report mentioned food security as one of the component aspects in promoting human security, especially a public action in alleviating structural poverty and deprivation (UNDP 1994). In 1996, the World Food Summit declared a commitment to achieve food security by reducing the number of undernourished people to one half by 2015 (FAO 1996). The concept of food security is quite flexible. It has been differently defined by many researchers and organisations according to the objectives and policy issues involved in their studies or public projects. Approximately 200 definitions and 450 indicators of food security have been proposed by various researchers in past studies (Hoddinott 1999). In general, food security can be defined as an availability of safe and nutritious food to meet an individual’s dietary needs at all times. Therefore, an individual is said to be food insecure when he cannot achieve the status of having physical, social and economic access to safe, sufficient and nutritious food that meets dietary energy needs for an active, healthy life.

As mentioned in the previous chapter, it is essential to consider not only the current state of poverty but also look at the future poverty incidence, or people who are at risk of becoming poor in the future. Similarly, food security should not only be concerned with current outcomes but also take into account the uncertainties associated with future food insecurity, namely vulnerability to food insecurity. There is no consensus in the current literature on how to define and measure vulnerability to food insecurity. In this study, household vulnerability to food insecurity is viewed as the probability or risk today of being insecure in food at some point in the future.

Poverty is the main cause of food insecurity because poor households are more likely to lack access to sufficient quality food for all members. Natural calamities, such as drought or flood, not only reduce domestic production and increase food prices but also cause food insecurity of the poor. Households with insufficient food access usually have shorter life expectancy and suffer malnutrition, disease or ill health. On the other hand, subsistence farmers who own very small landholdings tend to be more food insecure than those who own large tracts of land. This is possibly because small-scale farmers tend to have less productive assets and farming techniques, which limits their food production. Being able to identify households at high risk of becoming food insecure in the future and what characteristics affect food insecurity movements can provide a better understanding of the key micro-level binding constraints to food insecurity alleviation. In Thailand, there exists no empirical study on household vulnerability to food insecurity. In addition, no study in Thailand has examined the public policies that are associated with a reduction in household vulnerability to food insecurity. Many poor Thai households in rural areas were severely affected by high production costs and food prices during the global food crisis in 2008. These poor rural households were at high risk of being food insecure because they had to reduce their daily food intake. To cope with the future impact of food security, the government needs to launch better development policies targeting more households that are highly vulnerable to food insecurity in the future. To implement such policies, more research studies with appropriate methods to measure vulnerability to food insecurity and its determinants are required.

This chapter provides an empirical analysis of household vulnerability to food insecurity in Thailand by applying the methodologies applied in Chapter 3 on measurement and determinants of vulnerability to poverty. The method is based on the “Expected Poverty” approach, which assumes that cross-sectional variability mirrors temporal variability. This method is particularly designed for cross-section data, which is considered to be appropriate for Thailand and some countries where there is no collection of large household panel data. Instead of using the *per capita* total poverty line to measure vulnerability, the per equivalent household dietary energy requirements is used with a critical vulnerability threshold to measure vulnerability to food insecurity.

The chapter is organized as follows. In the next section, a review of the existing studies in the poverty literature on the concepts, measurements and determinants of vulnerability to food insecurity is provided. Section 4.3 provides the research methodology and data used in this study, followed by empirical results and sensitivity analysis in Section 4.4. Section 4.5 provides the vulnerability to food insecurity profile of Thailand and Section 4.6 concludes the chapter.

4.2 A Review of the Literature

This section provides a review of the literature on definitions, measurements and determinants of vulnerability to food insecurity. Various methodologies have been applied to demonstrate how food security is related to, but different from, other concepts, such as poverty and deprivation (Webb et al. 2006). The concept of food security is differently defined by many researchers in previous studies according to the specification of research questions and objectives. However, vulnerability in the context of food insecurity can be precisely defined as “the likelihood or the probability of becoming food insecure”. The food security line constructed in this study represents a minimum level of sufficient and quality food to actively participate in a society with a healthy life at all time. As at the moment, there is no consensus on the particular method in measuring and characterizing household vulnerability to food insecurity. A few methods have been proposed in previous studies to estimate household vulnerability to food insecurity. The literature on concepts and measurements of vulnerability to food security is discussed first, followed by the review of studies on determinants of household vulnerability to food insecurity.

4.2.1 The Concepts of Food Security

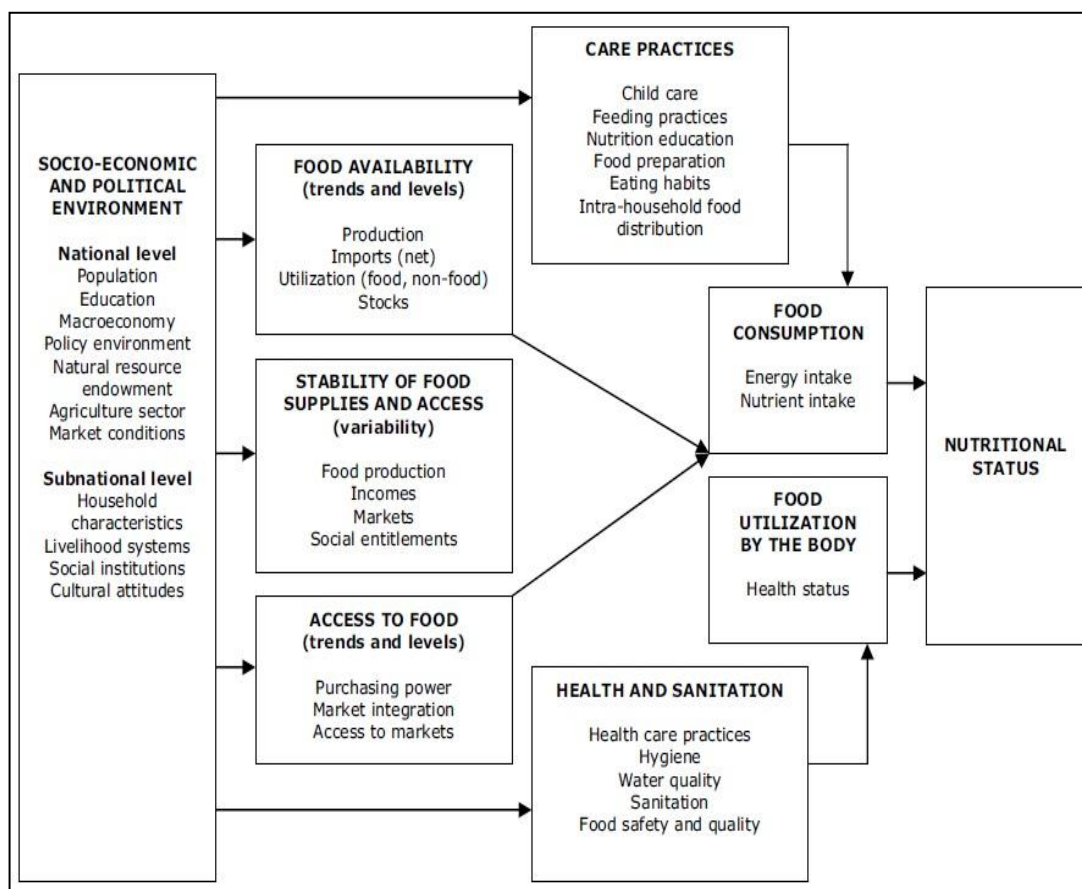
As previously mentioned in Chapter 2, vulnerability combines poverty dynamics and research on risk to provide forward-looking measures of downside risk or poverty risk. In general, vulnerability in the spotlight of poverty research is defined as an *ex ante* exposure to adverse events, such as natural disasters and other hazards, and an inability to prevent, mitigate and cope with them. A large number of concepts and definitions of food security have been proposed by many authors in the literature. Early definitions of food security in 1970s only reflect the supply side concerns and the fluctuations or uncertainties in food production and prices (Edward, Pillai and

Benson 1998). The Green Revolution in Asia in 1970s has improved farm technology, irrigation, seeds and fertilizers. However, an adequate food supply based on this revolution does not guarantee the food security level of all people. Numbers of undernourished adults and children remain high in many countries around the world, particularly in rural areas. According to Sen (1983), the definition of food security is more on demand than supply side. That is, the view of food security in the 1980s shifted to emphasize the demand side and food accessibility, which focuses on food access rights and entitlements of households (Drèze and Sen 1989).

The concept of food security was initially highlighted during the World Food Summit of 1974, regarding the availability and stability of global food supplies. Food security was defined as “availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices” (UN 1975). In 1996, the World Food Summit emphasized that people are secure in food if they “at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life” (FAO 1996). This definition of food security includes both physical and economic access to food that is nutritious and safe at all times. In 2001, the definition of food security was refined again by the FAO as “a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO 2002). As shown in Figure 4.2.1, the FAO defines four facets of food security: food availability, food accessibility, food utilisation and food stability.

Food availability means consistently having sufficient available food supplies. Food accessibility indicates physical and economic access to safe and nutritious food for all different groups of people. Food utilisation involves an individual’s health status. This last facet refers to the way the body utilizes food, which is determined by an individual’s basic knowledge of nutrient intake and health-care practices, as well as adequate quality water and general sanitation. Lastly, food stability refers to an individual’s ability to avoid or reduce the risk of adverse effects from floods, droughts, economic shocks or political instability, for example, on food security status at all times.

Figure 4.1: FAO Conceptual Framework of Food Security and Nutritional Status



Source: Guidelines for National FIVIMS (FAO 2000).

The terms “safe”, “sufficient”, “access” and “at all times” are mentioned in a range of food security definitions by many authors (See, for example, Maxwell and Frankenberger 1992; Power, Sheeshka and Heron 1998; Koc and Dahlberg 1999; Ganapathy, Duffy and Getz 2005). For example, some authors specifically define the term “sufficient food” as having enough food for survival, while others define this term as having enough food for an active and healthy life. The term “food access” is defined by some authors as having an access to both a sufficient “quantity” of food and “quality” of food at all times (Power, Sheeshka and Heron 1998). The quality of food involves the distribution and consumption of food as well as the impact of food production on households (Ganapathy, Duffy and Getz 2005). Apart from the quantity and quality of food, some authors include “food acceptability” in a definition of food security. It means that people should have access to a sufficient available food supply that is culturally acceptable (Koc and Dahlberg 1999). In other

words, the food should be produced in a way that respects people's culture, human rights, attitudes and dignity.

Overall, the choice of food security definitions depends on the research priorities, the level of analysis and the availability of data. In this study, the main objective is to analyse household food insecurity in accordance with anti-hunger and poverty elimination goals that are primarily concerned with household experiences of hunger or food poverty. In other words, households are defined as "food secure" if all household members have equal access to a sufficient quantity of food. As previously mentioned in Chapter 2, vulnerability is referred to as the likelihood of being exposed to risks or adverse shocks, as well as an inability to cope with them. Households are considered as vulnerable to food insecurity if they face a relatively high probability of being insecure in food in the future. Since household consumption surveys collect data on what is consumed by households, the terms "sufficient" and "quantity of food" mean that a household has a high enough food consumption to meet energy and nutritional requirements of all its members.

4.2.2 Measurements of Vulnerability to Food Insecurity

Several methods have been proposed by many authors to measure the "current" state of household food security (See, for example, Immink and Alarcon 1991; Maxwell and Frankenberger 1992; Haddad, Kennedy and Sullivan 1994; Maxwell, D. 1996; Maxwell, S. 1996; Flores, Khwaja and White 2005; Gentilini and Webb 2008). However, there are few studies on measures of vulnerability to food insecurity, which is the forward-looking analysis of food security. Most studies on household vulnerability focus on poverty rather than food insecurity. Poverty may be closely related to food insecurity, but they are not the same. According to Rose (1998), a one-to-one correspondence between measures of poverty and food insecurity does not exist even though there is a close relationship between poverty and hunger or food insufficiency indicators. In other words, factors that determine poverty do not always determine food security. Many poor households that are vulnerable to poverty are not always undernourished or more likely to consume less than the recommended calorie intake in the future. This section reviews the measures of vulnerability to food insecurity in the literature as well as some studies on the measures of

vulnerability, which can be developed further to measure vulnerability to food insecurity based on the household consumption surveys.

The International Fund for Agricultural Development (IFAD) measured a household level of vulnerability to food insecurity in Guatemala in 1996. The household survey of 241 rural households in 8 communities was conducted in an attempt to identify the determinants of food insecurity and the roles played by women (IFAD 1996). The study sets out a number of single socio-economic factors, which are likely to affect a household's food security status. It proposes the composite indicator of household food security, which combines information on household's food accessibility and vulnerability to entitlement failure relating to the roles of women. The composite indicator is constructed on the basis of five components: food production; household income; asset ownership; income diversification; and crop diversification. The proxies used for these components are selected from variables that reflect household supply and demand of food as well as its ability to cope with the food shortages. Households in this study are grouped into terciles in which the low tercile contributes low vulnerability, while the high tercile gives high vulnerability to household food insecurity. This approach is useful in locating households that are negatively associated with food security and identifying the most vulnerable groups within the context of food security. However, the indicator constructed according to this method does not give an absolute indicator of vulnerability to household food insecurity.

Løvendal, Knowles and Horii (2004) propose a conceptual framework based on the sustainable livelihoods approach to analyse household vulnerability to food insecurity using qualitative information. Their studies focus on food availability, food access, food utilisation and food stability in defining food security. It creates a vulnerability group profile based on interviews from institutional workshops on food insecurity and vulnerability as well as community-level focus group discussions. This livelihood method clusters vulnerable households together on the basis of shared socio-economic status and estimates the size of vulnerable groups by matching each group to a census-based occupational category. Even though this profiling approach is useful in targeting vulnerable groups, its lack of quantitative data makes it impossible to quantify the impact of different factors on a rise or fall in the likelihood of becoming insecure in food. Additionally, it does not allow policy

makers to inform public policies for a specific vulnerable group or compare degrees of vulnerability among groups.

As a follow-up to Løvendal, Knowles and Horii (2004), which proposes a conceptual framework in analysing *ex ante* food insecurity, Løvendal and Knowles (2005) expand their conceptual framework by developing a twin-track approach in relation to risk management to identify and improve policies for food insecurity reduction. Present food security status, characteristics of assets and livelihood activities of households are required to determine risk management. Health risks, life cycle-related risks, social risks and economic risks are considered as factors affecting household's food accessibility. Their proposed method assumes that households are likely to reduce their vulnerability through risk management. The potential impacts of risks depend on the type, level, frequency, timing and severity of each specific risk. Characteristics of risk management instruments are identified. Additionally, the study analyses the potential effectiveness of the key instruments in managing risks related to food security, which is defined in terms of food access, food availability and food utilisation. This policy approach is very useful in advocating policies for managing and eliminating threats to long-term food security. However, the choice of the key instruments is complicated and they are not easily determined. There is a wide range of risk factors and instruments in risk management related to food insecurity at different levels. These instruments are also linked to various dimensions of food security and some of them tend to affect more than one dimension. In addition, instruments at one level are associated with instruments at other levels. For instance, the risk management instruments involved in financial services, such as micro credit and agricultural loans, may have an impact on both household and community levels.

One existing approach of vulnerability proposed by some authors that could be applied to measure *ex ante* food insecurity is the measure of a household's ability to smooth consumption over time in response to various shocks (Glewwe and Hall 1998; Dercon and Krishnan 2000). In other words, this approach measures vulnerability in terms of the probability of falling below a specific consumption threshold or the probability of the share of food to total expenditures being above a critical level of welfare. This method is useful in determining who is likely to be

secure in food in terms of having sufficient quantity of food. However, it does not capture other components of the definition of food security, such as food stability and food utilisation.

As discussed earlier in Chapter 3, the two main methods of measuring vulnerability related to poverty proposed by many authors are the “expected poverty” approach (See, for example, Pritchett, Suryahadi and Sumarto 1999; Christiaensen and Boisvert 2000; Chaudhuri 2001; Chaudhuri, Jalan and Suryahadi 2002) and the “low expected utility” approach (Ligon and Schechter 2002, 2003). The expected poverty approach helps quantify the incidence of vulnerability to poverty and advocate policy for a specific group of vulnerable households. This method can capture the food availability component but still cannot encompass all dimensions of food security. The expected utility approach helps capture both aggregate and idiosyncratic risks in measuring vulnerability. This method can be used to quantify vulnerability effects of households with low returns to assets. Although the livelihood assets can be used as proxies for the ability to withstand or cope with shocks, this method only captures one component of the definition of food security – food accessibility.

Overall, all studies discussed above indicate that most existing theoretical and empirical approaches to measure vulnerability related to food insecurity do not fully encompass all food security dimensions. Food availability and food access have received the most attention from researchers, followed by food utilisation, while food stability and food acceptability have been mostly ignored. In addition, most studies use food intake as a proxy for food security. There is no explicit definition and measure of vulnerability to food insecurity. The choice of the most appropriate empirical method usually depends on the specific research objectives and available data sources. To distinguish chronic food insecurity from transitory food insecurity and direct pro-poor policies towards particularly vulnerable groups, a quantitative measure of vulnerability is required. The measure used in this study is adopted from the expected poverty approach, which measures vulnerability as the probability of being under a certain consumption threshold based on contemporaneously-observed household characteristics. This approach seems to be an appropriate measure of vulnerability to food insecurity for Thailand and other countries where a household panel data set is not available. Measures of vulnerability under the expected poverty

approach vary depending on the choice of poverty thresholds. In other words, a household vulnerability is measured in terms of the probability of falling below a particular poverty line. In this study, to cover more dimensions of household food security, the expected poverty approach is adopted to measure the probability of being below the minimum dietary calorie requirement for a specific household. This adjustment indirectly captures the “food utilisation” component of food security in terms of nutritional outcomes because the calorie intake of a household can reflect its ability to withstand risk from undernourishment.

4.2.3 Determinants of Vulnerability to Food Insecurity

The World Food Summit in 1996 indicated that a household’s economic, social, cultural and institutional circumstances have an influence on its food security status. Several empirical studies have been conducted, in both developed and developing countries, to determine factors affecting a household’s food security status (See, for example, Garrett and Ruel 1999; Iram and Butt 2004; Feleke, Kilmer and Gladwin 2005; Babatunde et al. 2008; Maharjan and Joshi, 2011; Mitiku, Fufa and Tadese 2012). However, no empirical study on the causes of household vulnerability to food insecurity has been conducted in Thailand. A study of the determinants of food insecurity is considered essential to successfully improve food security status and ease the implementation of food security development programs at different levels. Empirical evidence from past studies on food security shows that some household characteristics do not only affect poverty but also have an influence on food insecurity, particularly among low-income or poor rural households that engage in farm activities.

Following the methods proposed by Behrman and Deolailikar (1988) and Strauss and Thomas (1995), a household utility model is constructed by Garrett and Ruel (1999) to examine the determinants of food security and child malnutrition. They measure food security status in terms of calorie availability in a household. The height-for-age Z-scores based on the WHO reference are used as a proxy for child nutritional status. Their results show that the determinants of food insecurity and child malnutrition are nearly the same. Household income, maternal education, demographic structure and regional location are found to be the significant factors influencing calorie availability and child nutritional status. In addition, their studies indicate that levels

of food security and malnutrition, as well as their determinants, are different between rural and urban areas. The impact of household income on food security is stronger in urban areas, while household size has a relatively large negative impact in rural areas.

Similarly, Iram and Butt (2004) measure household food insecurity in terms of an inadequate nutrition outcome. The main features of the determinants of food security in Pakistan are examined using an OLS method. They derive the per capita daily calorie intake from the quantity of food consumed by a household as an indicator of food security. The explanatory variables included in this model are household characteristics, maternal characteristics and socio-economic factors. Their studies show that mother's age, mother's educational attainment, household income, dependency ratio, access to safe water and quality of health and sanitation facilities have significant impact on the food security status of a household. Similar results obtained from a logistic regression analysis by Foley et al. (2010) show that food insecurity level is highest among households that experience low education levels, high dependency ratio and poor health conditions. On a relevant issue, Khan, Azid and Toseef (2012) estimate the determinants of food security at a district level in rural areas of Pakistan with an OLS method based on three aspects of food security: food availability, food accessibility and food absorption. Their findings are consistent with the reports from Iram and Butt (2004) and Foley et al. (2010) in which adult literacy, safe drinking water, number of hospitals accessible and child immunization rates positively and significantly affect household food security. Primarily focusing on child vulnerability to chronic malnutrition in Egypt, Mazumdar (2012) also finds significant the effects of health facilities and water source on vulnerability to long-term nutrition deprivation among children.

Following the study of Singh, Squire and Strauss (1986), which defines food security within the theoretical framework of consumer demand and production, Feleke, Kilmer and Gladwin (2005) develop a model to determine household food security in Southern Ethiopia. They derive a household utility function based on the assumption that a household's production activities affect the household's income as well as its consumption behaviour. Household food security is determined by the difference between the amount of calories available and the calorie needs in a household. They

apply a logistic regression model to estimate vulnerability to food insecurity. To encompass food access and food stability in the definition of food security, the timing and amount of maize harvest are used as a proxy for food security in Ethiopia. Households who have to harvest early before maturity for one third or more of their maize are considered to be insecure in food due to their lack of food access and alternative sources of income. Their findings show that household size, number of livestock, technology adoption, farming system used and size and quality of land are the most important determinants of food security.

To identify the severity of food insecurity, Tarasuk (2001) analyses factors related to food insecurity with hunger by distinguishing between moderately food insecure households and extremely food insecure households. The author defines severity in terms of the duration and frequency of food deprivation over time. The data is based on three in-person interviews of women who participate in food hamper programs in Canada. Households are defined as food insecure if they response in their interviews that they have experienced food shortages – having very little food and no money to buy food in the last 12 months. Households are classified as food insecure with moderate hunger if they experience a reduction in food intakes among adult members. On the other hand, households with a reduction in both children and adults' food intakes are classified as food insecure with severe hunger. In addition, this study indicates that households are more likely to be insecure in food if they experience financial difficulty acquiring food (purchasing food on credit, putting off paying a bill to have money for food, for example), poor health condition or a lack of supportive social networks.

Regarding the impact of gender on food security, Babatunde et al. (2008) conduct an empirical study to identify the determinants of vulnerability to food insecurity among farm households in Nigeria. Using a gender-based analysis, they collect the gender disaggregated information on demographic and socio-economic characteristics of households, such as age, household composition, education level, land ownership, assets and employment status. An OLS regression model comprising ten explanatory variables is used to examine the determinants. The level of household vulnerability to food insecurity is measured in terms of the weighted sum reflecting frequency and severity of household coping strategies. In other words, the dependent variable in the

model is an index, which indicates how households response or adapt to food shortages. The higher the sum of the coping strategies, the more vulnerable to food security the household is. Their gender based analysis indicates that female-headed households are more likely to be poor and more vulnerable to food insecurity than male-headed households. In addition, their model predicts that an increase in food consumption expenditure and the number of labour hours would reduce vulnerability to food insecurity for both female- and male- headed households. Farm size and value of crop outputs are found to be significant only among male-headed households. In contrast, the age and education of a household head are only significant in female-headed households. Regarding the impact of age and gender inequality, Goldhar, Ford and Berrang-Ford (2010) also indicate that the prevalence of food insecurity is relatively high among women and adults aged 55 years and over, based on their qualitative interview results.

Using a negative nutritional outcome approach, Maharjan and Joshi (2011) study the determinants of household food insecurity in Nepal by applying a binary logistic regression in their analysis. They measure food insecurity in terms of food self-sufficient months, which is estimated by dividing the total calories available in a household for a year by the calorie requirements of a household for one month. Households with food self-sufficient months numbering less than 12 are considered to be insecure in food. In addition, the food security income threshold of a household is estimated by multiplying the number of self-insufficient months with an adult equivalent household size. Therefore, households that have less than 12 food self-sufficient months and whose income is below the food security income threshold are categorised as chronically food insecure. The regression model estimates food insecurity as the probability that the household will be food insecure. Their findings are in line with an analysis of food security by Babatunde et al. (2008) in which female-headed households are more likely to be insecure in food than male-headed households. In addition, the support of community-based organisation and resource ownership factors, which includes landholding and irrigation, are significantly and negatively correlated with food insecurity.

Mitiku, Fufa and Tadese (2012) examine food security status and its determinants of rural households in Ethiopia using the logit model analysis. Their method is similar

to the studies by Iram and Butt (2004) and Feleke, Kilmer and Gladwin (2005), which determines food security by comparing total calories available in a household with its calorie requirement per adult equivalent. In addition, the Foster-Greer-Thorbecke (FGT) measure is used to compute incidence, depth and severity of food insecurity. Their findings are consistent with the results obtained from some previous studies in which household size, household farm income, cultivated landholding, off-farm income and livestock ownership are found to be significant factors influencing household food security status.

Considering household food access, Leah et al. (2012) apply a sustainable livelihoods framework to examine the impact of livelihood assets on the food access of small-scale agricultural households. They define food security in terms of a household's ability to meet its food needs over the course of a year. The number of months of adequate household food provision is used as a proxy for food security of a household. They find that health status, type of housing material, space in household residence and community support are significantly associated with household food access.

Focusing on rural household food security, Bashir and Schilizzi (2013) review 40 studies on the determinants of food security among rural households in Africa and Asia. They propose a conceptual model which defines food security based on three components: food availability, food accessibility and food utilisation. They find that most studies on food security focus on food availability, followed by food accessibility and food utilisation respectively. The factors most affecting food availability are education, input availability, the adoption of agricultural techniques and land quality. Regarding food accessibility, the most studied factors are household income, household size and family structure. Lastly, the factors with most influence on food utilisation are gender and expenditure on food and health.

Overall, existing studies indicate that the most commonly used factors in studying the determinants of food security are food consumption, human capital (education, household demographics, health status, for example), land ownership, agricultural production, community support and housing conditions. Many studies in Asia consider farm credit, household income and sanitation as important factors in assessing food security at the micro-level. In addition, the most popular analytical

technique applied to several studies is the “logit”, or “logistic regression”, model. It predicts the relative effect of each explanatory variable on the probability of becoming food insecure based on the nutritional framework and critical food security threshold.

4.3 Methodology and Data

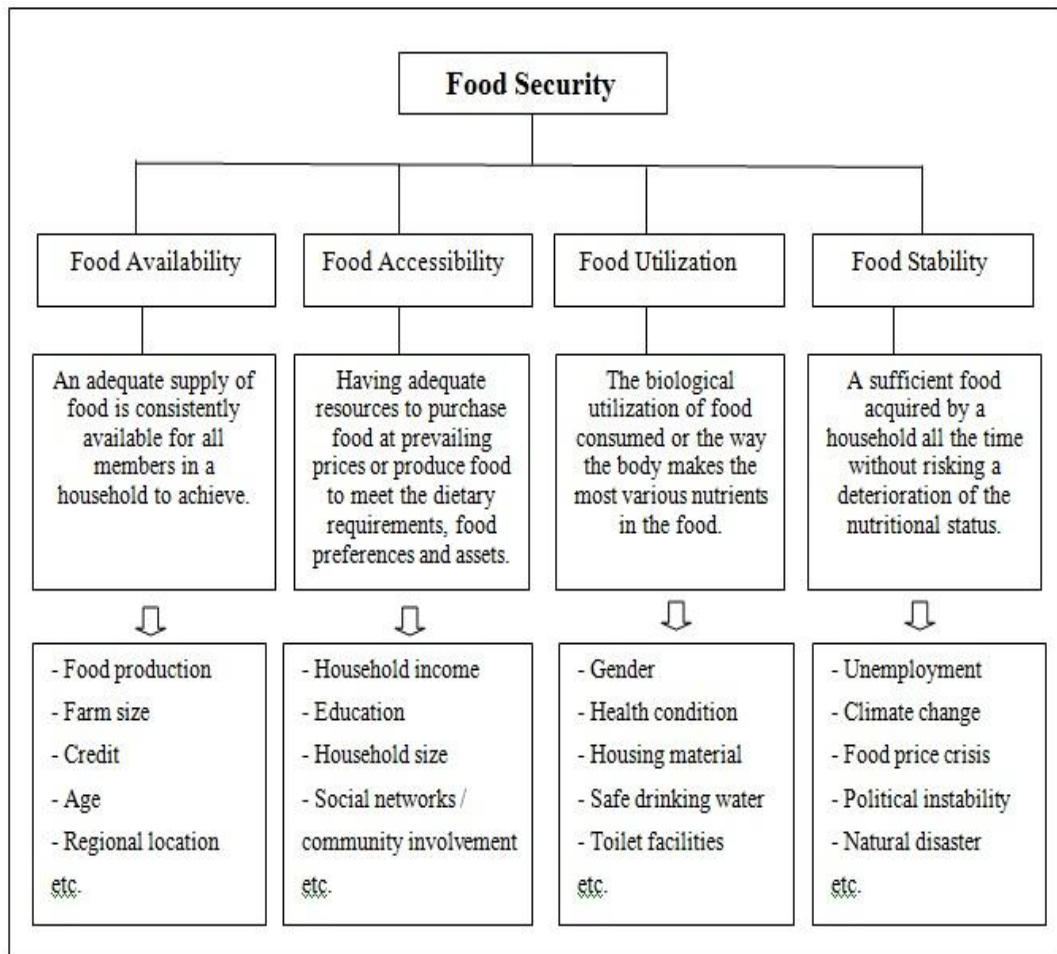
This section explains the concept of food security, an approach to measuring vulnerability to food insecurity, and the regression method used to identify the determinants of household vulnerability to food insecurity in this study, based on Thai household survey data from 2010.

4.3.1 The Conceptual Framework of Food Security

This study applies the conceptual framework of food security introduced by the UN Food and Agricultural Organisation (FAO 2000) to define household food security. Figure 4.1 illustrates a conceptual framework of household food security, which encompasses four dimensions of food security: food availability, accessibility, utilisation and stability.

Food “availability” represents the supply side of food security, which is determined by the level of food production in a household. Food “accessibility” implies the demand side of food security or an ability to obtain sufficient foods. The “utilisation” of food represents a biological perspective of food security which is related to health and sanitation of a household. Food “stability” refers to a situation of food and nutrient shortages during certain periods (transitory food insecurity) due to some adverse shocks or a long-term persistent lack of adequate food (chronic food insecurity).

Figure 4.2: Conceptual Framework of Household Food Security



Source: Adapted from Guidelines for national FIVIMS (FAO 2000).

4.3.2 Measure of Vulnerability to Food Insecurity

Chaudhuri, Jalan and Suryahadi (2002) and Chaudhuri (2003) develop the “expected poverty” approach, an *ex ante* measure of vulnerability to poverty, which defines household vulnerability as the probability that a household will fall into poverty in the future. Focusing on vulnerability in the context of food insecurity, this approach is adopted to measure household vulnerability to food insecurity at time t as the probability of its dietary energy consumption at time $t + 1$ being below the food security line (F):

$$V_{it} = \Pr(\ln c_{i,t+1} < \ln F) \quad (4.1)$$

The calorie consumption (c_i) function is estimated as:

$$\ln c_i = \beta X_i + e_i \quad (4.2)$$

where $\ln c_i$ is a log of *per equivalent* household food consumption; X_i is a set of household characteristics and other determinants of household nutritional norms, β is a vector of coefficients of household characteristics, and e_i is a disturbance term that captures the idiosyncratic shocks to per equivalent caloric consumption of a household. The variance of the disturbance term, e_i , depends on:

$$\sigma_{e,i}^2 = X_i \theta \quad (4.3)$$

β and θ are estimated using a three-step Feasible Generalized Least Squares (FGLS) procedure. The expected log caloric consumption and the variance of log caloric consumption are obtained as follows:

$$\hat{E}[\ln c_i | X_i] = X_i \hat{\beta} \quad (4.4)$$

$$\hat{V}[\ln c_i | X_i] = \hat{\sigma}_{e,i}^2 = X_i \hat{\theta} \quad (4.5)$$

Assuming that caloric consumption is log-normally distributed, the estimated vulnerability to food insecurity of a household i is given by:

$$\hat{V}_i = \Pr(\ln c_i < \ln F | X_i) = \Phi \left(\frac{\ln F - X_i \hat{\beta}}{\sqrt{X_i \hat{\theta}}} \right) \quad (4.6)$$

where $\Phi(\cdot)$ denotes the cumulative density function of the standard normal distribution. Thus, \hat{V}_i represents the probability that a per equivalent calorie consumption of household i with characteristics X_i at time t will be lower than the food security line (z) at time $t+1$.

Determining the Household Food Security line

The food security threshold plays an important role on determining household vulnerability to food insecurity. In this study, according to the nutritional conceptual framework, the household food security threshold represents a household's minimum dietary calorie requirements in terms of kilocalories per day. Therefore, a household is classified as insecure in food if its per equivalent daily caloric consumption is less

than the household's food insecurity line, which is a minimum dietary calorie requirement per day of a household.

Nutritional norms usually vary from country to country due to difference in climate, race and cultural eating habits. The average recommended energy allowances measured in terms of kilocalories for healthy Thai people are adjusted for the age, gender, weight and height of a person. They are estimated by the Nutrition Division (1989) as shown in Appendix 4.1. The average daily calorie requirement for adult males is typically higher than their female counterparts. Pregnant women have more calorie needs than single females, while elderly people need less calorie consumption. The calculation of household calorie consumption in this study cannot rely on this reference table. It is not up to date due to changes in the amount of energy needed over time. The Food and Agriculture Organization of the United Nations (FAO 2004) created a new standard for undernourishment estimates, in which each household has its own food security line depending on the age, gender and occupation or lifestyle of the household members.

The procedure for estimating the minimum dietary energy requirement for each household involves specifying the reference body weight and height among population groups of different age and gender. However, the Thai SES only contains information on age and gender, and does not record the weight and height of all members in a household. Because there is a high variability in the body weight and height of individuals, this study derives the corresponding body weight using the Body Mass Index (BMI) and the attained height table for Thai population. The BMI represents body mass based on an individual's weight and height, which is associated with body fat and nutritional status.

Furthermore, different households have different energy requirements depending on the metabolism and activity levels of occupants. The FAO report estimates Basal Metabolic Rate (BMR) and Physical Activity Level (PAL) factors for each individual (FAO 2004). They use the sex and age specific regression parameters of the Schofield equations (James and Schofield 1990) to obtain the minimum calorie intake per day of a person. This study computes the minimum energy requirement per day for children and adolescents who are less than 18 years old by multiplying the reference body weight for attained-height by energy requirements per kilogram of

body weight. The BMI reference tables published by the World Health Organisation (WHO 2007) are used in this study.

National Growth charts, published by the Ministry of Public Health in 2000, are used to obtain average height data by different age and gender for Thai population as shown in Appendix 4.2. Appendix 4.3 contains information on energy per kilogram of body weight for different age and gender obtained from the FAO (2004). This reference table is used to obtain the total dietary energy requirement per day in childhood and adolescence. For adults and children above 10 years, the body reference weight on the basis of the fifth percentile is used to estimate the minimum dietary energy requirements. The minimum calorie requirements per person for adults are computed by multiplying the estimated Basal Metabolic Rate (BMR) based on the Schofield equations by the Physical Activity Level (PAL) factors in Appendix 4.4.

Classification of occupational work or lifestyles in relation to an individual's physical activity is determined in terms of PAL values at different levels. According to the FAO (2004), the PAL values for normal adults who are healthy and have no chronic diseases usually range from 1.40 to 2.40. As shown in Appendix 4.5, this study categorises the PAL values into four levels based on a person's economic activity. For example, unemployed or retired people have very light active lifestyles. In contrast, those who are involved in agricultural or mining sectors are more likely to have very heavy lifestyles which require high calorie needs.

Estimating per equivalent calorie consumption

Households' needs grow with each additional member, but not in a proportional way due to economies of scale. In addition, the distribution of food consumption in a childless family is different from a family with children. In order to divide a household's calorie consumption, an equivalence scale is needed to identify the portion of food consumption attributed to children and the portion attributed to adults in a household. Therefore, the household size and the age of its members should be taken into account in estimating total household food consumption.

According to Atkinson (2003), there is a wide range of equivalence scales used in poverty studies, but there is no consensus on the particular method in determining

equivalence scales. The choice of a particular equivalence scale depends on technical assumptions regarding economies of scale in household consumption as well as critical judgments on the composition of a household or the priority assigned to the needs of elderly and children. The most commonly used scales are developed by the Organisation for Economic Co-operation and Development (OECD). The OECD equivalence scale uses the following functional form:

$$S(A, K) = 1 + \alpha(A - 1) + \beta K \quad (4.7)$$

An equivalence scale is denoted as the ratio of the dietary energy needed level for a household with A adults and K children relative to the energy needed level for a reference unit. The particular values of α and β employed by the original OECD scale in 1982 are 0.70 and 0.50 respectively (OECD 1982). In other words, this scale assigns a value of 1 to the first household member, of 0.70 to each additional adult aged 14 or over and of 0.50 to each child in a household. The modified OECD scale developed in 1994 changes the weight of the second adult and of the children to be 0.50 and 0.30 respectively (Förster 1994). In 2008, the OECD developed a square root scale to compare income inequality and poverty across countries (OECD 2008). This scale divides household income by the square root of household size, implying that a household of four members would need twice as much calorie intake as a household of a single person. Table 4.1 summarises the effect of these three different OECD equivalence scales.

Table 4.1: The Effect of OECD Equivalence Scales on Household Size

Household size	Equivalence scale			
	Per capita calorie consumption	Original OECD scale	Modified OECD scale	Square root OECD scale
1 adult	1	1	1	1
2 adults	2	1.7	1.5	1.4
2 adults, 1 child	3	2.2	1.8	1.7
2 adults, 2 children	4	2.7	2.1	2.0
2 adults, 3 children	5	3.2	2.4	2.2
Elasticity	1	0.73	0.53	0.5

Source: Atkinson (2003).

However, it is important to note that other functional forms of equivalence scales can also be used instead of the OECD scales. Another two parameter function form of equivalence scale that has been used widely by many researchers (See, for example, Jenkins 1991; Cutler and Katz 1992; Banks and Johnson 1994) is:

$$S(A, K) = (A + \rho K)^f \quad (4.8)$$

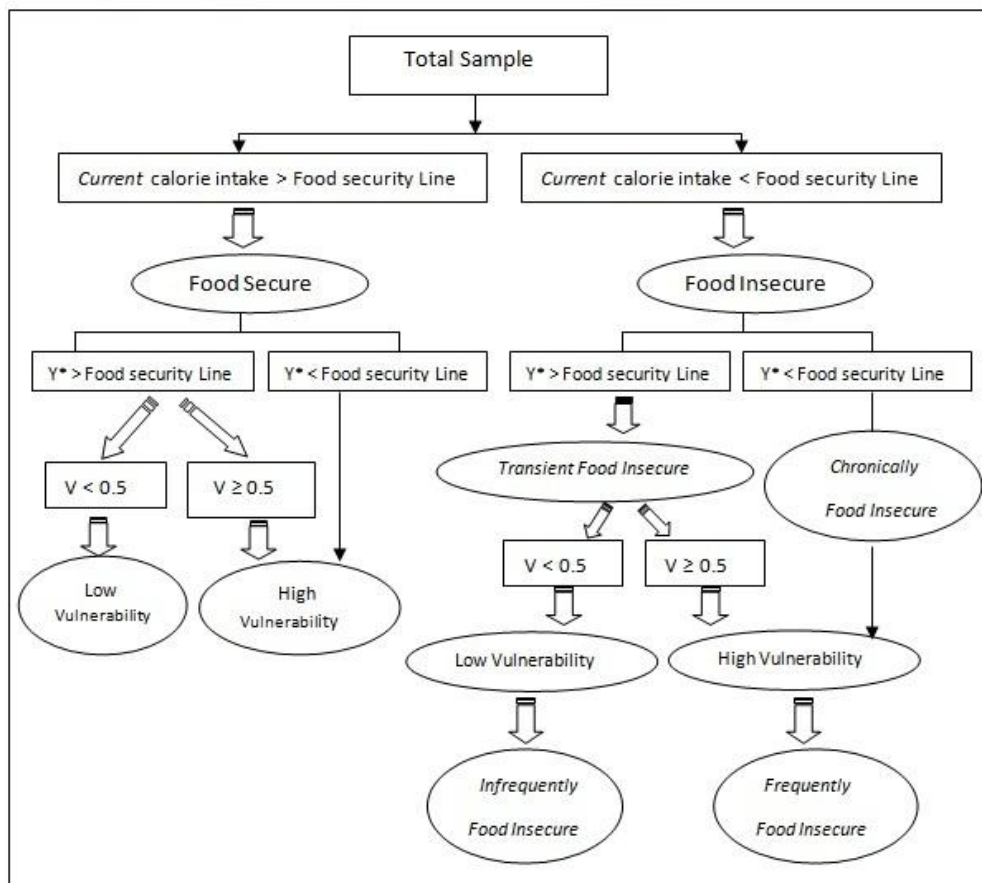
The parameter ρ denotes the equivalence between adult and children consumption. The parameter f represents the economies of scale in a household. In other words, the percentage increase in household consumption needs is related to the percentage increase in a household size when f is equal to one, while all households are assumed to require the same amount of calorie consumption when f is equal to zero. The two parameters are both less than 1.0. According to Cutler and Katz (1992), the values of ρ and f are estimated using non-linear least squares. The estimated values for ρ and f are 0.76 and 0.61 respectively. By using this scale, the cost of an additional member of a household depends on the composition and size of a household. On the other hand, the marginal cost of additional family member is independent of the size and composition under the OECD scales. However, the results from the Cutler/Katz scale are found to be quite sensitive and cause significant differences in estimating the poverty thresholds in an analysis of poverty. In this study, the sensitivity test is used to examine changes in the proportion of household being below the food security line by employing the four equivalence scales described above to estimate a household's dietary energy consumption.

4.3.3 The Classification of Food Insecurity and Vulnerability

As shown in Figure 4.3 below, the classification of food insecurity and vulnerability adapted from Bidani and Richter (2001) and Suryahadi and Sumarto (2003) is similar to the classification of vulnerability to poverty in Chapter 3. In this chapter, focusing on food security, a household is classified as “chronically food insecure” if its present and expected dietary energy consumption is less than the household's food security line. On the other hand, a household who is insecure in food today is classified as “transient food insecure” if its expected calorie consumption is greater than its food security line. Subsequently, the transient group is further divided into two subgroups: the “frequently food insecure” households with high vulnerability to

becoming food insecure; and those characterised as the “infrequently food insecure”, with low vulnerability to falling below the food security line.

Figure 4.3: Classification of Food Insecurity and Vulnerability



Source: Adapted from Bidani and Richter (2001) and Suryahadi and Sumarto (2003).

Similarly, a common vulnerability threshold of 0.5 which represents a 50 percent likelihood of becoming insecure in food each year is utilised again in this chapter. Non-poor households with a likelihood of becoming food insecure equal or greater than 0.5 are considered to be highly vulnerable to food insecurity. On the other hand, those who have a likelihood of becoming insecure in food less than 0.5 are defined as low vulnerable.

4.3.4 Determinants of Food Insecurity and Vulnerability to Food Insecurity

This chapter applies similar econometric methods as discussed in Chapter 3 to analyse vulnerability to food insecurity. Two regression models are used to examine

the influence of households' socio-economic and institutional characteristics on food insecurity and vulnerability to food insecurity in Thailand. Regarding the determinants of vulnerability to food insecurity, an OLS regression model is used to determine factors influencing a household's food insecurity level:

$$\hat{V}_i = X_i\delta + \mu \quad (4.9)$$

where \hat{V}_i is the estimated vulnerability to food insecurity for household i by equation (4.6), X_i is the vector of household idiosyncratic characteristics, δ is vector coefficients and μ is the error term.

The next step involves assessing the determinants of food insecurity in terms of factors affecting the household's probability of becoming food insecure. The binary probit model is applied to examine whether a household's per equivalent calorie intake is less than its food security threshold in 2010, conditioned on a vector of determinants of dietary energy consumption, X_i . The dependent variable is dichotomous taking a value of 1 if the household is food insecure and 0 otherwise. A household is identified as food secure or food insecure by comparing its total calorie intake per adult equivalent to the minimum dietary energy requirement per adult equivalent. The model is expressed in the following form:

$$Y_i = \Phi(\alpha + \sum \beta_i X_i + e) \quad (4.10)$$

where

$Y_i = 1$ if household is food insecure ($\ln C_i < \ln F$) and $Y_i = 0$ otherwise.

Φ = Cumulative density function for the standard normal curve

β_i = Regression coefficient of each explanatory variable

X_i = Explanatory variables

e = Error term

The main explanatory variables are selected based on the nutritional conceptual framework, which encompasses four dimensions of the definition of food security: food availability; food access; food utilisation and food stability. The demographic and socioeconomic characteristics of a household as well as information regarding a household's access to food based safety nets are included in the models. Household food availability in terms of resource ownership, such as lands and food stocks, are likely to be important factors affecting a household's food security status and its

ability to cope with idiosyncratic shocks. In regard to food utilisation and food stability, information on household health and housing conditions, access to medical services and adequate credit are included in the models. In addition, similar to the method in Chapter 3, two separate regressions are carried out for urban and rural areas to deal with structural difference by examining whether the influence of some factors, such as education and land size, differs between rural and urban areas.

4.3.5 Sensitivity Analysis: Estimating vulnerability with different thresholds

Regarding the precision of estimated household vulnerability, a total of 3,256 households were tracked in the 2011 SES (NSO 2011) to examine the percentage of vulnerable households in 2010 who actually became insecure in food in 2011. An accuracy of the expected poverty approach in estimating household vulnerability status depends on the choice of vulnerability and food security lines. In this study, two vulnerability thresholds and five food security lines are used to examine the sensitivity of estimated household vulnerability to food insecurity in equation (4.6). For the chosen vulnerability thresholds, the choices are similar to the sensitivity test in Chapter 3 in which the vulnerability thresholds of 0.5 and the mean vulnerability or the observed food insecurity headcount are utilised. For the chosen food security lines in this study, the *per capita* household food security and four different *per equivalent* household food security lines based on methods proposed by the OECD and the study by Cutler and Katz (1992) are used. The choice of the equivalence scale has a significant impact on food insecurity measures and changes in the food insecurity head count ratio.

4.3.6 Data Sources

The Thai ‘Household Socio-Economic Survey’ (SES) in 2010 (NSO 2010a), collected by the National Statistical Office of Thailand (NSO), was used to analyse household food insecurity and vulnerability. The survey is carried out from January to December every year, containing information on expenditure and income of Thai households in both municipal and non-municipal areas. Based on a stratified two-stage sampling, provinces in all regions in the survey are constituted into strata. The primary sampling units are blocks for municipal/non-municipal areas and the secondary sampling units are blocks for households. Household expenditures include

food, durables and non-durables. The survey contains both information of heads of the sample households and household members.

Subsequently, the 2011 SES (NSO 2011) is used to track the same respondents between 2010 and 2011 in order to calculate the percentage of households estimated to be vulnerable in 2010 and that actually became insecure in food in 2011. The food quantities consumed by this repeated group of households are converted into nutrient values to obtain their daily calorie intakes and food security lines in 2011. Household data on food consumption from the SES in 2010 and 2011 (NSO 2010a, 2011) was collected from respondent households over a seven-day reference period in terms of quantity and monetary value in baht. The survey contains almost two hundred food items consumed by the Thai population. These food items are grouped into 12 categories, not including alcoholic beverages, as shown in Appendix 4.6.

The table of nutritive values of Thai foods commonly consumed by the population provided by the Nutrition Division (2001) is utilised to convert a household's total food quantity in 2010 and 2011 into dietary energy values in terms of kilocalories per day. However, the data on food consumed away from home is usually collected in monetary values, not in quantity. Therefore, the nutritive values in terms of daily calorie intake have to be estimated indirectly using the food baskets and spatial price indices provided by the Department of Business Economics, Ministry of Commerce. The spatial price indices are calculated separately for consumption of food and non-food items (Kakwani and Krongkaew 2000). The Department of Business Economics first computes the price indices for 1992 and uses the urban and rural consumer price indices for each region to compute the price indices for other years.

Nine different baskets, which contain prices and a total of approximately 125 food items consumed by Thai people, are utilised by the Department of Business Economics to compute the spatial food price indices for rural and urban areas in five regions. The nine baskets consist of five baskets in the municipal districts and four baskets in the sanitary districts. The spatial food price indices take into account regional food price differences, which reflect the relative cost of living in different regions and areas. The value of the index is relative to Bangkok for four other regions: the Central, North, Northeast and South. Following Kakwani and Krongkaew (2000), the nine food baskets which contain food consumption levels in

kilograms per month are multiplied by the nutrient values, based on the conversion factors provided by the Department of Health, Ministry of Public Health in Thailand, to obtain the daily calorie content of the basket.

Generally, the average calories obtained per baht based on sanitary district baskets are lower than the municipal baskets (Kakwani and Krongkaew 2000). This indicates that the sanitary food baskets are more cost effective than the municipal baskets because households in the sanitary districts pay lower energy costs than households in municipal areas. As a result, as shown in Table 4.2, the cost of calories obtained per baht in 2010 and 2011 are calculated based on the average sanitary district basket by converting each baht spent on food into calories. Finally, the cost of food consumption away from home in terms of baht per day is obtained by multiplying the total money spent on food by the calories obtained per baht in the table for each region.

Table 4.2: Calories obtained per baht based on Average Sanitary District Basket

Regions	Sanitary District Price		Municipal District Price	
	2010	2011	2010	2011
North	86	83	72	69
Northeast	85	82	71	68
South	76	73	62	59
Central	82	79	68	65
Bangkok	82	79	61	59

Source: Author's calculation based on the spatial food price indices and nine food baskets provided by the Ministry of Commerce, Thailand (MOC 2010, 2011).

Table 4.3 provides the weight characteristics of Thai household data by area in 2010. The sample size only includes households that reported their food consumption quantities in full details in the original 2010 (NSO 2010a), which is approximately 75 percent of the sample. For per equivalent household daily calorie consumption, a modified OECD equivalence scale assigns the value of 1 to a household head, 0.5 to each additional adult member and 0.3 to each child in a household. The reference family unit used in estimating adult equivalent calorie consumption is a household of two adults and two children (de Vos and Zaidi 1997). This modified OECD scale is chosen according to the results obtained from the sensitivity test in Section 4.45, which indicates that this scale is more accurate than other scales.

Definitions and statistical descriptions of variables included in the regression models are given in Table 4.4. Variables are chosen based on the key determinants found in the literature review on food security. Most selected variables are qualitative data called dummy variables such as levels of education and regional location. The parameters are estimated by STATA software package version 10.

Table 4.3: Weight Characteristics of Thai Household Data by Area, 2010

Variables:	National	Urban	Rural
Sample size (households)	33,204	19,765	13,439
Daily calorie intake per equivalent (Kcal)	2,076	2,093	2,068
Household size (Mean)	3.24	3.10	3.38
Age of head of household (Mean)	48.46	48.65	48.34
Head of household is female	9,985	6,627	3,358
Dependency ratio	3.38	3.24	3.42
Household head's highest education is primary schooling	17,925	11,564	6,361
Household head's highest education is secondary schooling	4,667	3,573	1,094
Household head's highest education is high school	2,783	1,726	1,057
Household head's highest education is university	2,412	1,145	1,267
Socio-economic class is a farm operator, mainly own land	3,113	1,024	2,089
Socio-economic class is a farm operator, mainly rent land	1,332	425	907
Socio-economic class is a landless farm worker	1,684	582	1,102
Socio-economic class is a construction / mining labour	5,243	2,518	2,725
Socio-economic class is a professional, technician, entrepreneur	8,259	5,897	2,362
Socio-economic class is a plant operator/ assembler	2,514	1,138	1,376
Cultivated land owned by households (Rai)	2.08	1.87	3.22
Home-produced food (baht/month)	398	263	374
Household's net profits from farming (baht/month)	3,427	3,329	3,846
Access to safe drinking water and piped water supply	18,762	11,238	7,524
Household owns a cement/brick independent house	9,524	7,640	2,884
Household member got sick & unable to work at t-1	849	263	586
Unable to fully pay for housing rent/housing utilities/ education at t-1	3,124	1,268	1,856
Full Access to long-term business or agricultural loans at t-1	16,368	10,543	5,825
Full Access to emergency funds at t-1	9,962	6,379	3,583
Household's income from migrant remittances	1,145	1,132	1,389
Access to the government's medical services	9,524	5,653	3,871
Household lives in Bangkok	1,927	1,927	-
Household lives in Central	8,522	5,653	2,869
Household lives in North	7,524	5,121	2,403
Household lives in Northeast	9,397	5,682	3,715
Household lives in South	5,834	3,641	2,193
Household Lives in rural areas	11,180	-	-
Household Lives in urban areas	22,024	-	-

Source: 2010 Household Socio-Economic Survey (NSO 2010a)

Table 4.4: Definition and Statistical Description of Variables

Variable Labels:	Description	Mean	Std. Dev.
Calorie	Daily calorie intake per equivalent (Kcal)	2,076	1,382
Size	Household size	3.24	1.36
Size_sq	Household size-squared	15.32	14.13
Age	Age of household head (yrs.)	46.54	13.23
Age_sq	Age-square of household head	2166.7	1241.12
D_Female	Head of household is female	.301	.195
Dependency	Share of members \leq 15 years old	.539	.362
D_primary	Household head's highest education is primary schooling	.141	.128
D_secondary	Household head's highest education is secondary schooling	.083	.195
D_highschool	Household head's highest education is high school	.073	.105
D_university	Household head's highest education is university	.301	.195
D_farm_own	Socio-economic class is a farm operator, mainly own land	.076	.217
D_farm_rent	Socio-economic class is a farm operator, mainly rent land	.040	.194
D_landless	Socio-economic class is a landless farm worker or labour	.050	.128
D_heavy_labour	Socio-economic class is a construction / mining labour	.127	.263
D_professional	Socio-economic class is a professional, technician, entrepreneur	.434	.629
D_manufacture	Socio-economic class is a plant & machine operator/assembler	.051	.178
Land	Cultivated landholding (Rai)	2.08	1.03
Food_produce	Home-produced food (baht/month)	398	119.43
Farm_profits	Household's net profits from farming	3427	1262
D_safe_water	Access to safe water	.565	.274
D_housing	Household owns a cement/brick made independent house	.287	.315
D_health	Experienced sickness Absence in the work place at $t-1$.026	.043
D_financial	Unable to fully pay for housing rent/housing utilities/education at $t-1$.094	.305
D_loans	Full Access to long-term business or agricultural loans at $t-1$.493	.572
D_emergency	Full Access to emergency funds at $t-1$.300	.416
D_remittance	Income from migrant remittances	1145	574.63
D_medical	Access to public medical services	0.243	0.126
D_Bangkok	Household lives in Bangkok	.058	.167
D_Central	Household lives in Central	.257	.423
D_North	Household lives in North	.227	.438
D_Northeast	Household lives in Northeast	.176	.209

4.3.7 Diagnostic Tests for Regression Analysis

To obtain the best-fit model, the following diagnostic tests are utilised to examine multicollinearity, model specification error, goodness of fit and heteroskedasticity in the probit and OLS determinant models constructed in this chapter.

Multicollinearity

The Variance Inflation Factors (VIF) for selected quantitative explanatory variables and the Contingency Coefficients for dummy variables are computed to detect multicollinearity in the model of the determinants. Using STATA software package, the mean VIF for the probit model and the mean VIF for the OLS model are estimated to be approximately 4.12 and 3.58 respectively. The computed contingency coefficients of dummy variables are estimated to be around 0.643. As mentioned in the previous chapter, the most common rule of thumb for VIF and Contingency Coefficients are 10 and 0.75 respectively (See O'Brien 2007; Mitiku, Fufa and Tadese 2012). The results indicate that no strong correlation exists among the selected explanatory variables. The next step is to see if the models are correctly specified.

Model Specification Error

Several tests can be used to detect problems due to model specification errors such as omitted variables and incorrect functional form. As mentioned in the previous chapter, the Link Test and the Ramsey's RESET Test in STATA are used to detect model specification error in this study. By regressing the dependent variable on the prediction and the prediction squared, the p-value of the squared predictions obtained from the Link Test is found to be greater than 0.10. This implies that the null hypothesis which states that the model is correctly specified should not be rejected. Subsequently, the p-value obtained from the Ramsey's RESET Test is greater than 0.10. Thus, the test has failed to reject the assumption that the models have no omitted variable at 1% level.

Heteroskedasticity

The Breusch-Pagen/Cook-Weisberg test and the Likelihood Ratio test are used in STATA to detect the problem of heteroskedasticity in this study. The Breusch-Pagen/Cook-Weisberg test and the Likelihood Ratio test give the p-value of 0.104

and 0.135 respectively. The results indicate that both tests have failed to reject the null hypothesis that the variance of the residuals is homogenous at 1% level.

4.4 Estimation Results and Sensitivity Analysis

This section explains the results obtained from estimated regressions of vulnerability to food insecurity by the FGLS based on the expected poverty approach, the determinants of vulnerability to food insecurity and the sensitivity of vulnerability to food insecurity estimator.

4.4.1 Estimation of Vulnerability Equations

The regression results from equations (4.4) and (4.5) by FGLS are shown in Table 4.5. The log of household calorie consumption per equivalent in 2010 and variance of the disturbance term are estimated by household demographic and socio-economic characteristics. The estimated coefficient of a household size is significantly negative at 1% level. The result indicates that a larger household tends to provide a lower share of food consumption due to limited food resources. The coefficient of the age of a household head is negative and highly significant. Thus, household calorie consumption declines as the household head's age increases. The square of household size and the square of household head's age are positive and highly significant as expected. This confirms the non-linearity of relationship between per equivalent calorie intake, household size and the age of household head.

Surprisingly, the coefficient of households headed by a female member is positively related to calorie consumption per equivalent and is significant at 1% level. The implication is that households headed by females tend to have higher dietary energy consumption than male-headed households. The finding is totally different from the analysis of vulnerability to poverty in which female-headed households are poorer than male-headed households. This is possibly because female heads, who are largely single mothers, are more concerned about food and have better caring capacity for children's food consumption than male heads. The effect of a number of children in a family is statistically significant. An increase in the dependency ratio leads to a decline in household's calorie consumption per equivalent and higher variance. Thus, households with more children tend to have lower calorie needs because children normally require a lower amount of calories than adults.

Table 4.5: Estimation of Vulnerability to Food Insecurity Equations in 2010

Variable labels	Log calorie intake per equivalent		Variance	
	Coeff.	Robust t-stat.	Coeff.	Robust t-stat.
Size	-.136	(-17.23)**	.079	(12.38)**
Size_sq	.0003	(13.09)**	-.0004	(-15.12)**
Age	-.015	(-8.24)**	-.021	(-14.71)**
Age_sq	.000	(9.76)**	.000	(7.72)**
D_Female	.135	(4.82)**	-.078	(-3.24)**
Dependency	-.452	(16.21)**	.063	(4.41)**
D_primary	.115	(5.42)**	-.059	(-3.01)**
D_secondary	.130	(5.26)**	-.072	(-17.69)**
D_highschool	.206	(11.82)**	-.102	(-14.51)**
D_university	.359	(15.02)**	-.180	(-22.46)**
D_farm_own	.221	(4.83)**	-.119	(-2.34)*
D_farm_rent	-.214	(-17.98)**	.106	(14.05)**
D_landless	-.352	(-25.41)**	.124	(12.16)**
D_heavy_Labor	-.409	(-24.02)**	.138	(9.24)**
D_manufacture	-.131	(-4.62)**	.152	(2.19)*
D_professional	.138	(8.32)**	-.110	(-4.15)**
Land	.859	(24.31)**	-.848	(-16.71)**
Food_produce	.256	(16.04)**	-.154	(5.43)**
Farm_profits	.530	(24.98)**	-.015	(-2.74)**
Remittances	.112	(7.89)**	-.098	(-8.24)**
D_safe_water	.164	(18.21)**	-.105	(-2.23)*
D_housing	.172	(15.87)**	.169	(4.25)**
D_health	-.098	(4.26)**	.085	(2.02)*
D_loans	.236	(20.57)**	-.201	(-5.57)**
D_emergency	.475	(27.29)**	-.102	(-1.95)
D_finance	-.564	(32.70)**	.367	(14.09)**
D_Bangkok	-.224	(-17.05)**	.307	(20.54)**
D_Central	-.265	(-11.31)**	.134	(5.26)**
D_North	-.089	(20.52)**	.102	(7.24)**
D_Northeast	-.306	(-12.37)**	.425	(10.82)**
Constant	8.83	(298.17)	2.95	(11.56)
Obs.	19765		13439	
Prob (F)	0.000		0.000	
R-squared	0.4321		0.0146	

The dummy variables of education of a household head are significant and positive for all education levels. This indicates that a household headed by a person with higher educational attainment has larger dietary energy consumption per equivalent. The coefficient of total cultivated landholdings is positive and highly significant. This implies that farmers with larger landholdings are associated with higher income

and food production. In addition, the household head's occupation has a significant influence on household calorie consumption. Farm operators who cultivate their own land have a relatively high calorie intake per equivalent. In contrast, households that are farm tenants or contain landless farm workers face a decline in calorie consumption. The landless farm worker is found to have a larger fall in food consumption than a farm operator who leases land. This confirms that landholding is essential to food availability for agricultural households. Households headed by a person who engages in non-agricultural activities, such as a chief executive, a professional, a manager or an entrepreneur, are likely to have higher calorie consumption. Highly skilled workers usually earn more money and have better welfare services than low-skilled manual labourers. Households headed by a person who is a construction or mining worker face a larger decline in their calorie intake per equivalent than those headed by a manufacturing sector worker. Income is considered to be an important factor in increasing food accessibility and reducing hunger rates. Households who produce a larger amount of food at home and earn higher farming profits tend to have a higher calorie intake and food consumption.

The estimated coefficient of remittance variable reveals that income from migrant remittances raises household calorie consumption. This implies that households are better protected through income shocks when they receive income from seasonal urban migration. Households experiencing financial difficulties over 12 months and that cannot fully pay rent or education expenses face a decline in food consumption. In addition, households able to borrow long-term business, agricultural loans and emergency funds have relatively high calorie consumption. This implies that households with the ability to receive funds in response to income shocks may be able to partially smooth consumption over time.

Health and sanitation have a strong impact on household nutritional status. The dummy variables of housing material, access to safe water and health condition capture environmental effects on household food utilisation. The estimated coefficients show that households where members became sick and could not work in the past 12 months tend to have a significant decline in calorie consumption. In addition, households that live in a cement or brick made independent house with

access to safe drinking water and piped water supply have a relatively high calorie intake per equivalent.

Surprisingly, the estimated coefficients of geographical location variables give a striking result as compared to the determinants of poverty in Chapter 3. In chapter 3, households that live in Bangkok are found to have higher consumption expenditure per capita and lower vulnerability levels than residents in other regions. However, under the vulnerability to food insecurity analysis, living in the Bangkok and Metropolitan areas decreases a household's daily calorie intake. The decline in calorie consumption of households in Bangkok is even larger than those living in the North region. This is possibly because the rural population is concentrated in the North region. Rural households are able to consume more food than urban households because the amount of home-produced food is larger in rural areas and rural food prices are quite low. The profile of household vulnerability to food insecurity in Section 4.5 shows that rural households have a slightly higher estimated daily calorie intake than urban households.

4.4.2 Categories of Food Insecurity and Vulnerability to Food Insecurity

The categories of household vulnerability to food insecurity in 2010 based on the classification scheme in Section 4.3.3 are shown in Table 4.6. The table shows that, while Thailand is one of the world leaders in rice exports, many households are still affected by food insecurity. Around 11.28 percent of the population was estimated to be vulnerable to food insecurity in 2010. The percentage of the chronically food insecure and transient food insecure was approximately 2.13 percent and 3.25 percent respectively. The higher proportion of the transient food insecure indicates that a larger number of households is temporarily insecure in food than remains undernourished over an extended period of time.

Surprisingly, the proportion of households that are vulnerable to food insecurity in the future is estimated to be greater than the share of those that are currently insecure in food. This finding is different from the vulnerability to poverty profile in which the observed poverty rates are greater than vulnerability rates. Around 5.38 percent of the total population is estimated to be insecure in food, while 5.9 percent is considered to be 'highly vulnerable' to food insecurity sometime in the future. Furthermore, the number of households highly vulnerable to chronic food insecurity

is nearly twice as high as the number of households currently suffering from chronic food insecurity in 2010. Therefore, in spite of the low percentage of total food insecure households, the problem remains in the proportion of the current food secure households that face a high risk of becoming chronically food insecure in the near future.

Table 4.6: Vulnerability to Food Insecurity Categories, 2010

Vulnerability to Food Insecurity Category	(%)
Total Food Insecure: (Chronically food insecure + Transient food insecure)	5.38
- Chronically Food insecure	2.13
- Transient Food insecure (Frequently food insecure + Infrequently food insecure)	3.25
- Frequently Food insecure	1.83
- Infrequently Food insecure (low vulnerable)	1.42
High vulnerable Food Insecure (Chronically food insecure + Frequently food insecure)	3.96
Total Food Secure:	94.62
- Food secure & high vulnerable to Chronically food insecure	3.78
- Food secure & high vulnerable to Frequently food insecure	2.12
- Food secure & low vulnerable	88.72
High vulnerable Food Secure	5.90
Total High vulnerability (High vulnerable food insecure + High vulnerable food secure)	9.86
Total Low vulnerability (Infrequently food insecure + Low vulnerable food secure)	90.14
Total Vulnerability to Food Insecurity (Total High vulnerability + Infrequently food insecure)	11.28
Mean Vulnerability to Food insecurity	7.03

Source: Author's calculation.

As shown in Table 4.7, households that are highly vulnerable to chronic food insecurity are concentrated in rural areas. In 2010, around 3.83 percent of rural households were highly vulnerable to food insecurity and 2.02 percent were vulnerable to chronic food insecurity. In contrast, the share of food secure households vulnerable to frequent food insecurity was relatively high in urban areas. On the other hand, the share of those vulnerable to chronic food insecurity was higher in rural than urban areas. It can be seen that more than half of the vulnerable households in urban areas are more vulnerable to frequent food insecurity.

Table 4.7: Classification of Vulnerability to Food Insecurity by Location, 2010

Vulnerability to Food Insecurity Category	Urban (%)	Rural (%)
Total Food Insecure:	4.52	4.29
- Chronically Food Insecure	1.68	2.24
- Transient Food Insecure	2.84	2.05
- Frequently Food Insecure	1.21	0.92
- Infrequently Food Insecure	1.63	1.13
High vulnerable Food Insecure	2.89	3.16
Total Food Secure:	95.48	95.71
- High vulnerable to Chronically Food Insecure	1.45	2.02
- High vulnerable to Frequently Food Insecure	2.09	1.81
- Low vulnerable	91.94	91.88
High vulnerable Food Secure	3.54	3.83
Total High vulnerability	6.43	6.99
Total Low vulnerability	93.57	93.01
Total Vulnerability to Food Insecurity	8.06	8.12
Mean Vulnerability to Food Insecurity	6.70	5.62

Source: Author's calculation.

Regarding households that are currently food insecure, approximately 4.29 percent of rural households are food insecure. In addition, around half of the rural food insecure households tend to remain in food insecurity for the next few years, namely chronic food insecurity. In contrast, more than half of the urban food insecure households are considered to be transient or temporarily insecure in food. This indicates that the situation of transient food insecurity is more severe in urban than rural areas.

4.4.3 Determinants of Food Insecurity and Vulnerability to Food Insecurity

The regression results which examined the difference between the determinants of food insecurity and the determinants of vulnerability to food insecurity in 2010 are shown in Table 4.8 and Table 4.9 respectively. Similar regression methods utilised in Chapter 3 are carried out in analysing the determinants of vulnerability to food insecurity in this chapter. Similarly, two separate regressions for urban and rural areas are run to observe the structural differences in the probit and OLS models. The modified OECD equivalent scale is used to compute the per equivalent food security line for each household. The reason for the choice of food security line is explained in the next section on the sensitivity analysis. The probit model, which gives the coefficients in terms of marginal effects, is used to examine whether a household's calorie intake per equivalent is below the per equivalent food security

line. The values of estimated household vulnerability, based on the expected poverty approach in equation (6), are used in the OLS model to analyse the determinants of vulnerability to food insecurity. The results clearly show that both models tend to give similar signs of coefficients and significance.

With respect to household size, food requirements tend to increase with a rise in number of household members. The results show that an increase in the number of family members makes a household more vulnerable to food insecurity with significant non-linear effects. Households headed by an older person are more likely to have a higher risk of becoming food insecure. The positive effect of family size and the age of a household head are slightly higher in rural than urban areas. Therefore, an additional member in rural households is more likely to have less employment opportunities to enhance household income and food availability than one living in an urban area. A large number of households in rural areas participate in agricultural activities. Household heads who are younger farmers have relatively high potential to enhance agricultural techniques and productivity as well as to find off-farm jobs to earn more income in response to income shocks or climate related shocks.

Surprisingly, the marginal effect of being a female head is negative although it is only significant in urban areas. This indicates that female-headed households tend to be less vulnerable to food insecurity than their male-headed counterparts. In contrast, in Chapter 3, female-headed households are found to be more vulnerable to poverty than male-headed households even though the result is only significant in rural areas. The possible explanation of this contradictory result is that the food share of total household consumption tends to be higher among female-headed households than their male-headed counterparts. In 2010, the average dietary energy consumption was approximately 2,092 kcal per day for female-headed households and 2,058 kcal per day for male-headed households. In addition, rural female-headed households typically have lower income and education levels than urban female headed-households. Generally, there are more job openings for educated workers in big cities. As a result, urban female-headed households are more likely to meet their household's calorie requirements because they have more opportunities for general income improvement.

Household vulnerability tends to rise with an increase in the dependency ratio. According to Christiaensen and Boisvert (2000), this is possibly because households with more children are “less able to adjust or compensate for income shocks ex post”. In addition, they highlight that the coefficient of an interaction term between the number of children and the potential to temporarily send children away to stay with relatives or friends in times of need is negative and statistically significant. This indicates that a decrease in the number of dependent children by temporarily sending them away can reduce household vulnerability to food insecurity.

An increase in the level of a household head’s educational attainment significantly lowers household food insecurity and vulnerability in both areas. However, the effect is slightly higher in rural than urban areas. Similar results are found in the determinants of poverty and vulnerability in Chapter 3. This indicates that education is a very important factor in reducing both chronic poverty and chronic food insecurity in rural areas. The majority of rural households are involved in agricultural work. Thus, the results imply that educated farmers tend to adapt more easily in hunger periods and suffer less from food insecurity.

The results, which are similar to the findings in Chapter 3, show that land ownership plays an important role in food insecurity and vulnerability reduction. An increase in cultivated land size leads to a decline in food insecurity and vulnerability, particularly in rural areas. The estimated coefficient of land variable is negatively related to food insecurity and vulnerability in both areas. However, the effect is slightly higher in rural areas. Households headed by a farm operator who mainly owns land are relatively less vulnerable to food insecurity. In contrast, those who live in a household headed by a farm tenant or a landless farm worker face a higher risk of becoming food insecure. Households headed by a person who is a highly skilled and educated worker, such as professional, manager or technician, are less vulnerable to food insecurity. This implies that the low skilled and less educated worker is less protected against general shocks and more likely to become food insecure. Furthermore, the marginal effects of non-agricultural occupations are greater in urban than rural areas. Average living costs in urban areas are generally higher than in rural areas. Assuming the same minimum wage per hour in both areas,

household heads with heavy manual labour jobs in urban areas tend to be more food insecure and vulnerable than those who work in rural areas.

The estimated coefficients of home-produced food, income from farming profits and migrant remittances are all negatively related to food insecurity and significant at 1% level in rural and urban areas. The results highlight the importance of home food production and household income diversification on household food security status. The availability of food, which is considered as one dimension of food security, is associated with household self production, technology adoption and input availability. In other words, an increase in the value of food produced at home and farming profits, either due to technology adoption or more input availability, indirectly causes an improvement in agricultural productivity. Because rural households engage highly in farming activities, the effects of these variables are greater in rural than urban areas. Vulnerability is likely to be lower among rural households that diversify their income through reliance on migrant remittance receipts, either from overseas or urban migration, because they can alleviate the difficulties in smoothing their food consumption.

Financial credit is another important factor affecting food availability and food stability. The estimated coefficient of the financial problem variable is positively related to food insecurity and significant at the 1 percent level. That is, households-reporting the incidence of financial difficulty, such as failure to pay housing rent, utility bills or tuition fees in the past 12 months, are more vulnerable to food insecurity in both rural and urban areas. Agricultural finance can improve household agricultural production and increase household food supply. A household's ability to borrow loans for farming or non-farm business as well as emergency funds helps protect a household from vulnerability to food insecurity. The marginal effects of all financial variables are nearly the same between urban and rural areas. Therefore, adequate financial resources and financial support for households in unexpected financial difficulties are necessary for reducing household food insecurity in all areas.

Health status, housing conditions and basic services, such as water and sanitation, are important factors affecting a household's food utilisation. The estimated coefficients

of housing materials, access to safe water and illness of a household member are estimated to be significant at the 1 percent level. Housing materials and an availability of safe drinking water and piped water supply have nutritional effects on a household's food security status. Households with good quality of sanitation facilities in a more hygienic environment tend to have better food absorptive capacity and lower risk of becoming food insecure. Household members' health condition also has an influence on their nutritional status. The estimated coefficient of sickness absences of household members in the work place in the previous 12 months is positively and significantly related to food insecurity and vulnerability at the 1% level. This indicates that households in poor health condition are more vulnerable to food insecurity because their illnesses can prevent their bodies from utilizing adequate amounts of energy. These health-related factors are important in reducing household food insecurity and vulnerability in both rural and urban areas.

Regarding regional differences, the estimated coefficients of geographical locations are positive and significant for all regions. Households in the rural Northeast have the highest risk of being food insecure. This finding is consistent with the results obtained from the analysis of vulnerability to poverty in Chapter 3. It implies that the rural Northeast households are the most vulnerable group in Thailand based on both dimensions of vulnerability. Surprisingly, however, residents in the Bangkok and Metropolitan areas face a higher risk of becoming food insecure than residents in the rural North and Central regions. The Northeast region has a large number of rural households participating in the agricultural sector, as does the North region. However, farmers in the Northeast region, due to lack of irrigation facilities, tend to produce food at low productivity levels. When focusing on household food consumption in terms of calorie intake, rural farm households with more agricultural productive assets are able to produce more food than urban households. In other words, rural households are more likely to face a higher risk of falling below the non-food poverty line, while urban households face a higher risk of being insecure in food.

Table 4.8: Determinants of Food Insecurity in Thailand, 2010

Variables	Probit Model: whether household is food insecure			
	Urban		Rural	
	dy/dx	z-values	dy/dx	z-values
Size	.076	(4.20)**	.082	(8.04)**
Size_sq	-.0012	(-6.93)**	-.0014	(-3.62)**
Age	.0078	(5.49)**	.0085	(2.97)**
Age_sq	-.00006	(-7.18)**	-.00008	(-4.48)**
D_Female	-.083	(-2.72)**	-.021	(-1.14)
Dependent	.339	(10.86)**	.318	(8.16)**
D_primary	-.059	(-3.26)**	-.068	(-2.42)**
D_secondary	-.067	(-4.15)**	-.085	(-3.75)**
D_highschool	-.104	(-5.81)**	-.112	(-3.91)**
D_university	-.168	(-7.95)**	-.174	(-6.74)**
D_farm_own	-.105	(-11.30)**	-.113	(-8.41)**
D_farm_rent	.092	(4.62)**	.106	(3.17)**
D_landless	.192	(3.40)**	.208	(5.26)**
D_heavy_labor	.187	(6.25)**	.202	(4.74)**
D_professional	-.073	(-11.77)**	-.064	(-4.05)**
D_manufacture	-.062	(-8.82)**	-.058	(-4.13)**
Land	-.398	(-4.76)**	-.426	(-2.53)**
Food_produce	-.115	(-8.16)**	-.129	(-3.75)**
Farm_profits	-.257	(-15.32)**	-.269	(-7.48)**
Remittances	-.038	(-1.27)	-.052	(-2.50)*
D_water	-.074	(-10.60)**	-.076	(-6.19)**
D_housing	-.082	(-10.25)**	-.084	(-7.49)**
D_health	.045	(8.36)**	.049	(2.78)**
D_loans	-.124	(13.28)**	-.126	(5.35)**
D_emergency	-.227	(-7.74)**	-.229	(-2.82)**
D_finance	.278	(5.70)**	.280	(2.47)**
D_Bangkok	.106	(8.12)**	-	-
D_Central	.123	(2.23)*	.097	(4.56)**
D_North	.114	(10.46)**	.076	(5.43)**
D_Northeast	.136	(6.53)**	.152	(3.69)**
Obs.	19,765		13,439	
Pseudo R ² :	.2416		.2287	
Log likelihood Ratio:	-14765.3		-11632.4	
Wald chi-square:	8296.39		6325.41	
Prob(F):	0.000		0.000	

Note: * and ** denote significance at 5% and 1% levels, respectively.

Table 4.9: Determinants of Vulnerability to Food Insecurity in Thailand, 2010

Variables	OLS Model: determinants of vulnerability to food insecurity			
	Urban		Rural	
	dy/dx	z-values	dy/dx	z-values
Size	.078	(15.39)**	.087	(16.81)**
Size_sq	-.0014	(-14.71)**	-.0016	(-10.60)**
Age	.0082	(16.12)**	.0093	(4.74)**
Age_sq	-.00007	(-19.08)**	-.00009	(-14.19)**
D_Female	-.075	(-11.87)**	-.024	(-0.85)
Dependent	.341	(18.12)**	.323	(17.33)**
D_primary	-.053	(-12.63)**	-.076	(-5.43)**
D_secondary	-.078	(-13.30)**	-.094	(-12.16)**
D_highschool	-.116	(-16.44)**	-.122	(-13.09)**
D_university	-.181	(-19.54)**	-.189	(-14.28)**
D_farm_own	-.213	(-44.12)**	-.235	(-22.98)**
D_farm_rent	.104	(14.58)**	.117	(11.86)**
D_landless	.198	(12.63)**	.211	(15.44)**
D_heavy_Labor	.206	(27.32)**	.218	(14.21)**
D_professional	-.075	(-45.23)**	-.067	(-14.19)**
D_manufacture	-.064	(-22.17)**	-.061	(-14.26)**
Land	-.412	(-14.62)**	-.508	(-10.16)**
Food_produce	-.118	(-16.13)**	-.134	(-12.36)**
Farm_profits	-.320	(-49.56)**	-.347	(-24.71)**
Remittances	-.059	(-1.08)	-.064	(-12.03)**
D_water	-.152	(-38.44)**	-.154	(-17.61)**
D_housing	-.160	(40.31)**	-.163	(27.74)**
D_health	.048	(22.31)**	.052	(11.84)**
D_loans	-.248	(23.99)**	-.250	(14.42)**
D_emergency	-.323	(-18.16)**	-.325	(-10.46)**
D_finance	.395	(-27.36)**	.398	(-12.19)**
D_Bangkok	.124	(22.98)**	-	-
D_Central	.167	(16.42)**	.105	(11.74)**
D_North	.132	(13.41)**	.083	(26.12)**
D_Northeast	.230	(8.04)**	.262	(14.38)**
Constant	0.065	(4.59)**	0.034	(2.78)**
Obs.	19,765		13,439	
R ² :	0.76		0.72	
Prob(F):	0.000		0.000	

Note: * and ** denote significance at 5% and 1% levels, respectively.

4.4.4 Sensitivity Analysis of Estimated Vulnerability to Food Insecurity

Table 4.10 presents the estimated household vulnerability to food insecurity in 2010 based on different vulnerability and food security thresholds. A total of 3,256 households were tracked in the 2011 SES (NSO 2011) to estimate the percentage of

overlap, which is the share of vulnerable households in 2010 that actually became food insecure in 2011. The results clearly show that, based on the same food security line, the fixed vulnerability threshold of 0.5 seems to give more accurate results than the headcount ratio vulnerability line. For instance, based on the per capita food security line, the vulnerability threshold of 0.5 gives a percentage of overlap of around 6.71 percent, while the percentage of overlap calculated by using the headcount ratio vulnerability threshold is only 4.87 percent.

Table 4.10: Estimated Vulnerability to Food Insecurity by Different Choices of Thresholds (number of households)

Food Security line	Estimated Vulnerability in 2010	Observed food insecure in 2011	Vulnerable households became food insecure in 2011	Percentage of Vulnerable households became food insecure in 2011
Fixed Vulnerability threshold = 0.5				
Per capita food security line	864	97	58	6.71
Per equivalent food security line (Original OECD scale)	725	212	136	18.76
Per equivalent food security line (Modified OECD scale)	532	395	161	30.26
Per equivalent food security line (Square root scale)	469	348	102	21.75
Per equivalent food security line (Cutler/Katz scale)	740	323	152	20.54
Vulnerability threshold = Varying threshold headcount ratio				
Per capita food security line	1336	97	65	4.87
Per equivalent food security line (Original OECD scale)	1072	212	108	10.07
Per equivalent food security line (Modified OECD scale)	658	395	174	26.44
Per equivalent food security line (Square root scale)	594	348	112	18.86
Per equivalent food security line (Cutler/Katz scale)	872	323	143	17.55

Source: Author's calculation.

Taking into account the marginal costs of an additional household member, the modified OECD equivalence scale gives a higher percentage of overlap than the Cutler/Katz scale and other OECD equivalence scales. Therefore, using the fixed vulnerability line of 0.5 and the per equivalent household specific poverty line gives the most accurate estimated household vulnerability to food insecurity. Therefore,

the vulnerability to food insecurity profile of Thailand in 2010 is constructed in the next section based on the selected choice of thresholds.

4.5 Vulnerability to Food Insecurity Profile in Thailand

The results obtained from the previous section are utilised in constructing household vulnerability to food insecurity profile for Thailand based on the 2010 SES (NSO 2010a). The vulnerability profile provides food insecurity and vulnerability statistics at the household level derived from the estimation of food security and vulnerability as well as the analysis of the determinants of household vulnerability to food insecurity. The profile also demonstrates how vulnerability to food security varies across subgroups of a population. The key characteristics of high vulnerable households are compared with low vulnerable households in order to provide better understanding of food security. The profile assists the government in formulating appropriate policies for fighting and monitoring the levels of household food insecurity and vulnerability over time.

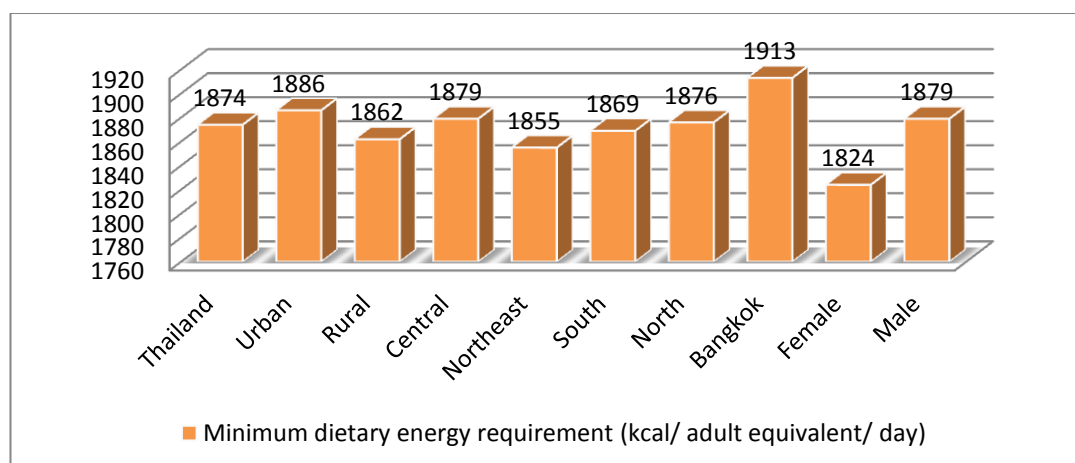
4.5.1 Food Insecurity and Vulnerability: The Current Situation

This study defines food security based on the nutritional conceptual framework, which encompasses four dimensions of food security: food availability; food accessibility; food utilisation and food stability. Food insecurity incidence at the household level is measured in terms of the proportion of households whose daily calorie consumption per equivalent is falling below the food security line. The Thai household food consumption data, which contains many food items collected from the 2010 SES (NSO 2010a), is grouped into twelve categories and standardized into grams before being converted into nutrient values.

The referred BMI and PAL values updated by the FAO report in 2004 are used together with the table of nutritive values of Thai foods provided by the Ministry of Public Health of Thailand in 2001 to estimate household's food consumption quantities in terms of kilocalories per day. The household food security line is measured by the minimum dietary energy requirements of a household. The modified OECD equivalent scales are used to estimate the household's per equivalent food security line. Vulnerability incidence is measured as the proportion of households with a 50 percent or higher chance of becoming food insecure in the future.

The average minimum dietary energy consumption per equivalent per day by different subgroups in 2010 is illustrated in Figure 4.4. The average minimum dietary energy requirement of the Thai population is around 1,874 kilocalories per equivalent per day. Rural households have on average a lower minimum calorie intake than urban households. This is possibly because the percentage of children and elderly people in a household is higher in rural than urban areas, particularly in the North and Northeast regions. Children and elderly people normally have lower energy requirements. Therefore, households with more dependants tend to have a lower number of adult equivalents, which results in lower minimum dietary energy requirements per equivalent. The Bangkok and Metropolitan areas have the highest minimum dietary energy requirement due to the large proportion of adults in the population, including seasonal rural to urban labour migration.

Figure 4.4: Minimum Dietary Energy Requirement by Different Subgroups

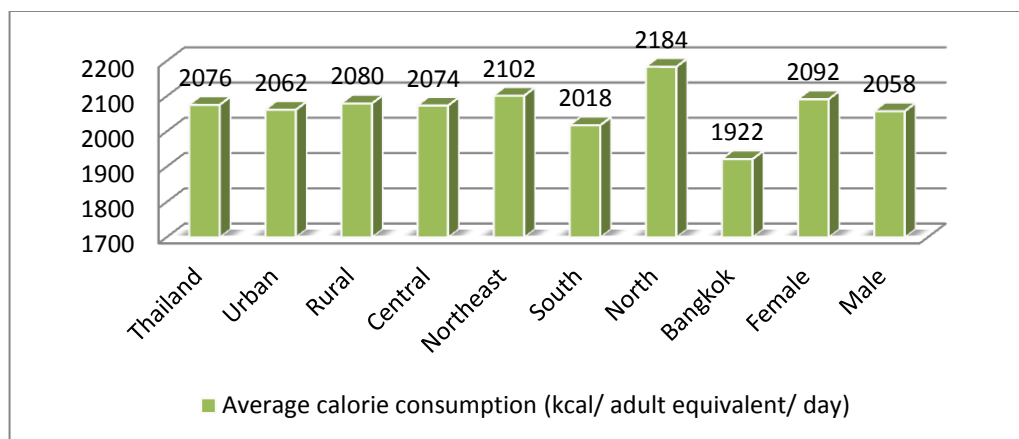


Source: Author's calculation.

The calorie requirement is lower among female-headed households than male-headed households due to the lower number of adult members in a female-headed household. Households headed by female typically have less males and more children in their families. Adult females who are single mothers with young children typically have lower calorie needs because their physical activity levels are lower than male counterparts. The average daily calorie consumption per equivalent of Thai households by subgroups is shown in Figure 4.5. The average daily calorie consumption of the Thai population was approximately 2,076 kilocalories per equivalent per day in 2010. In line with the calorie requirement, the average calorie

consumption level is higher among the rural population. This is because the amount of home-produced food is substantially larger in rural than urban areas.

Figure 4.5: Average Daily Calorie Consumption by Different Subgroups



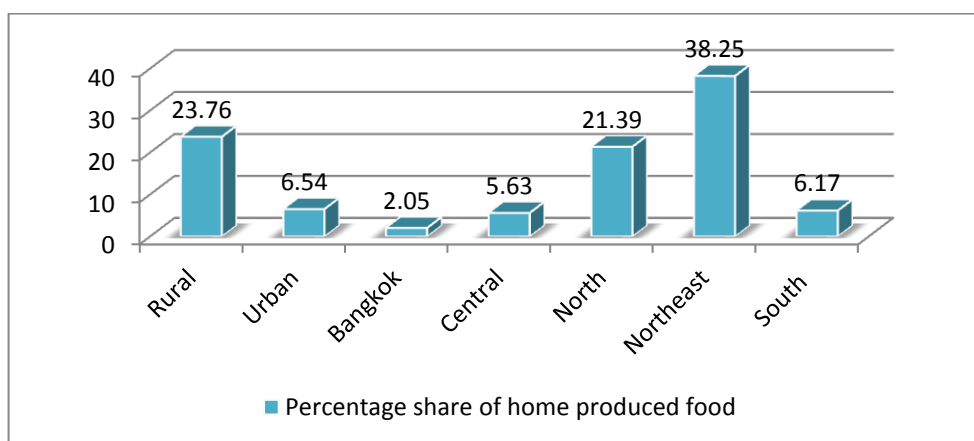
Source: Author's calculation.

Figure 4.6 clearly shows that rural households tend to rely more on home-produced food than urban households. The share of home-produced food is around 23.76 percent in rural areas, while the share of home-produced food is only 6.54 percent in urban areas. Because the rural population is concentrated in the North region, the average calorie consumption is largest in the North region and lowest in the Bangkok and Metropolitan areas. In addition, female-headed households have higher calorie consumption than male counterparts. This implies female-headed households are likely to be more concerned about food consumption and food preparation, especially for children, than male-headed households. Households in Bangkok and the Central region are more likely to produce less food and depend mostly on purchased food and food consumed away from home. This is because the street food price in urban areas is lower than the price of raw food materials sold fresh at the markets. Many couples in middle class families in Bangkok are office workers. Some of them live in small apartments without a kitchen and usually dine out, buy takeaway meals and have food delivered to their homes for their children.

Figure 4.7 illustrates vulnerability to food insecurity incidence by different subgroups. Approximately 11.28 percent of the total population is vulnerable to food insecurity. The number of total vulnerable households is slightly higher in rural than urban areas. Even though the share of households living below the food security line

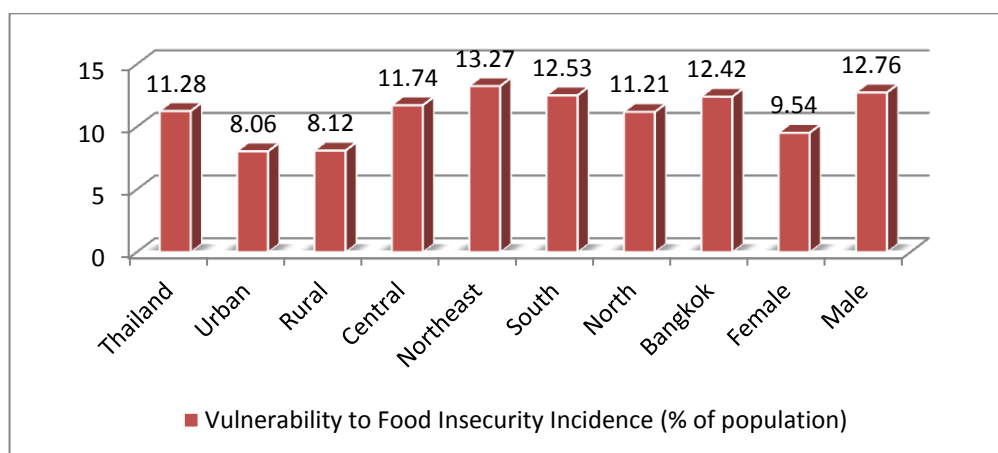
or being undernourished is higher in urban areas, the proportion of high vulnerable households is greater in rural areas. There is a disparity among different regions. Vulnerability level is found to be highest in the Northeast region, followed by the South, Bangkok, Central and North respectively. This finding is consistent with the regression results, which show that households in Bangkok face a higher probability of being food insecure than households in the rural Central and North regions.

Figure 4.6: Percentage Share of Home-Produced Food in 2010



Source: Author's calculation.

Figure 4.7: Vulnerability to Food Insecurity Incidence by Different Subgroups



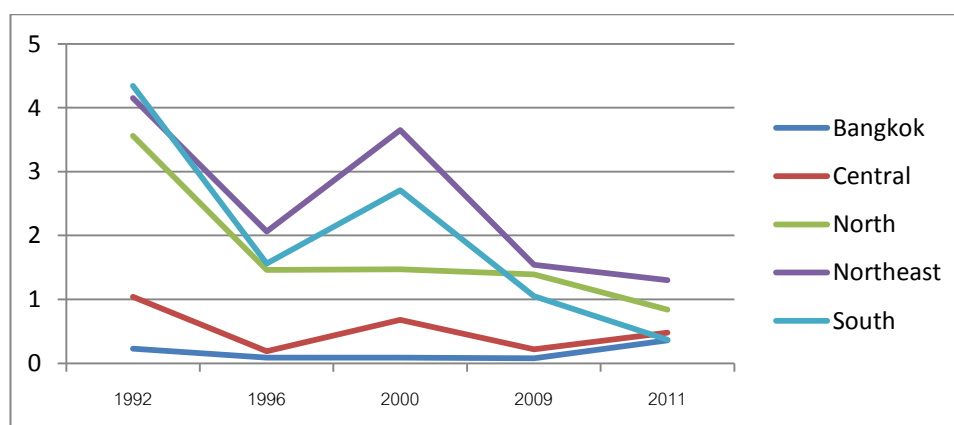
Source: Author's calculation.

Even though the average daily calorie consumption is higher in rural than urban areas, a large number of households in the rural Northeast are still at high risk of being chronically food insecure. As illustrated in Figure 4.8, the percentage of households being below the food poverty line, computed by the NESDB (2012), has remained highest in the Northeast region since 1992. Approximately 1.3 percent of

the total population in the Northeast region is estimated to have been food poor in 2011 and more than half of them were rural residents. This evidence supports the estimated vulnerability to food insecurity incidence illustrated in Figure 4.9 that rural households are more likely to be chronically food insecure - remaining below the food security line for a long period of time. Approximately 2.02 percent of rural households are estimated to be vulnerable to chronic food insecurity, while 1.81 percent of them are vulnerable to frequent food insecurity. In contrast, the share of households being vulnerable to frequent food insecurity is higher in urban areas. Only 1.45 percent of urban households are vulnerable to chronic food insecurity, while 2.09 percent of them are vulnerable to frequent food insecurity.

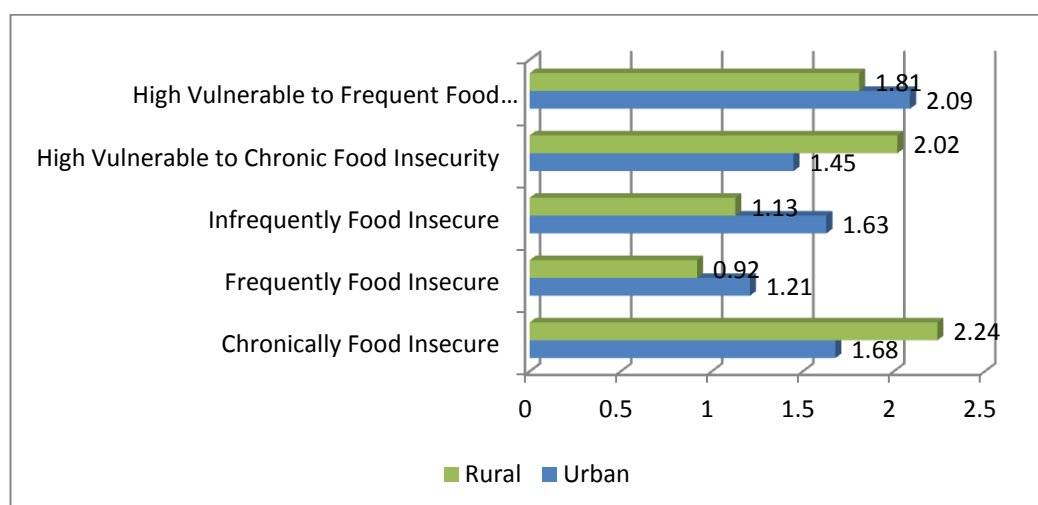
Even though the number of food poor households has fallen in the North, Northeast and South regions, there is an increase in food poverty rates in the Central region and Bangkok. In the Central region, where the majority of population is concentrated in urban areas, the food poverty rate increased between 1996 and 2000, but fell between 2000 and 2009. This indirectly confirms that while most rural households are vulnerable to chronic food insecurity, urban households are more vulnerable to transitory food insecurity – moving in and out of food insecurity over a period of time. In other words, the share of rural households vulnerable to chronic food insecurity has declined over time, except in the Northeast region, while the proportion of urban households vulnerable to transitory food insecurity has grown.

Figure 4.8: Food Poverty Incidence by Region, 1992 – 2011



Source: NESDB (2012).

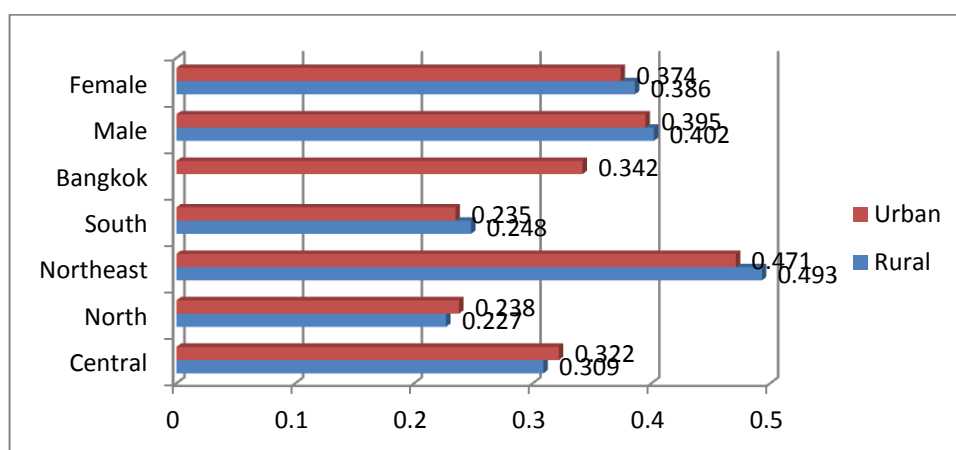
Figure 4.9: Vulnerability to Food Insecurity by Groups (% of population)



Source: Author's calculation.

Considering the rural-urban difference, as shown in Figure 4.10, household vulnerability level is highest in the rural Northeast and lowest in the rural North. This finding is consistent with the results shown in Figure 4.5 that the average household calorie consumption is highest in the North, around 2184 kilocalories per equivalent per day, due to the relatively large amount of home-produced food in the rural part of the region. As previously mentioned, household vulnerability to poverty in the Northeast region is ranked the highest. Even though the Northeast has a large number of rural households and high amount of home-produced food like the North region, Northeast households still suffer from low agricultural productivity and inadequate health and sanitation services. The estimated vulnerability of female-headed households is slightly lower than male-headed households in both rural and urban areas. These results are in line with the findings that female-headed households have a higher calorie consumption. The aggregated vulnerability of both female- and male-headed households is higher in urban than rural areas. Even though the amount of home-produced food is higher in rural than urban areas, rural households are less able to adjust to income shocks because they have fewer job opportunities and lower educational attainment. Subsequently, the estimated regression results clearly show that income from farm profits and education are crucial factors for vulnerability to food insecurity reduction. To effectively eliminate chronic food insecurity in the Rural Northeast, better education and food utilisation, in terms of health and sanitation, are required.

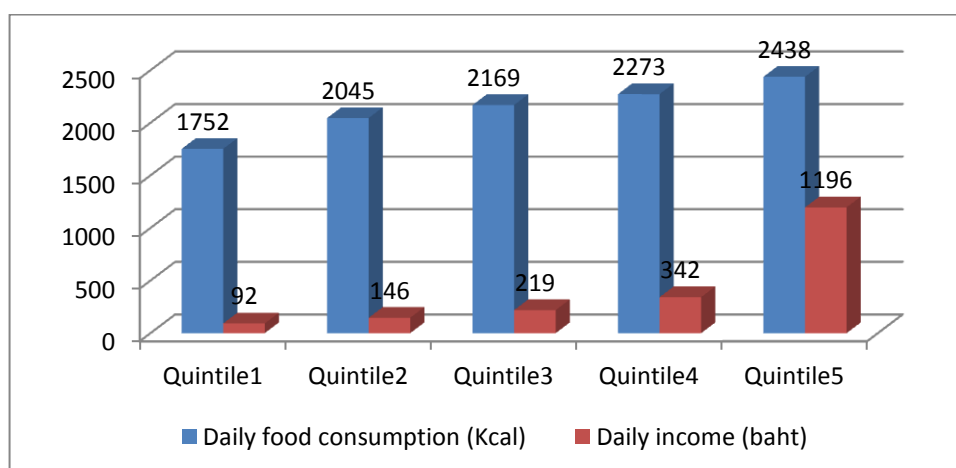
Figure 4.10: Average Vulnerability to Food Insecurity by Area, 2010



Source: Author's calculation.

Households with higher income tend to have higher average per equivalent daily food consumption. As shown in Figure 4.11, households in the bottom 20 percent consume 1,752 kilocalories per equivalent per day, while households in the top 20 percent consume 2,438 kilocalories per equivalent per day. High income inequality affects a household's ability to access good quality and sufficient food, which increases household vulnerability to food insecurity.

Figure 4.11: Household Per Equivalent Food Consumption and Daily Income



Source: Author's calculation.

Table 4.11 illustrates the share of income and food ratio between rural and urban areas. Households at the richer quintile are less vulnerable to food insecurity because they have a lower percentage of food expenditure to total expenditure ratio. The rural-urban income gap and the difference in the share of food consumption

expenditure on food are quite large. The share of the poorest quintile is much higher in rural than urban areas. Urban households in the richest quintile spend only 9.02 percent of their total income on food. In contrast, the share income spent on food consumption of the wealthiest rural households is around 13.48 percent of their total income. This is possibly because low income households tend to spend more money on food rather than non-food items, such as housing, health and education. As a result, poorer quintile households are more likely to be vulnerable to food insecurity due to their lower capacity to acquire sufficient amounts of nutritious food subjected to appropriate food processing and storage methods.

Table 4.11: Share of Household Income and Food Ratio by Area in 2010

Group	Share of income (%)		Food ratio (%)		Average vulnerability	
	Urban	Rural	Urban	Rural	Urban	Rural
Quintile 1 (poorest)	1.1	8.9	38.94	57.53	0.496	0.543
Quintile 2	3.4	13.3	31.42	46.39	0.364	0.427
Quintile 3	7.2	17.6	25.56	37.81	0.320	0.336
Quintile 4	18.1	23.5	19.75	29.37	0.115	0.129
Quintile 5 (richest)	70.2	36.7	9.04	13.48	0.049	0.054

Source: Author's calculation.

4.5.2 Characteristics of Household Vulnerability to Food Insecurity

The regression results obtained from analysing the determinants of poverty, food security and vulnerability in both contexts give similar signs and significance. This implies that poverty, food insecurity and vulnerability share similar characteristics.

Household size and age of household head are crucial factors that affect poverty, food insecurity and vulnerability. As shown in Table 4.12, vulnerability to poverty and food insecurity rises as the household size becomes larger. For instance, the average vulnerability to food insecurity among households with three members is 0.087, but it is 0.193 among households with five members. The positive sign of the coefficient of household size confirms the positive effect of family size on poverty

and food insecurity. In other words, an additional household member increases a household's minimum basic needs and food requirements. Thus, it increases the likelihood of becoming poor and food insecure. The coefficient of the quadratic form of household size implies that the probability of being food insecure rises as the household size increases over time. In addition, households with more children or a high dependency ratio have more chance of falling below the food security line. This is because children tend to contribute less to household's food availability and accessibility. Therefore, households with a smaller number of dependants are less likely to be affected by a fall in calorie consumption during macroeconomic shock.

Table 4.12: Aggregated Vulnerability by Household Size in 2010

	Household Size					
	1	2	3	4	5	6 or more
Vulnerability to Poverty	0.027	0.038	0.099	0.116	0.204	0.312
Vulnerability to Food Insecurity	0.022	0.032	0.087	0.095	0.193	0.290

Source: Author's calculation.

As shown in Table 4.13, the age of a household head also affects a household's poverty and food security status. Vulnerability to food insecurity level is high among households headed by a person aged 29 years or younger or aged 60 years or older. Similar results are found in an analysis of vulnerability to poverty. Average vulnerability to food insecurity is roughly the same among households headed by people aged 30 to 49 years. Household income is one of the key determinants of food insecurity. In Thailand, income and other benefits received after retirement age, such as age pension and superannuation, are quite low. As a result, households headed by an elderly person are more likely to be vulnerable to food insecurity. Furthermore, similar to an analysis of vulnerability to poverty, the positive impact of the age of a household head on food insecurity is slightly lower in urban areas. This indicates that households headed by an older person are less vulnerable in urban than rural areas. This is possibly because rural households are likely to have poorer food sanitation, lower average income and less chance to earn extra income after retirement than urban households.

Table 4.13: Aggregated Vulnerability by Age of Household Heads in 2010

	Age of Heads of Households						
	≤ 20	21 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 or more
Vulnerability to Poverty	0.320	0.091	0.148	0.136	0.114	0.178	0.443
Vulnerability to Food Insecurity	0.454	0.381	0.220	0.208	0.135	0.308	0.569

Source: Author's calculation.

Regarding educational attainment, as shown in Table 4.14, households headed by a person with a higher level of education are less likely to be vulnerable to food insecurity. The percentage of food insecure households is highest among households headed by a person with primary education only. In contrast, households headed by a person with tertiary education have the lowest vulnerability. Thus, education seems to be the key factor affecting both poverty and food insecurity. Regarding food utilisation and food access, household heads with higher education tend to have better knowledge of their children's health, diet and food processing and sanitation practices than less educated household heads. Furthermore, higher educational attainment helps provide better job opportunities and leads to more productive agricultural techniques, which increase household income and food availability. Past studies on the determinants of food security highlight that proper education significantly increases efficiency of farm production. This is because educated farmers are more likely to have better access to agricultural prices and new farming technologies. According to Bashir and Schilizzi (2013), food supply and food processing have been improved in many developing countries, such as Kenya, Pakistan, Nigeria and Malaysia, through better education of farmers. For example, farmers with secondary education in Kenya are found to be more capable of adopting wheat production technologies and enhancing wheat varieties than farmers at a lower education level (Ndiema et al. 2007; Bashir, Naeem and Niazi 2010; Oluwatayo 2009; Sharif and Merlin 2001). Their findings emphasize the importance of education on enhancing food security, particularly in rural areas where agriculture is an important sector.

Table 4.14: Food Insecurity and Vulnerability by Education in 2010

Level of Education	Food Insecure (Headcount Ratio)	Vulnerability to Food Insecurity (Headcount ratio)	Average Vulnerability level
Primary	27.6	34.5	0.731
Lower Secondary	10.2	14.2	0.062
Upper Secondary	9.4	11.0	0.044
Tertiary	3.0	4.7	0.018

Source: Author's calculation.

Occupation of a household head is another key determinant of a household's food security status. As shown in Table 4.15, a household belonging to the socio-economic class of a landless farm worker has the highest risk of being food insecure. In contrast, food insecurity rate and household vulnerability are lowest among households that include professionals, entrepreneurs and managers. The results show that household food insecurity and vulnerability levels are relatively high among households involved in the agricultural sector and the construction industry.

Table 4.15: Food Insecurity and Vulnerability by Occupation in 2010

Occupation	Food Insecure (Headcount Ratio)	Vulnerability to Food Insecurity (Headcount ratio)	Average Vulnerability level
Landless Farm workers	34.5	38.2	0.581
Farm tenants	28.0	32.3	0.420
Farm owners	8.3	11.6	0.197
Construction workers	31.7	35.4	0.462
Manufacturing workers	26.6	30.3	0.395
Recipients of Pension and Assistance	11.9	13.4	0.206
Self-Employed	5.4	7.8	0.163
Professions /Entrepreneurs /Managers	3.2	5.5	0.124

Source: Author's calculation.

Approximately 34.5 percent of households classified as landless farm workers are currently food insecure and around 38.2 percent of them are vulnerable to food insecurity. In addition, households relying on construction workers for income face a high probability of being food insecure, with an average vulnerability of 0.462. This is possibly because both agricultural activities and construction jobs require heavy

manual labour. The average daily calorie needs and food ratio are found to be very high for these occupations, but their salary rates are relatively low. Therefore, most of these households cannot meet their nutritional requirements and have relatively high chance of falling below the food security line.

The categories of poverty and food insecurity clearly show that households vulnerable to chronic poverty and chronic food insecurity are concentrated in rural areas where agriculture is the main sector. Because home-produced food can reduce vulnerability to food insecurity, land size is considered as a crucial factor in agricultural and food production. Table 4.16 shows that households that own land of less than 5 rai are most vulnerable to food insecurity, while those that own land of more than 40 rai face the lowest probability of being food insecure. This finding is similar to the outcomes obtained from an analysis of vulnerability to poverty in Chapter 3.

Table 4.16: Food Insecurity and Vulnerability by Land Ownership in 2010

Land Owned	Food Insecure (Headcount Ratio)	Vulnerability to Food Insecurity (Headcount ratio)	Average Vulnerability level
Land < 5 rai	28.4	30.7	0.315
Land 5 -19 rai	18.5	20.2	0.291
Land 20 – 39 rai	4.9	7.3	0.224
Land > 40 rai	2.2	4.8	0.153

Source: Author’s calculation.

In addition, land quality is another important factor for agricultural activities. Unfortunately, the SES does not have information on household access to irrigation and fertilizer use. As a result, the land quality variable cannot be generated in this study to measure its effect on household food insecurity. However, better land quality usually leads to higher crop yields and more farm profits. The regression results confirm that an increase in farm profits significantly reduces food insecurity and vulnerability, particularly in rural areas. Most farmers in the rural North, Central and South regions become less vulnerable to food insecurity as their land size increases. In contrast, around 38 percent of farmers in the rural Northeast region are

found to be more vulnerable to food insecurity as their land size becomes larger. These contradictory results may be due to the low land quality and productivity in this region. Poor farmers in this region are found to be less educated than farmers with equal landholding in other regions. Furthermore, drought conditions in the rural Northeast tend to be more severe than other regions in almost every year. Less than 10 percent of land is irrigated in the Northeast. Thus, farmers in this region are most likely to suffer from drought and crop failure due to water scarcity.

Drinking water supply and housing conditions significantly affect the food utilisation of a household. Contaminated water and poor housing conditions directly affect household health conditions and increase its probability of becoming food insecure. Table 4.17 clearly shows that food security and vulnerability is lowest among households that drink bottled water, while those accessing water from the river or rain water tanks are at the highest risk of becoming food insecure. In Thailand, the source of bottled water is usually spring or mineral water. It is generally considered safe. Tap water is not completely safe or clean enough to drink. It may contain bacteria or poisonous substances due to damaged pipes or breakages. Some households choose to drink boiled tap water or purified tap water to lower the risk of water contamination. Ground water supplies, river water and rain water are considered unsafe for household consumption because they may contain agricultural chemicals, toxic industrial waste or acid rain.

Table 4.17: Food Insecurity and Vulnerability by Type of Drinking Water in 2010

Drinking Water supply	Food Insecure (Headcount Ratio)	Vulnerability to Food Insecurity (Headcount ratio)	Average Vulnerability level
Bottled water	29.5	31.0	0.274
Tap water	44.7	46.5	0.393
Ground water	53.2	57.4	0.481
River water / rain water	65.3	69.2	0.645

Source: Author's calculation.

Unsafe drinking water can lead to severe health issues because the body could be harmed by toxic chemicals, metals, pesticides, bacteria or parasites. These contaminants are very dangerous for elderly people, pregnant women, infants and

young children. People who drink unsafe water regularly are more likely to have poor health status which, in turn, could lower the body's capacity to digest and absorb food. As a result, people can become undernourished, even though there is high food availability in their area, because of their low capacity for food absorption. With regard to quality of drinking water sources in Thailand, rain water is ranked the highest, followed by bottled water and tap water respectively. Less than 10 percent of the total population drank ground water and river water in 2010. The percentage of households that drink bottled water was estimated to be highest in Bangkok, at approximately 89.7 percent in 2010, and lowest in rural areas, particularly in the Northeast.

Housing condition is another important factor that affects a household's food utilisation. Poor housing condition indirectly implies poor hygiene and sanitation of a household, which can increase household vulnerability to food insecurity. In this study, as shown in Table 4.18, various housing conditions are classified into five categories: very high; high; average; low and very low. The highest quality of housing is a brick or concrete independent house, which has a separate entrance and does not share a common wall. The lowest quality of housing is a house built from poor structural materials such as plywood and zinc. The lowest quality of housing is usually found in slum areas of municipalities.

Table 4.18: Categories of Housing Quality in Thailand

Category	Description
Very High	Brick or concrete independent/ detached houses
High	Brick or concrete semi-detached houses , Condominiums
Average	Townhouses, Flats, Apartments, Shop houses / office
Low	Wood independent/ detached houses
Very low	Houses built from plywood, planks, zinc etc.

Source: Author's design.

Table 4.19 clearly shows that households residing in a very high quality house have the lowest risk of being food insecure. In contrast, food security incidence and vulnerability level are highest among those living in a very low quality house. This finding is consistent with the regression results showing that households that own an independent house made of brick or cement blocks are less likely to be vulnerable to

food insecurity. Due to their poor health and unsanitary conditions, people in slum areas are most likely to suffer from malnutrition, diarrhoea, cancer and birth defects.

Table 4.19: Food Insecurity and Vulnerability by Housing Quality in 2010

Housing quality	Food Insecure (Headcount Ratio)	Vulnerability to Food Insecurity (Headcount ratio)	Average Vulnerability level
Very High	5.8	7.1	0.152
High	9.3	11.4	0.206
Average	10.3	12.8	0.271
Low	21.4	23.6	0.455
Very low	29.2	31.5	0.519

Source: Author's calculation.

Lastly, food insecurity and vulnerability seem to vary according to different loan sources. Table 4.20 shows that households that mainly rely on borrowings from the Bank for Agriculture and Agricultural Cooperatives (BAAC) are most likely to be food insecure and vulnerable.

Table 4.20: Food Insecurity and Vulnerability by Main Sources of Loans in 2010

Main sources of loans	Food Insecure (Headcount Ratio)	Vulnerability to Food Insecurity (Headcount ratio)	Average Vulnerability level
Bank for Agriculture and Agricultural Cooperatives (BAAC)	24.7	27.5	0.641
Government Savings Bank (GSB)	12.6	14.1	0.292
Government Housing Bank (GHB)	19.0	21.3	0.442
Community saving cooperatives	16.3	18.5	0.374
Private Banks	4.4	5.7	0.125

Source: Author's calculation.

As previously discussed, the regression results show that households that have access to long term loans and emergency funds are less likely to be food insecure. The availability of credit is an important factor in increasing a household's ability to

withstand and recover from income shocks as well as maintain their sufficient nutritional status. Approximately 60 percent of households that mainly rely on loans from the BAAC are dependent on low-income and less educated farmers. Many of them are unable to pay back the loans. Their outstanding debt with the bank is considerably high. This is possibly because these farmers cannot efficiently use their farm credit to improve their income through enhancing farm productivity.

To develop newer agricultural innovations, better farm skills and efficient use of agricultural resources are required. Besides providing financial support to farmers, the government needs to develop farmers' knowledge and teach them how to convert their knowledge to practices through social learning or group learning. Millar and Curtis (1997) conduct a study on Australian farmer knowledge. They highlight that local knowledge, which experienced farmers gain from their errors, observations and interaction, is considered to be an important factor in rural development in many developing countries. Apart from local knowledge, the technological transfer of farm knowledge and innovations from researchers to farmers via an extension agent is essential in agricultural modernization. The authors find that farmers' knowledge on land and livestock management as well as their ability to put these science-based technologies into practice can be improved via group learning. Farmers are found to benefit from learning how to estimate their livestock feed requirements and determine the quantity and composition of their grassland and forage at different harvest periods and reproduction.

Being able to make profitable management decisions, farmers who participate in group learning can effectively apply both local and scientific farm knowledge to local situations. Landholders who participate in group learning have more confidence in sharing their local knowledge and their ability to understand technical and practical terms used by extension officers. In Thailand, this collaborative learning should be supported by the government. Researchers and officers from the Department of Agricultural Extension can arrange some group learning activities to increase the use of local knowledge among farmers. In addition, trust between scientists and farmers should be fostered and partnerships with private industry should be created to increase the number of facilitators and advisors. This program could develop farm skills for less educated farmers, particularly in the rural

Northeast region, improve their productivity and lower their farm debts in the long run.

4.5.3 Government Programs towards Food Insecurity and Vulnerability

Reduction

As previously discussed in Chapter 3, the four main pro-poor programs launched in 2001 have not effectively targeted the poor and high vulnerable groups of households. More than 50 percent of the total households that participated in these programs were in the low vulnerable group. Food insecurity is related to poverty, but they are not exactly the same. This section examines the effectiveness of the same pro-poor programs in Chapter 3 on targeting food insecure households and those who are highly vulnerable to food insecurity.

As Shown in Table 4.21, approximately 54.75 percent of households eligible for pro-poor programs are in the low vulnerability grouping. On the other hand, only 15.24 percent of them are highly vulnerable to food insecurity. In addition, only 30 percent of the total beneficiaries are currently food insecure. As previously shown in Chapter 3, these programs are found to target chronic groups of vulnerability to poverty more efficiently. However, regarding the food insecurity issue, transitory food insecure groups are found to benefit more from these programs. Around 14.47 percent of beneficiaries are frequently food insecure, while only 5.33 percent of them suffer from chronic food insecurity. This implies that the programs do not efficiently help people who are currently in chronic food insecurity and those who are still facing a high risk of becoming food insecure.

The regression results show that household vulnerability to food insecurity increases among households that have experienced workplace absence due to illness in the past twelve months. Furthermore, households that have access to government medical services tend to face a lower risk of becoming food insecure. The findings emphasize the important role of health services supported by the government in improving health conditions of the population. Public medical services help lower the risk of household food insecurity, particularly in remote rural areas where the percentage of chronic food insecurity is high. The results in Chapter 3 show that universal health coverage cards successfully target the chronic poor. However, Table 4.21 clearly shows that only 12.68 percent of beneficiaries are chronically food insecure

households. The percentage of infrequently food insecure and frequently food insecure households eligible for the universal health coverage card is 11.95 percent and 13.31 percent respectively. Therefore, the benefit obtained from this health service is almost equally distributed among the food insecure groups rather than targeting the chronically food insecure.

In Thailand, the health condition of the population tends to be much lower in remote rural areas than in urban areas. Poor sanitation, contaminated water supply and inadequate toilet facilities are mostly found in rural households. Child malnutrition is relatively high in rural areas because of poor living conditions significantly affecting child development. The failure in targeting chronic food insecurity may increase the number of chronically food insecure households in rural areas, particularly in the Northeast region where a high rate of underweight children is commonly found.

As previously mentioned, farm credit plays an important role in reducing food insecurity, particularly among poor farmers (Table 4.20). The microcredit program, or “Village Fund”, helps provide small loans for the poor. It seems to be more successful in targeting the chronically food insecure than transitory food insecure groups. In contrast, from the poverty perspective in Chapter 3, this program benefits the frequently poor rather than the chronically poor (Table 3.18). This contradictory result implies that households that are chronically food insecure may not always be chronically poor. In other words, a household who usually moves in and out of poverty over a short period of time may be considered as chronically food insecure at the same time. This is possibly because the total household food consumption does not meet nutritional requirements.

Even though the Village Fund program has failed to help chronically poor farmers in rural areas, it can still be used to eradicate food insecurity among those who have been undernourished over an extended period of time. However, the Village Fund seems to benefit the low vulnerable rather than the high vulnerable groups. The program aims to offer interest-free loans to rural poor farmers to help them improve their farm practices and productivity. While the frequently poor and chronically food insecure farmers have benefited from this program, households that are highly vulnerable to both poverty and food insecurity are mostly left out. These groups are the poorly educated farmers with high income fluctuations in both rural and urban

areas. They are prone to suffer from macroeconomic shocks, harvest failure and natural disaster shocks. This failure to help highly vulnerable groups may lead to an increase in the number of transitory food insecure households in the future, particularly in urban areas where the percentage of home-produced food is relatively low.

Apart from the microcredit program, the government has been trying to help poor farmers by giving them a three year debt moratorium. The program aims to give more time for the poor farmers who have high agricultural debts to pay back their loans. Thus, the farm moratorium is expected to mainly target chronically poor farmers. However, as previously shown in Table 3.18, the program does not effectively reach the chronically poor and high vulnerable groups. Similarly, from the food insecurity perspective, it does not effectively target the high vulnerable food secure groups either. Around 3.85 percent of the total beneficiaries have low vulnerability to food insecurity, while 2.25 percent of them are in the high vulnerability group. In addition, households that are frequently or chronically food insecure seem to be better off than the infrequently food insecure households. As a consequence, the problem remains unsolved among the high vulnerable food secure households. These households have also been left out from the microcredit program.

Lastly, the food support program is expected to substantially reduce household vulnerability to food insecurity by increasing food accessibility and helping poor households to maintain their nutritional status during income shocks. As a consequence, the government has launched the “free school lunch” program to help low income families pay less for their children’s education. This program aims to lower the percentage of children who are underweight, particularly in remote rural areas. As previously mentioned in Chapter 3, this program fails to reach the chronic poor and the high vulnerable chronic non-poor households. However, in terms of reducing food insecurity, it targets the chronically food insecure households quite well. Considering the beneficiaries who are not currently food insecure, but vulnerable, low vulnerable households benefit more from this program than high vulnerable households. In addition, the benefits seem to be equally distributed among households that are highly vulnerable to chronic food insecurity and frequently food insecure. The failure to reach the high vulnerable groups can increase food

insecurity, malnutrition and stunting rates among young children in the families. Poor children who are chronically malnourished or undernourished for a long period of time are more likely to experience slow growth and development. Poor children are more susceptible to disease due to their weak immune system.

Apart from providing food aid for the food insecure and high vulnerable groups, a mother's education level is a crucial factor influencing child malnutrition and household food security status. According to Garrett and Ruel (1999), mothers' education is found to significantly affect children's nutritional status at the ages of 0-23 months. Literate mothers tend to have much better knowledge about their children's feeding, health and hygiene than less-educated mothers. In addition, the authors highlight that this significant effect is independent of household income. It indicates that even literate mothers, or mothers with some level of education in the low-income families, may have better maternal caring practices than less-educated mothers in middle-income or rich families.

Table 4.21: Structure of the Pro-Poor Programs by Vulnerability Category in 2010

Pro-Poor Programs	%	Vulnerability to Food Insecurity Level					
		Food Secure (% of population)			Food Insecure (% of population)		
		Low vulnerable (< 0.5)	Vulnerable to chronic food insecure (>0.5)	Vulnerable to frequent food insecure (> 0.5)	Infrequent food insecure (< 0.5)	Frequent food insecure (> 0.5)	Chronic food insecure (> 0.5)
Households participated In this programs	100	54.75	6.48	8.76	10.21	14.47	5.33
Universal health coverage card	73.4	18.54	7.04	9.88	11.95	13.31	12.68
Borrowed from the Village Fund	34.6	9.01	2.49	2.02	6.70	7.20	8.98
Received Free school lunch	21.7	5.44	3.37	3.14	1.79	2.76	5.22
Received debt moratorium for farmers	18.5	3.85	1.21	1.04	2.27	4.97	5.16

Source: Author's calculation.

4.6 Conclusion

This chapter aims to estimate household vulnerability to food insecurity and identify the factors influencing the likelihood of becoming food insecure in the near future. Food insecurity and poverty are found to share some similar characteristics. This implies that the two problems are closely related, but they are not the same. In other words, households that are highly vulnerable to poverty may not always face a high risk of becoming food insecure in the future. For instance, rural poor subsistence farmers may have a sufficient quantity and quality of food supply, which makes them less vulnerable to food insecurity. Furthermore, food insecure households that cannot meet their nutritional requirements may be living above the total poverty line, which combines the food and non-food poverty lines, if they can still afford other basic needs that are non-food goods, such as clothing and shelter.

The estimated results clearly show that approximately 11.28 percent of the population is found to be vulnerable to food insecurity, while 20.12 percent of the total population is vulnerable to poverty. According to the classification of vulnerability to food insecurity, the share of the transitory food insecure is estimated to be higher than the share of the chronically food insecure. This indirectly indicates that households are currently temporarily food insecure rather than remaining below the food security line for a long period of time. However, the proportion of households vulnerable to food insecurity is found to be greater than the proportion of those who are currently food insecure. This finding is different from the estimation of vulnerability to poverty in which the share of poor households is greater than the share of those vulnerable to poverty. Furthermore, the percentage of households that are highly vulnerable to chronic food insecurity is nearly twice as high as the percentage of those that are currently chronically food insecure. As a result, this significantly indicates that government programs objectively targeting food secure households that at high risk of becoming chronically food insecure should be given high priority for food insecurity reduction in Thailand.

With regard to the determinants of food insecurity, food insecurity and poverty share similar household demographic and socio-economic characteristics for some variables, such as household size, age of the household head and the dependency ratio. An increase in family size, age of the household head or dependency ratio

tends to increase household vulnerability in the context of poverty and food insecurity. Land size is another very important factor in lowering food insecurity, poverty and vulnerability in both rural and urban areas. The effects of landholding and home-produced food are estimated to be slightly larger in rural than urban areas. This is possibly because agriculture is the main sector in rural areas.

Subsequently, income from farm profits and remittances significantly reduce food insecurity and vulnerability by protecting households from the income shock in both areas. Food utilisation is improved through good health and sanitation. Better housing condition and safe water supply can significantly reduce the risk of becoming food insecure in both areas. In addition, households that suffer from poor health conditions and experience sickness absences from the work place due to illness are more likely to be food insecure. Apart from income from farm profits and remittances, access to financial credit, such as long term loans and emergency funds, is a crucial factor in lowering food insecurity and vulnerability. Farm credit helps low income farmers to improve their farm productivity. Small business loans provide capital to small business owners to improve or expand their small business during macroeconomic shocks.

Households with access to emergency funds can maintain their nutritional requirements during income shocks. The effect of regional location is found to be different between vulnerability to poverty and vulnerability to food insecurity. While residents in Bangkok face the lowest probability of being poor, their probability of becoming food insecure is significantly larger than residents in the rural Central and rural North regions. This is possibly because the amount of home-produced food is relatively large in rural areas. Households in the rural Northeast have the highest probability of becoming poor and food insecure. This region is commonly known as the poorest region. Farmers living in this region usually suffer most from drought and financial crisis. As a result, irrigation, land and soil development should be given highest priority in this region by the government.

The government's four main pro-poor programs are found to efficiently target the groups of chronic vulnerability to poverty rather than the transitory poor. However, with regard to food insecurity, transitory food insecure groups seem to benefit more from these programs. The government's universal medical scheme for the poor

successfully targets the chronically poor. However, the benefits obtained from this health service are somewhat equally distributed among the food insecure groups. The “Village Fund”, which is a microcredit program provided by the government to support the poor, successfully reaches the chronic food insecure rather than the high vulnerable groups. With regard to vulnerability to poverty, this program seems to target the frequently poor more than the chronically poor. This implies that households considered to be chronically food insecure may not always be chronically poor. In other words, the program benefits households that have been food insecure for a long period of time. However, it does not efficiently support the chronically poor farmers in rural areas. Subsequently, the farm moratorium is found to be less effective in targeting the chronically poor, but more effective in supporting the frequently food insecure and chronically food insecure. However, households that are highly vulnerable to poverty and food insecurity have been left out of this program. Lastly, the school feeding program can only target households that are chronically food insecure, but rarely benefits the chronically poor and other highly vulnerable food insecure groups. Overall, the four main pro-poor programs are not fully effective in targeting all groups highly vulnerable to poverty and food insecurity.

As previously mentioned, households that are sensitive to income or macro economic shocks are more likely to fall below both the poverty and food security lines. This indicates that the share of households being vulnerable to both poverty and food insecurity is significantly influenced by these shocks. The next chapter investigates the impact of crisis on household poverty. The incidence, severity and the determinants of household poverty, which include several crisis-related shocks in Thailand, are analysed using the special household Socio-Economic Survey in 1999. The survey contains information about financial and economic shocks at household level. The analysis measures the impact of different types of crisis shocks on household poverty in order to capture the impact of the crisis on all sectors of the economy.

Chapter 5

The Impact of Crisis on Poverty

5.1 Introduction

The Asian financial crisis, which took place between 1997 and 1998 after the devaluation of the Thai baht, caused a large increase in unemployment rates and inflation. Exports of goods and services were contracted significantly, which resulted in an economic downturn. The financial sector collapsed, leading to huge non-performing loans and a systemic banking crisis. There was a sharp contraction of output growth in many important sectors in the economy, particularly in the property and construction sectors. Even though the economy began to slowly recover after the Asian crisis with a rise in economic growth, the country was hit again by the Global Financial Crisis (GFC) in 2008-09. The impact of the GFC on exports was even larger than that of the Asian financial crisis. Because exports account for nearly 70 percent of the country's GDP, the crisis affected the whole economy of Thailand resulted in a large decline in economic activity in all sectors and social groups.

Apart from the financial crisis, other adverse shocks, such as the tsunami disaster in 2004, the political crisis in 2008 and the bird flu in 2009, caused large output losses, particularly in the services sector. The poor seem to be the most vulnerable groups who are severely affected by these shocks. There has always been a sharp rise in the observed poverty rates every time a crisis erupts. A crisis affects the overall living standards of the Thai population in terms of a fall in the per capita real income. The falling income, rising food prices, increasing unemployment and deteriorating government support for social services during a crisis always widen the income poverty gap. As mentioned earlier in the previous chapters, problems of poverty and income inequality have remained unresolved in Thailand even though several pro-poor programs have been implemented by the government since 2001 to eradicate poverty and food insecurity. Even though it is commonly known that a crisis affects household income and living standards, the magnitude and distribution of the impacts of various crisis-related shocks across the Thai population have not largely been determined in past studies.

This chapter provides an empirical analysis of the impact of large-scale crisis on poverty, based on the household Socio-Economic Survey in 1999 (NSO 1999). Apart from crisis factors, some socio-economic and demographic characteristics of households, which are found to be the key determinants of vulnerability to poverty and food insecurity from the previous chapters, are included in the regression models in this chapter. Subsequently, the determinants of poverty are examined using different poverty lines to examine whether crisis-related factors affect different dimensions of poverty.

The chapter is organized as follows. The next section reviews the existing literature on characteristics of the poor, poverty measures and the impact of crisis on poverty. Section 5.3 provides the research methodology and data used in this study, followed by empirical results in Section 5.4. Section 5.5 provides and compares the poverty profiles of Thailand before and after the Asian financial crisis period in 1996 and 1999. Section 5.6 concludes the chapter.

5.2 A Review of the Literature

This section provides a review of the literature on characteristics of the poor, poverty measures and the impact of financial and economic crisis on poverty. To categorise the poor, it is important to understand the distinctive characteristics of the poor. The review of existing empirical studies on the determinants of vulnerability to poverty in Chapter 3 shows that household demographic characteristics, educational attainment and land ownership are the most distinctive characteristics of households vulnerable to poverty. As previously mentioned in Chapter 2, poverty can be defined in either “absolute” or “relative” terms. “Absolute” poverty is the most commonly used definition of poverty in developing countries. A household is defined as poor if its welfare is below the minimum basic needs, which are estimated in terms of an absolute poverty line. Several methods have been used in the literature to measure poverty. The most commonly used method to measure poverty incidence is the “head-count ratio”, which measures the proportion of households living below a defined poverty threshold. Other popular methods, such as the “poverty gap” and the “severity of poverty”, are also discussed in this section. Several attempts have been made to analyse the impact of large-scale crisis on poverty. However, no consensus on the use of a particular method is found.

5.2.1 Characteristics of the Poor

The regression results obtained from the determinants of vulnerability to poverty in Chapter 3 show that the significant factors affecting household's probability of being poor in the future are the demographic and socio-economic characteristics of a household such as household size, age and number of children and occupation. Empirical studies on the determinants of poverty in Thailand and other developing countries are discussed below. Because poverty and vulnerability are closely related, to avoid duplicating materials, existing empirical studies are summarised in groups of household characteristics. The studies on factors affecting vulnerability related to poverty are not included or discussed in this section.

Household size and Composition

The correlation between household poverty and a household's size and composition has been examined in several poverty studies on developing countries (Lanjouw and Ravallion 1995; Coulombe and McKay 1996; Kakwani 1993; Mukherjee and Benson 2003; Glauben et al. 2011). For instance, Lanjouw and Ravallion (1995) examine whether a large household size increases household poverty based on the size elasticity of the equivalence scale. Using a modified Engel's method, their study shows that larger households tend to be poorer at the size of elasticity above 0.6. In addition, the proportion of severe child stunting is more likely to increase with a larger household size. However, the proportion of the poor tends to increase as family size increases at the elasticity size of 0.4. As a result, the authors suggest that the correlation between poverty and household size should be interpreted cautiously. Kakwani (1993) emphasises that household size is an important factor affecting household poverty. The author measures poverty based on three classifications, which are: "small" households with one to four members; "medium-sized" households with five to six members; and "large" households with seven or more members. The results show that large households are estimated to experience the highest levels of poverty across all poverty measures. The study on persistent poverty in China by Glauben et al. (2011) gives similar results on the effect of household size, in which the probability of being long term poor rises as household size increases.

Coulombe and McKay (1996) analyse the determinants of poverty among different socio-economic groups in Mauritania. A household's size is found to be insignificant in influencing the living standards of non-working households and wage-earning households in rural areas. However, household size is found to significantly reduce the living standards of urban households engaged in self-employment or wage employment. The number of children is found to adversely affect the living standards of all socio-economic groups, while the share of elderly residents aged 65 years or over positively increases the living standards of non-working households in urban areas. Household consumption usually increases with household size. As a result, greater household size tends to lead to higher household welfare or minimum basic requirements costs, which in turn increase the likelihood of poverty. Amudeo-Dorantes (2004) examines household poverty and the determinants of informal sector work in Chile. The study shows that an additional household member increases the likelihood of household poverty and the likelihood of wage and salary work in the informal sector. The study highlights the finding that less-educated and low-income household heads are more likely to work in the informal sector as a second choice of employment to earn more income when they are experiencing difficulty in meeting their minimum basic needs, such as food, clothing and shelter.

Subsequently, the number of adult members undertaking income-generating activities is correlated with household poverty. Epo and Baye (2012) study the determinants of household economic well-being and poverty changes in Cameroon using a two year household consumption survey. Their analysis, based on econometric techniques, which resolves potential heterogeneity and endogeneity problems, highlights that the fraction of active household members is found to be a significant factor affecting a household's well-being. They explain that an increase in the number of working household members leads to greater income generation, which in turn results in an increase in household well-being or household expenditure per capita. Regarding the number of household members, Mukherjee and Benson (2003) indicate that the negative effect of having an additional number of children in a household is significantly larger than having an additional number of young adults. Furthermore, the negative effect on welfare with an additional female adult is found to be larger than for male counterparts in urban areas. The authors explain that this difference is due to the fact that job opportunities in municipalities

are more numerous for men than women. Similar results are obtained by Rhoe, Babu and Reidhead (2008) and Akerele et al. (2012) in the cases of Kazakhstan and Nigeria, in which an additional household member and higher dependency ratio have significant negative effects on household welfare.

Age, Gender and Marital Status

Apart from household size, the age of a household head is usually included in existing studies to examine its influence on household welfare. Mukherjee and Benson (2003) find the effect of the age of a household head to be minimal, but statistically significant in rural areas in Malawi. That is, a household headed by an elderly person aged 65 years or more in a rural area is more likely to be poor. Similarly, Kakwani (1993) finds that poverty comparisons by the age of household head show that poverty of a household headed by a person in the age group of 65 years or over is significantly higher than other age groups.

In relation to gender, a household headed by men is found to have higher household welfare than those headed by their female counterparts (Epo and Baye 2012). The authors point out that this is because there seems to be potential job discrimination in favour of men in urban areas. Similarly, Coulombe and McKay (1996) find the marginal effect of having a female household head to significantly increase the likelihood of the head not working, but significantly decrease the probability of being wage employees. In addition, Mukherjee and Benson (2003) find that the negative impact of having an additional female adult is relatively large in urban areas. The authors explain that this difference is due to the fact that job opportunities in the municipalities tend to be higher for men than women. In addition, this gender difference is found by Crespo, Moreira and Simões (2013) in the case of Portugal. Their results address the difference between men and women in terms of wage salary and job promotions in which being a female household head is found to increase the probability of a household being poor.

With regard to marital status, according to Coulombe and McKay (1996), the living standards of a household headed by a married person are significantly higher than those of a household headed by a person who is separated or divorced. In Indonesia, the study on the determinants of poverty dynamics by Dartanto and Nurkholis (2013) shows that the probability of being non-poor is higher among married households

outside Java-Bali. The authors explain that the majority of households living in this area are mainly involved in agricultural activities. The agricultural sector is usually labour-intensive. As a consequence, “married” households tend to have higher income and agricultural production than “single” households due to a larger number of working-age members in their families. However, according to Crespo, Moreira and Simões (2013), households where spouses are unemployed are estimated to have a higher probability of falling below the poverty line.

Educational Attainment

Education is generally highlighted as one of the most important factors influencing household welfare in poverty literature. According to Epo and Baye (2012), variable education is positively and significantly associated with per capita household expenditure. They point out that education is a crucial factor in providing better job opportunities and increasing household earnings, which in turn improves household welfare. The study by Bigsten et al. (2003) on analysing the determinants of poverty in Ethiopia indicates that a higher level of household head educational attainment increases household welfare, particularly in the case of a female household head. Similarly, Glauben et al. (2011) find a significant negative relationship between the proportion of educated household members and the probability of becoming persistently poor. These findings on education are similar to the results obtained by Coulombe and McKay (1996), Mukherjee and Benson (2003), Gang, Sen and Yun (2008), Glauben et al. (2011) and Dartanto and Nurkholis (2013).

In rural India, the study by Gang Sen and Yun (2008) shows that higher education from secondary level and above statistically leads to the highest increase in the ratio of household per capita expenditure. According to Coulombe and McKay (1996), a household headed by a more educated person is more likely to be in the wage employment group than the non-working or self-employed groups, which earn lower income. Furthermore, basic education is estimated to have a positive impact on agricultural productivity for agricultural households. Their finding is similar to the study by Dartanto and Nurkholis (2013) in which higher educational attainment of a household head significantly increases the likelihood of being non-poor. However, the educational effect tends to differ depending on area and gender. Mukherjee and Benson (2003) point out in their study that the marginal effect on household welfare

of having a higher level of education is estimated to be positively significant only in urban areas. The authors explain that this is possibly because job opportunities in rural areas do not require very high level education. Furthermore, turning to the gender issue, the educational effect tends to be higher for adult females than their male counterparts. In other words, this indicates that educational attainment significantly affects economic opportunities for women in developing countries.

Employment status and Occupation

Several studies on poverty and its determinants show that household employment status and occupational types are two of the most important household socio-economic characteristics affect household poverty (Coulombe and McKay 1996; Mukherjee and Benson 2003; Epo and Baye 2012). In Malawi, where agriculture is the main employment sector in rural areas, Mukherjee and Benson (2003) find that an additional household member working in this sector tends to increase household welfare in most regions. Among non-agricultural sectors, working in the manufacturing sector does not significantly increase household welfare. In contrast, the marginal effect of engaging in the sales and service sector significantly increases household consumption in all regions. According to Coulombe and McKay (1996), households' living standards of urban wage earners in Mauritania who mainly work in the private formal sector are estimated to be higher than those who work for the government or the informal sector. The same results are obtained in the study by Epo and Baye (2012) in which households in Chile who work in the formal sector have higher living standards than those who work in the informal sector. They explain that it is because workers in the formal sector tend to receive more employee benefits, such as work insurance, workplace loan borrowing and secure income sources, than people who work in the informal sector.

In Vietnam, Minot and Baulch (2005a) find that a household headed by an unskilled worker faces the largest decline in their per capita consumption expenditure and this negative effect is substantially larger in urban than rural areas. Furthermore, a household headed by a person who works in agriculture, forestry and fishing is more likely to have a decline in household welfare, particularly in rural areas. In contrast, a household headed by a person who works in non-agricultural sectors, such as professionals and service workers, is likely to have an increase in household

consumption. This indicates that occupations of a household head play an important role on household's standard livings in both rural and urban areas. In China, the study on the determinants of persistent or long-term poverty by Glauben et al. (2011) shows that the probability of being poor for a long period of time rises with an increase in the number of household members' non-working days. This indicates that being unemployed reduces total household income and an ability to escape the poverty trap. Similarly, in Sri Lanka, the study by Silva (2008) indicates that the marginal effect of residing in households headed by casual labourers significantly increases the probability of becoming poor. In contrast, households face a decline in their probability of being poor when they are headed by a person who has a salaried wage job. Since the wage for casual workers is usually lower than salaried occupation, households with lower earnings are more likely to be poor. Furthermore, the author also highlights that a household headed by a person who works in the trade and manufacturing sector has a smaller chance of being in poverty. This is possibly because household heads working in this sector tend to earn higher wage than other sectors. Similar results are found from the analysis of poverty in Ethiopia (Bigsten et al., 2002) and Turkey (Caglayan and Dayioglu, 2011). According to Bigsten et al. (2002), household heads who are casual workers in Ethiopia face the highest decline in their expenditure, while those who work in the private business have the largest increase in household expenditure. In Turkey, the dummy variable of being a part-time worker, with a full-time worker as the reference group, causes the highest increase in the probability of being poor. In addition, the probability of being poor is compared between rural workers and urban workers, casual workers and regular-waged workers and employers and self-employed workers. The results show that rural workers, casual workers and employers have relatively higher probability of becoming poor (Caglayan and Dayioglu, 2011).

Agricultural Productivity and Landholdings

Existing studies show that landholding and farm productivity have an influence on household poverty, particularly in rural areas where agriculture is the main sector. Moene (1992) analyses the effect of land ownership on labour allocation, poverty and income distribution in the least developed countries. The ownership of land is categorised into three classes, which are landlords, small holders and landless people. Landholding is found to be very important in the areas where land is scarce.

Furthermore, the author indicates that the effects of land reform and land ownership distribution on poverty reduction depend on the amount of fertile or productive lands. Focusing on rural areas, Dao (2004) analyses the determinants of rural poverty in 32 developing countries. The author indicates that an increase in per capita agricultural production and a rise in soil fertility significantly reduce poverty incidence in rural areas. This implies that an improvement in agricultural productivity greatly contributes to rural poverty reduction in developing countries where the major exports are agricultural products. In China, the study on the determinants of rural poverty by Wang et al. (2009) clearly shows that an increase in the amount of cultivated land per capita significantly reduces a population's likelihood of falling into poverty. Apart from fertile land, the study shows that rural farm households with better irrigation conditions are less likely to become poor.

The study by Dercon (2006) on the determinants of poverty changes in Ethiopia addresses the significant impact of landholding on household poverty changes. That is, positive change in landholding and the return of land significantly increase household's food consumption growth. In addition, the author points out that the livestock ownership is considered to be very important in farm production. However, it has to be excluded from the regression model because of its high correlation with land. Similar findings are obtained in the case of Ethiopia, India and China. According to the study by Bigsten et al. (2002) on the impact of growth on poverty in Ethiopia, the per capita expenditure of rural households significantly becomes larger when the amount of cultivated lands and farm crops increases. This is because agricultural activities are the main source of cash income for rural households. In India, Gang, Sen and Yun (2008) also point out that the cultivated land variable has a significant positive effect on the ratio of household expenditure to the poverty line across all social groups in rural India. Gustafsson and Sai (2009) analyses the determinants of temporary poverty and persistent poverty in China. Their study shows that the dummy variable of access to irrigated land significantly reduces the probability of falling into persistent poverty. However, its effect on temporary poverty is insignificant. This indicates that land is the crucial factor in reducing long-term poverty in rural areas. Focusing on ethnic minority groups in Vietnam, which are poorer than their majority counterparts, Imai, Gaiha and Kang (2011) find that the coefficients of land area and its squared are estimated to be significantly positive

and negative respectively. This implies that an increase in total land size leads to an increase in per capita household consumption. However, the positive effect of land becomes smaller as land size becomes larger due to the non-linear effect.

Geographical Variation

Many existing studies on the determinants of poverty examine the effects of geographical variation or regional difference on household poverty. For instance, the study by Minot and Baulch (2005b), which examines the geographic distribution of poverty in Vietnam, shows that poverty incidence is highest in remote rural areas and lowest in large urban areas. In addition, their study finds that the majority of the poor are concentrated in areas where poverty incidence is intermediate rather than in the poorest areas. In Egypt, the study by Haddad and Ahmed (2003), which analyses the determinants of total, chronic and transitory poverty, finds that urban households are less likely to fall into transitory poverty. In Ethiopia, Bigsten et al. (2002) finds that households living in the North near urban centres have a higher probability of moving out of poverty. Gounder (2013) examines the effects of regional variation on poverty in Fiji by estimating six different regressions based on four regional divisions. The author finds that poverty incidence varies across the regions and households living in the Western and Northern regions have a significant decline in their welfare due to lack of employment opportunities and infrastructure in the rural areas of these regions.

Similar results are obtained from studies by Glauben et al. (2012), Gustafsson and Sai (2009) and Meng, Gregory and Wan (2007), in the case of China. Glauben et al. (2012) find that households living close to cities have a lower probability of being permanently poor. Additionally, Gustafsson and Sai (2009) indicate that residents in mountainous and hilly areas face a higher risk of becoming both temporary and persistently poor. Focusing on urban poverty, Meng, Gregory and Wan (2007) observe poverty changes from 1986 to 1993. Their decomposition results obtained from probit estimations show that the effect of regional variation tends to increase over time. In addition, by adopting the hierarchical linear modelling approach to investigate this variation, their study shows that provinces with lower income and higher food prices are more likely to have higher poverty incidence. Interestingly, provinces with high income inequality are found to be less poor in the first half of the

1990s. Meng (2004) explains that this is possibly because the rise in inequality primarily increases household income in the top of the income distribution, but does not lower income of those at the bottom.

The World Bank report (World Bank 1996) on growth, poverty and income distribution in Thailand reveals that more than 80 percent of the poor live in the Northeast and North regions. Rigg (1998) conducted a survey in two villages in the Northeast region over a period of 12 years between 1982 and 1994. This region was chosen because it was known as the country's poorest region. Poverty incidence in this region remains highest, while poverty in other regions has gradually been declining since the 1990s. The author finds that some of the original poor in 1982 remained poor in 1994, while some of the rich had fallen into poverty. This indicates that households in this region suffer from both chronic and transitory poverty. The survey reveals that most poor households living in the Northeast region mainly work in the rice fields. They had high income fluctuation due to the drought conditions between 1993 and 1994. Consequently, many rural households in this region had to find extra income from non-farm employment to support their families and improve their welfare position.

Overall, the most important characteristics of the poor found in many existing studies on the determinants of poverty are household size and composition, age and gender of a household head, marital status, educational attainment, household's main occupation, cultivated landholding size and geographical variation. Other factors, which are estimated to significantly affect household welfare by some studies, are remittance receipts (Walle and Cratty 2004), social capital or community networks (Rupasingha and Goetz 2007; Hinks 2008; Hassan and Birungi 2011), migration (Serumaga-Zake and Naudé 2002; Glauben et al. 2011; Dartanto and Nurkholis 2013), household and public infrastructures (Bellon et al. 2005; Dercon et al. 2012; Gounder 2013) and political allegiances and participation (Watson 2000; Rupasingha and Goetz 2007). In this study, the main focus is to analyse the impact of crisis-related shocks on poverty. As a result, only the most important household characteristics found in existing literature and the results obtained from previous chapters are included and examined in the model of the determinants of poverty in this chapter.

5.2.2 Poverty Measures

Poverty Indices

Poverty can be assessed by employing different methods. The most widely used measures of poverty utilised by several existing studies are the headcount ratio, the poverty gap and the severity of poverty (See Foster, Greer and Thorbecke 1984; Foster, Greer and Thorbecke 2010). The headcount ratio measures the proportion of the population who are poor or living below the pre-selected poverty line. Because of its simplicity, this headcount ratio seems to be the most commonly used measure of poverty in constructing poverty profiles for many developing countries. However, it cannot be used to explain the degree or extent of poverty, which implies the effect of transfers from the poor to the less poor or from the poor to the non-poor. Before the FGT was introduced, Sen (1976) developed the following index to measure poverty:

$$S = H[I + (1 - I)G_p] \quad (5.1)$$

where

- G_p = Gini coefficient for the income distribution of the poor
- H = Proportion of the poor population (headcount index)
- I = $\frac{z - \bar{y}}{z}$ where z represents the poverty line and \bar{y} is the mean income of the poor population

The index proposed by Sen satisfies the monotonicity and transfer axioms, in which the poverty index should be associated with the distance of the poor to the poverty line, and reflect the distribution of income among the poor. However, the disadvantage of this index is that it does not satisfy the subgroup monotonicity axiom in which the poverty measure of a given population subgroup should be positively associated with the poverty measure of the whole population. The Foster-Greer-Thorbecke (FGT) indices, introduced by Foster, Greer and Thorbecke (1984), satisfy all axioms or theoretical requirements for establishing a poverty measure, and can be used to measure poverty in different dimensions. The model is expressed in the following form:

$$FGT_{\alpha,i} = \frac{1}{N} \sum_{i=1}^m \left(\frac{Z - y_i}{Z} \right)_i^{\alpha} \quad (5.2)$$

where

- y_i = Individual or household's welfare indicator
- Z = Poverty line
- N = Total population
- α = Poverty aversion parameter ($\alpha \geq 0$)
- m = Number of individuals or households whose welfare is below the poverty line

The model measures three dimensions of poverty: poverty incidence, poverty gap and severity of poverty. The model's parameters can take the value of 0, 1 and 2, which indicate poverty incidence, poverty gap and poverty severity respectively. When the poverty aversion parameter (θ) takes the value of 0, it measures poverty in terms of the headcount ratio. The poverty gap takes the value of parameter equals 1, which estimates the depth or the intensity of poverty. In other words, it indicates the average shortfall of household welfare from the poverty line over the total population or the level of welfare needed to escape poverty. For the severity of poverty, the parameter takes the value of 2, which measures the sensitivity or the distribution of poverty among the poor, by giving more weight on the poorest population.

Living Standard Indicators

To measure poverty using poverty indices, first of all, an indicator of well-being and the level of household welfare, which distinguishes the poor from non-poor households, must be determined. Various welfare indicators and poverty lines are used in both empirical and theoretical literature based on different approaches. Household's well-being can be measured in either monetary or non-monetary dimensions. Most existing studies focus on using household income or consumption expenditure as the most common indicator of household well-being (World Bank 2005). Some studies use indicators such as life expectancy, level of literacy or health status as the non-monetary measures of well-being. As previously mentioned in Chapter 2, consumption seems to be a better indicator in measuring poverty than income, particularly in agricultural areas where income is fluctuates highly (see World Bank 2005; Deaton and Zaidi 2002). According to Ravallion (1992), aggregate expenditure on all goods and services seems to be the most popular measurement of the standard of living in the development literature. In contrast,

income is preferable to consumption in most industrialised countries (Deaton and Zaidi 2002). However, poverty can be measured by both income and consumption to test the sensitivity of the results when data is available from household surveys.

Besides, Ravallion (1992) emphasises the difference in household size and composition for which some studies use equivalence scales in normalizing a household's living standards. The author argues that the equivalence scale should be carefully derived from consumption behaviour because it can reflect both differences in needs and inequalities among household members. In addition, the author highlights the problem in using food share as a measure of household well-being. This is because the proportion of food to total consumption is normally different across households due to the differences in their preferences and income elasticity demand for food. Furthermore, even though there is advantage in measuring household welfare in terms of nutritive value because it is unaffected by relative price changes, it does not completely cover all aspects of well-being (Ravallion 1992). As a result, the solution to this problem would be to use different assessments for a broader aspect of well-being when making poverty comparisons.

Deaton and Zaidi (2002) discuss different approaches in adjusting for household demographic composition using equivalence scales: behavioural approach, a subjective approach and an arbitrary approach. The authors point out that there is no consensus on the particular method for calculating equivalence scales. Various authors use different ways to compare the welfare costs of children relative to adults and examine the extent of economies of scale. However, all approaches are generally constructed based on the same underlying principle, which takes into account different needs among household members. The behavioural approach is useful in estimating equivalence scales, which takes into account the extent of economies of scale. Behavioural analysis is used to estimate the proportion of goods shared within a household. According to Deaton and Paxson (1998), economies of scale tend to be large among households with a small share of consumption of private goods. In contrast, economies of scale are likely to be small among households with a high proportion of private goods relative to public goods. In regard to the subjective approach, equivalence scales are estimated based on the "Leyden" technique by asking households to evaluate the amount of income they would need. This amount

of income is then ranked in six different levels: very bad, bad, insufficient, sufficient, good and very good (See Van Praag and Warnaar 1997). The “good” status of household income is used to estimate the elasticity of needs to household size, which reflects the extent of the economies of scale. Deaton and Zaidi (2002) argue that this approach may lead to biased and inconsistent estimation of economies of scale. This is because household size tends to be negatively correlated with the error term and the cost of children may not be the same, but vary across households. The authors point out that equivalence scales could be estimated arbitrarily by defining the number of adult equivalents in the following specific form:

$$AE = (A + \alpha K)^\theta \quad (5.3)$$

Where A is the number of adults and K is the number of children in a household. The parameter α represents the cost of children and θ reflects the extent of economies of scale. The authors indicate that the cost of children is relatively larger in developed countries, but lower in poor countries where agriculture is the main sector. As a consequence, for poor countries, the parameters α and θ are suggested by the authors to be approximately 0.3 and 0.9 respectively. They explain that it is because households in poorer economies have a large share of public goods, which results in very large-sized economies of scale. This arbitrary approach is recommended by the authors and has been used widely by several researchers, as previously mentioned in Chapter 4 (Jenkins 1991; Cutler and Katz 1992; Banks and Johnson 1994). The OECD scales, which are the most commonly used scales in many developing countries, are also constructed based on this arbitrary approach. Using this approach, the values of α and θ are determined according to a country’s level of development. The advantage of this approach is that it allows the comparison of poverty between children and elderly people when the results are robust. In this study, the modified OECD equivalent scale is used to calculate the per equivalent poverty line for each household. This choice of equivalent scales is selected according to the results obtained from the sensitivity analysis in Chapter 4.

Poverty Lines

Turning to the poverty line, several approaches are used to determine the standard of living, which separates the poor from the non-poor population. As previously mentioned in Chapter 3, Thailand and other developing countries mainly rely on the

concept of absolute poverty in constructing a poverty line. An absolute poverty line is generally defined in terms of the cost of basic needs or the cost of minimum food and non-food requirements in order to attain acceptable living standards. In contrast, developed countries are more likely to rely on the concept of relative poverty. The relative poverty line distinguishes the poor from the rest of the population based on the constant proportion of the national mean. For instance, households with income or consumption less than 50 percent of the national mean income or consumption are considered to be poor. Besides, the poverty line can be constructed based on a subjective approach in which households are asked to judge their current living conditions, their minimum needs and the most vulnerable groups in their society (World Bank 2005). This self-reported threshold, namely the subjective poverty line, is not as popular among economists and policy makers as the previous two approaches because of its failure in capturing discrimination against particular groups. Furthermore, policy makers usually feel that it is difficult to understand the observed perceptions of poverty determined by the population.

In Thailand, as briefly mentioned before in Chapter 3 and 4, the current official poverty line is constructed by the National Economic and Social Development Board (NESDB), based on the absolute poverty concept. The first official poverty line was initially developed by the World Bank in 1970s. However, the technique used in constructing a household poverty line was changed considerably in 1998 due to its several weaknesses. By assuming that calorie requirements are the same across households, the World Bank poverty line failed to capture the difference in age and gender of each individual and price variation in different areas.

According to the NESDB (1998), the new household poverty line is constructed to eliminate these weaknesses based on the method proposed by Kakwani and Krongkaew (1998). In other words, the NESDB poverty line is determined according to the difference in its age, gender and location. Food and non-food poverty lines are calculated separately to obtain the total official poverty line. Because food and non-food requirements are assumed to vary across households, the household's utility function has to take into account these differences.

According to Kakwani and Krongkaew (1998) and Kakwani (2010), the individual's utility function is defined as

$$u = u\left[\frac{q_f}{r}, \frac{q_n}{n}\right] \quad (5.4)$$

where

q_f = Quantity vectors of food consumption

q_n = Quantity vectors of non-food consumption

r = Individual's calorie requirement

n = Individual's non-food requirement

To obtain the demand functions, the food and non-food utility functions are maximized subject to budget constraint as follows:

$$p_f \cdot q_f + p_n \cdot q_n \leq x \quad (5.5)$$

where p_f and p_n represent the price vectors of food and non-food consumption respectively, and x is the total household expenditure on food and non-food items.

The results yield the following Marshallian demand functions:

$$q_f = r g_f(x, r p_f, n p_n) \quad (5.6)$$

$$q_n = n g_n(x, r p_f, n p_n) \quad (5.7)$$

Substituting the two demand functions into the budget constraint gives the following cost function:

$$x = e(u, r p_f, n p_n) \quad (5.8)$$

Hicksian demand functions are obtained by substituting the cost function into the food and non-food demand functions respectively:

$$q_f = r g_f(u, r p_f, n p_n) \quad (5.9)$$

$$q_n = n g_n(u, r p_f, n p_n) \quad (5.10)$$

Suppose u^* is the point where the level of utility is the same for all individuals. Substituting u^* in the two Hicksian demand functions above gives the food and non-food poverty lines as follows:

$$F = p_f q_f = r p_f g_f(u^*, r p_f, n p_n) \quad (5.11)$$

$$NF = p_n q_n = n p_n g_n(u^*, r p_f, n p_n) \quad (5.12)$$

Suppose c is the vector that converts the quantity vectors of food into calories. Since the calorie intake, $c q_f$, should equal to the calorie requirement, r , at the food poverty line, the food poverty line can be written as

$$F = p_f q_f = r p_f g_f(u^*) \quad (5.13)$$

The food poverty line can also be written in terms of the cost of food expenditure per calorie as

$$ccost^* = p_f g_f(u^*) \quad (5.14)$$

Adjusting for the food prices, the real calorie cost function is written as

$$ccost^* = g_f(u^*) \quad (5.15)$$

In practice, the real calorie cost can be obtained by calculating the calorie cost for the population at different quintiles and choosing a reference group (the bottom quintile, for example) to construct the food poverty line. Taking into account regional variation in food prices, the food basket, which contains different food items consumed by the population in different regions, is required in order to estimate the calorie cost for each region separately. In addition, spatial food price indices are estimated according to the food basket of the reference group.

To estimate the non-food poverty line, Kakwani (2010) suggests that the utility u^* should be solved first by substituting the estimated food poverty line F into the food expenditure function to obtain the total poverty line z . Because the total poverty line combines the food and non-food poverty lines together, the non-food poverty line is calculated by subtracting the food poverty line from the total poverty line. The non-food poverty line reflects a household's basic non-food needs. According to

Ravallion (1998), the non-food poverty line is equal to the non-food expenditure if the total expenditure is equal to the food poverty line. In other words, non-food items, which households spend when their total expenditure can only meet the food requirement, are considered as their basic non-food needs. However, Kakwani (2010) argues that this idea is not consistent with standard economic theory, in which food and non-food poverty lines should correspond to the same level of utility u^* .

To solve this problem, the author suggests that the non-food poverty line should be estimated using several basic non-food components collected from the household survey. The non-food items, such as alcohol and tobacco, which are not considered as basic non-food needs should be excluded from the estimation. In this chapter, taking into account different dimensions of poverty, the determinants of poverty are examined based on different categories of poverty. Subsequently, taking into account household size and composition difference, three different per equivalent household poverty lines are used in this study.

5.2.3 The Impact of Crisis on Poverty

Different approaches have been used in existing studies to analyse the impact of large-scale crisis on household welfare and poverty. Many studies compare the changes in observed poverty rates, inequality and socio-economic indicators pre- and post- crisis (See, for example, Baldacci, Mello and Inchauste 2002; Suryahadi and Sumato 2003; Jones, Hull and Ahlburg 2000; Booth 1999; Fallon and Lucas 2002). However, some researchers are dissatisfied with this most commonly used approach and point out its disadvantages in their studies (Kakwani and Son 2001; Datt and Hoogeveen 2003).

Baldacci, Mello and Inchauste (2002) conduct a cross-country regression analysis to compare changes in the probability of being poor between crisis-affected countries and the control or unaffected group during pre- and post-crisis periods. The long term impact of the crisis is estimated using pooled data. Their findings show that the effect of household characteristics on poverty risk slightly changes during a crisis period. According to their pooled regression analysis, poverty risk significantly increases in the aftermath of a crisis, particularly in urban areas. This implies that the impact of financial crisis is stronger in urban than rural areas. In the case of Indonesia, Suryahadi and Sumato (2003) find that the poverty level significantly

increases from the pre-crisis level. Following a method developed by Chaudhuri (2000) in estimating vulnerability before and after the economic crisis, their study shows that chronic poor and high vulnerable households are most affected by the crisis. Suryahadi, Widyani and Sumarto (2003) study poverty short-term dynamics by comparing poverty movement during and after the crisis period in Indonesia. Different poverty categories classified according to Jalan and Ravallion (2000) are used in estimating poverty incidence. Their results show that the percentage of households moving in and out of poverty increases relative to the post-crisis period. Similarly, Dhanani and Islam (2002) estimate consumption-based poverty in the pre-crisis and during crisis period in Indonesia. They estimate and compare capability poverty between rural and urban areas using housing and health conditions, educational attainment and the human poverty index as the poverty indicators. The national poverty line is re-estimated using the scaling-up method to construct the non-food poverty line. Subsequently, the rural food poverty line is corrected by deflating the cost of the food bundle in urban areas. The results show that poverty rates, poverty gap between rural and urban areas and the severity of poverty sharply increase during crisis periods, particularly the extreme poverty in urban areas. Inflation shock causes more people to become vulnerable to poverty after the crisis. Measuring welfare using both monetary and subjective indicators, Lokshin and Ravallion (2000) examine welfare changes pre- and post-crisis. Their study shows that crisis causes household income from salary to decline. On the other hand, income from home production and the poverty rate increase in the post-crisis period. This implies that a household seems to rely more on other income sources when its main income falls during a crisis. The negative effect of crisis is greater on household expenditure than income. The authors explain that this is possibly because households usually realise the full impact of crisis on their expenditure faster than their income.

Kakwani and Son (2001) argue that the approach most commonly used by many researchers above has not provided sufficient results. They criticise the approach, suggesting that it can only be used to analyse the structural changes of poverty in the period before and after a crisis. Furthermore, it does not explain how poverty during the crisis deviates from its long-term trends. To solve this problem, the authors suggest analysing the impact of crisis on poverty by comparing the percentage

change between the actual poverty incidence during a crisis and its predicted value based on past trends prior to the crisis. Natenuj (2002) follows the method similar to the study by Kakwani and Son (2001) in order to analyse the impact of the Asian economic crisis on poverty and inequality in Thailand. The author estimates the crisis index from the difference between the actual and expected values of poverty during the crisis period. Poverty is defined into three categories; the ultra-poor, whose income is below the 80 percent poverty line, the marginal poor, with income between 80 and 100 percent of the poverty line, and the near poor, whose income is between 100 and 120 percent of the poverty line. The results show that crisis causes a sharp increase in poverty incidence and inequality in all regions, but the effect is relatively stronger in rural areas. Furthermore, crisis is found to substantially increase the number of ultra-poor. This indicates that the ability to escape poverty is weakened by a crisis.

However, Datt and Hoogeveen (2003) argue that the approach proposed by Kakwani and Son (2001) may be problematic because the period of the past trends prior to the crisis studied is arbitrary and not clearly-identified. Additionally, the approach introduced by Kakwani and Son (2001) does not capture the impact of other non-crisis related factors on the changes in household welfare. As a result, Datt and Hoogeveen (2003) apply a regression analysis to assess the distributional impact of the crisis in the Philippines by taking into account other non-crisis factors. That is, household welfare is regressed against crisis-related shocks and some other household characteristic variables. Three different types of shocks are included in their model: labour market shock, drought shock and joint shock, which combines the effects of the previous two shocks. Their findings show that labour market shock has the largest negative impact on per capita household consumption. The effect of joint shock is greater than the effect of drought shock. Furthermore, the estimated coefficients of the interaction terms show that the negative impact of crisis on consumption is greater among households with higher educational attainment. For drought shock, the impact is larger among those who own more land. This implies that the impact of crisis-related shocks on consumption depends on household and community characteristics.

Using time series state-level data, Datt and Ravallion (1997) examine the impact of macroeconomic crisis and the stabilisation program on poverty for rural India. Using the observed poverty measure as the dependent variable, macroeconomic indicators and other crisis-related explanatory variables, such as inflation rates, state development spending and real agricultural wage, are included in the model of determinants. The regression results obtained from a nonlinear least-squares estimator show that a higher rate of inflation significantly increases poverty, while development expenditure is insignificant. The estimated parameters of agricultural yield, non-agricultural output and real wages are estimated to be negatively significant. The results indicate that these factors contribute to a reduction in poverty. The model can explain the variance related to state-specific intercepts and time trends quite well. However, it cannot explicitly explain the variance related to the fluctuation by time varying variables. The authors claim that this is possibly due to the lack of a rich database on the low-frequency events of stabilisation programs. To test for asymmetric effects of the economic crisis on poverty in Brazil, Agénor (2002) applies a VAR model to examine the cyclical position of the economy and the impact of output shocks on poverty. The author defines “crisis” as the negative shocks that cause a drop in output more than 4 percent, while a drop in output less than 4 percent is defined as normal recession. The poverty headcount index is used in constructing a symmetric VAR model to measure output movements. The results show that the poverty rate declines when the output gap is initially positive. However, the negative output gap, which arises from recession or crisis, does not explicitly affect poverty and unemployment. Only wage effect is found to be statistically significant. This method is useful in measuring the non-linear effects of crisis in terms of output shocks on poverty. However, the standard VAR approach used in this study only measures the short-run asymmetric effects of poverty. The model cannot measure the long-term determinants of poverty.

Applying a static Computable General Equilibrium (CGE) model with a micro-simulation, Ahmed and O’Donoghue (2010) analyse the impact of the Global Financial Crisis on poverty in Pakistan. The poverty level, measured in terms of the headcount ratio, is found to increase by almost 80 percent during the crisis period, particularly in urban areas. Furthermore, the results suggest that the impact of crisis on households participating in the agricultural sector is smaller than those who are

skilled manufacturing workers. Applying the same approach, using the dynamic CGE model with a micro-simulation model, similar results are obtained from the study by Breisinger et al. (2011). Their study shows that the impact of financial crisis is concentrated more in urban than rural areas. The total crisis scenario in this study consists of food, financial and fuel crises. The service sector is found to suffer most from all crises. Similarly, Vos (2010) adopts a dynamic CGE model to evaluate the simulated impact of financial crisis on poverty in Bolivia, Honduras and Nicaragua. The model is built on the analysis of the determinants of basic needs satisfactions towards Millennium Development Goals (MDGs), which aim to meet the target of poverty reduction. The results explicitly show that global crisis increases the cost of poverty reduction strategies towards MDGs and slows down the process. Focusing on the structural differences at both the micro and macro levels, Boccanfuso and Savard (2011) use macro-micro CGE simulation models to examine the impact of food crisis on poverty between Mali and Senegal. The results obtained from a comparative analysis reveal the differences in the distributional impact of food crisis on poverty and inequality between the two countries. While rural households suffer more from crisis in Senegal, the urban households in Mali are affected more by crisis. Their findings emphasize an important role of the structure of the economy, particularly on trade and agricultural sectors.

Using a fixed-effect panel data analysis for a cross-country study, Nikoloski (2011) analyses the short-term effects of currency and debt crises on poverty. The author highlights that different types of crises have different effects on poverty. While banking and currency crises directly affect poverty rate and its depth, debt crisis indirectly affects poverty through a decline in public expenditure. As a result, equal weights are given to currency, banking and debt crises in estimating the impact of financial crisis on poverty. The effect of currency crisis is found to be significantly larger than that of banking crisis, while the debt crisis dummy appears insignificant. The author explains that this is because currency crisis is strongly associated with economic downturn and price changes, which directly affect the poor, while debt crisis does not have a great impact on those who are currently poor. In addition, the author points out that the insignificant results of the banking crisis dummy for all poverty specifications is possibly due to the insufficient data on the number of debt crisis periods included in the sample. Stewart (2012) investigates the contrast

between the impact of financial crisis and debt crisis on poor countries. His findings are similar to Nikoloski (2011) in that the impact of financial crisis appears much larger than debt crisis. The study shows that crises affect the poor through a decline in private income and public entitlements. In addition, the effect of financial crisis is found to vary across countries due to differences in countries' main sources of income (trade, foreign direct investment, remittances, for example).

Overall, various approaches are applied to assess the impact of crisis on poverty. The choice of appropriate methods seems to depend on research aims and data availability. Some studies focus on analysing the short-run effects of crisis, while others may concentrate on analysing long-term effects on poverty. Most existing studies evaluate the impact of crisis by comparing changes in the observed poverty and some micro- and macro-economic factors between the pre- and post-crisis periods. Various poverty measures and different dimensions of a crisis (financial crisis, food crisis, debt crisis, for example) are used in existing studies. Many studies apply various types of linear and non-linear regression analyses to examine the impact of the crisis and household characteristics on poverty incidence or poverty risk. Some studies try to link policy reforms to changes in poverty by applying static or dynamic CGE models and simulation to estimate the impact of crisis at both micro and macro levels.

For Thailand, the 1999 Socio-Economic Survey is the only available data for analysing the impact of the Asian crisis at the household level. Unlike most studies, this study does not just compare the changes in observed poverty between the pre- and post-crisis periods. Focusing on the distributional impact of the crisis on household poverty, this study adopts the method proposed by Datt and Hoogeveen (2003) in assessing the impact of crisis on poverty, which allows the self-reported measure of shock in classifying different types of crises. Furthermore, adopting an idea from a study by Natenuj (2002), this study uses different categories of poverty to examine the determinants of poverty and construct a poverty profile for Thailand.

5.3 Methodology and Data

This section explains various definitions of crisis, an approach to measure household poverty and the regression method used in examining the impact of crisis on poverty.

The Thai 1999 SES data (NSO 1999), which specifically collected extra information on the impact of the Asian financial crisis on households, is used in this study. The descriptive statistics of this household survey data are presented later on in this section.

5.3.1 Defining the Crisis

Many existing studies measure the impact of crisis on important macro-economic variables by focusing on a single crisis, such as currency crisis, banking crisis or food crisis. As previously mentioned in the literature review section, previous studies clearly show that many households are usually affected by more than one shock. In addition, different types of shocks have different impacts on poverty measures (See, for example, Datt and Hoogeveen 2003; Nicoloski 2011). Therefore, unlike most studies, this study aims to measure the impact of crisis on selected micro-economic variables associated with poverty. Different dimensions of the crisis are taken into account in examining the determinants of poverty.

According to Datt and Hoogeveen (2003), crisis-related shocks for the Philippines are categorised into three groups: labour market shock; drought (El Niño) shock; and joint shock, which combines the effects of labour market and drought shocks. These categories of shocks are defined according to responses from households that were asked to report the problems they faced during the crisis period. In the case of Thailand, the information on crisis-related shocks is obtained from the 1999 household SES data. Households were asked to consider if, after comparing their income in the first six month period of 1999 with income from the same period of 1998, the following factors had affected them or not:

- i) Job loss
- ii) Reduced Wages
- iii) Decreased business income/Enterprise shutdown
- iv) Decreased property income
- v) Declined remittance from people outside the family
- vi) Decreased farm income
- vii) Drought/Flood

Following the study by Datt and Hoogeveen (2003), based on the questionnaire, these crisis-related shocks can be categorised into four groups: (1) employment

shock, (2) wage shock, (3) income shock, and (4) climate shock. Table 5.1 illustrates the relative frequency of these shock categories. Approximately 85.4 percent of sample households were affected by income shock. This implies that the size of the sample households not affected by income shock is too small to be constructed as a control group because almost every household was affected by this shock. Therefore, as suggested by Datt and Hoogeveen (2003), income shock should be disregarded and other shocks linked to a low proportion of households being affected by the crisis should be combined. Finally, this study focuses on three main categories of shocks: (1) labour market shock (employment and wage shocks), (2) climate shock, and (3) joint shock, which combines labour market and climate shocks. Based on three main categories of shocks, approximately 10.8 percent of the sample is estimated to be affected by labour market shock, 33.5 percent is affected by climate shock and about 21.4 percent is affected by both types of shocks. Thus, these three shocks together account for more than 60 percent of the overall Thai sample households.

Table 5.1: The Relative Frequency of Crisis-related Shocks

Crisis-related shocks	Percent of sample households affected
(i) Employment shock	11.0
(ii) Wage shock	15.7
(iii) Income shock	85.4
(iv) Climate (drought/ flood) shock	39.7
Employment shock only	0.2
Wage shock only	0.3
Income shock only	25.4
Climate shock only	1.6
Hit by at least one of the five shocks	91.7
Hit by at least one of the four shocks other than the income shock	64.5
Labour market shock (regardless of the income shock)	10.8
Climate shock (regardless of the income shock)	33.5
Both Climate and Labour market shocks (regardless of the income shock)	21.4

Source: Author's calculation from National Statistical Office (1999)

5.3.2 Measures of Poverty

To measure poverty, first of all, it is necessary to define the welfare indicator and the poverty line. In the literature, consumption expenditure is suggested by many existing studies as the most popular measurement of well-being (See, for example, World Bank 2005; Deaton and Zaidi 2002; Ravallion 1992). In regard to the choice of household poverty line for Thailand, this study follows the method used by the NESDB (1998) in constructing the per capita total poverty line, which combines the food and non-food poverty lines. Following the method proposed by Kakwani and Krongkaew (1998) and Kakwani (2010), the total poverty line is determined according to the differences in age, gender and location. Subsequently, taking into account the difference in the distribution of food consumption between adults and children within a family, a “per equivalent” poverty line is constructed in this study instead of a “per capita” poverty line, using the OECD method in the following functional form:

$$S(A, K) = 1 + \alpha (A - 1) \beta K \quad (5.16)$$

The equation above indicates the ratio of the required energy level for a family with A adults and K children relative to the required energy level for a reference unit. The values of α and β employed by the modified OECD scale are 0.5 and 0.3 respectively. Subsequently, to construct a poverty profile, three different poverty dimensions are estimated using the Foster-Greer-Thorbecke (FGT) indices: (1) the headcount ratio, (2) the poverty gap, and (3) the severity of poverty.

5.3.3 Modelling the Determinants of Poverty

To assess the impact of crisis, this study follows the method proposed by Datt and Hoogeveen (2003) in which household welfare is determined by household and community characteristics, including various crisis-related shocks. Their regression analysis uses per capita household consumption and income as the measure of household living standards. Therefore, households are considered to be poor if their incomes (consumptions) are below the per capita poverty line.

However, adopting an idea from Natenuj (2002), this study uses three different categories of poverty status to examine the determinants of poverty: (1) general poverty; (2) food poverty; and (3) extreme poverty. The total household poverty line

combines the food poverty line with the non-food poverty line. Furthermore, taking into account the effect of household size and the age of its members on the distribution of food, a per equivalent poverty line is used instead of a per capita poverty line. Households are defined as “generally poor” if they live below per equivalent total poverty line. Households whose consumption expenditure on food is below their per equivalent food poverty lines, while their total expenditure remains above the total poverty line, are considered as “food poor.” Lastly, those who live below both the food and total poverty lines are defined as “extremely poor.”

This study uses a probit regression model in which a binary variable, representing whether a household is poor, is regressed on a set of selected explanatory variables. The regression estimates represent how a change in each explanatory variable affects the probability of a household being poor, holding all other influences constant. The model can be expressed in the following form:

$$y = \Phi(\alpha + \sum \beta_i X_i + e) \quad (5.17)$$

where

$y = 1$ if a household is poor for a specific poverty type (e.g. food poor)
and takes other poverty types as 0

Φ = cumulative density function for the standard normal curve

β_i = regression coefficient of each explanatory variable

X_i = independent variables

e = error term

Following the method proposed by Datt and Hoogeveen (2003), the basic model for examining the determinants of poverty and the impact of the crisis is written as:

$$Y_j = \beta_j X_j + \gamma^L S_j^L + \gamma^C S_j^C + \gamma^{LC} S_j^{LC} + \varepsilon_j \quad (5.18)$$

where

Y_j = the poverty binary status (poor or non-poor) in household j

β_j = regression coefficient of household j 's characteristic variables

X_j = a set of household characteristics and other determinants of household j

$\gamma^{(\cdot)}$ = regression coefficient of each crisis-related dummy variable

S_j^L = a dummy variable indicating if the household j experiences labour market shock

S_j^C = a dummy variable indicating if the household j experiences climate & agricultural shock

S_j^{LC} = a dummy variable indicating if the household j experiences both labour market and climate shocks

ε_j = a random disturbance term

However, it is important to note that this simple model carries the implication that a given crisis shock has the same proportional impact on poverty for all households affected by this shock. This assumption may not always be true because some households may do better or worse than others. For instance, the impact of a labour market shock may be less severe in a household headed by a person who has tertiary education than for a household headed by a person with primary education. Therefore, to solve this problem, a more complex model is constructed by adding the interaction between crisis shock variables and some household characteristics (Z_j) as follows:

$$Y_j = \beta X_j + \gamma^L S_j^L + \gamma^C S_j^C + \gamma^{LC} S_j^{LC} + \delta^L Z_j S_j^L + \delta^C Z_j S_j^C + \delta^{LC} Z_j S_j^{LC} + \mu_j \quad (5.19)$$

In the second model, the returns to some specific characteristics (education level, land ownership, household socio-economic class, for example) are altered by shocks related to the crisis. The reason that not all household characteristics are interacted with crisis-related shocks is because it may cause a large number of insignificant interaction terms, which results in imprecise estimation (Datt and Hoogeveen 2003). Furthermore, similar regression methods to those used in Chapters 3 and 4 are applied again in this chapter. Separate regressions are carried out for urban and rural areas to deal with structural difference. This method helps examine whether the influence of some factors, such as educational attainment and land size, are different between rural and urban areas.

The vector X_j , which represents household characteristics and other potential determinants of household welfare, is selected from the literature review in section 5.2.1. Household welfare is measured in terms of per equivalent household consumption. The main characteristics of the poor are household demographics, characteristics of a household head, a household's main occupation, education level of a household head and landholding.

5.3.4 Data Sources

The Thai '*Household Socio-Economic Survey*' (SES) in 1999 (NSO 1999), collected after the Asian crisis by the National Statistical Office of Thailand (NSO), is used to examine the impact of the crisis on household poverty in Thailand. The 1999 SES is a special survey because it contains information on the impact of the crisis on the living standards of households in terms of income losses. While the SES in every year normally contains a sample size of more than 30,000 households, the special 1999 SES covers less than 10,000 households. In addition, the 1996 SES (NSO 1996) and the Labour Force Survey in 2010 (NSO 2010b) are used to construct a household poverty file to investigate changes in poverty indicators between the pre- and post-crisis period.

The household total poverty line, which combines the food poverty line with the non-food one, is calculated using survey data on household demographics, incomes, and expenditures on food, durable and non-durable goods. A method proposed by Kakwani and Krongkaew (1998) and Kakwani (2010) is adopted in this study to estimate the household poverty line for Thailand. First of all, the nutritional requirements of individuals and spatial price indices are used to estimate the food poverty line, which represents the monthly cost of the calorie requirements for each household member. The data on a recommended nutritional requirement per day for Thai people is obtained from the Department of Health (Appendix 4.1).

The food baskets and spatial price indices, which are estimated by the Department of Business Economics for municipal areas and sanitary districts within each region, are used in this study to compute the calories obtained per baht based on the average sanitary district basket in 1999 (Table 5.2). Secondly, the household food poverty line is obtained by calculating food costs in terms of baht per month for each household using the modified OECD equivalence scale. Thirdly, the non-food

poverty line is calculated using the utility approach based on the costs of nine basic non-food items which include clothing and footwear, shelter, medical treatment and supplies, fuel, personal care, household goods, education, transportation and communication. Finally, the total household poverty line equals the sum of the food and non-food poverty lines.

Table 5.2: Calories obtained per baht based on Sanitary District Basket in 1999

Regions	Sanitary District Price	Municipal District Price
North	149	124
Northeast	145	122
Central	140	117
South	132	108
Bangkok	141	105

Source: Author's calculation based on the spatial food price indices provided by the Ministry of Commerce (1999), using the 1992 prices as the base year.

The weight characteristics of Thai household data by area in 1999 are provided in Table 5.3. Table 5.4 contains the definition and statistic description of variables included in the regression models. Explanatory variables are chosen based on the key determinants found in the literature review on determinants of poverty. The parameters are estimated by STATA software package version 10.

Table 5.3: Weight Characteristics of Thai Households by Area, 1999

Variables:	National	Urban	Rural
Sample size (households)	7,789	4,246	3,543
Monthly expenditure per equivalent (baht)	2,811	4,027	1,906
Household size (Mean)	3.5	3.3	3.6
Age of head of household (Mean)	48.4	44.6	49.0
Dependency burden on children and elderly (Mean)	.45	.43	.48
Household head is married	5,233	3,024	2,209
Head of household is female	2,155	993	1,162
Household head's highest education is primary schooling	5,794	3,285	2,508
Household head's highest education is secondary schooling	655	366	289
Household head's highest education is high school	334	237	97
Household head's highest education is university	639	533	106
Socio-economic class is a very small farm operator - mainly own land from 5 to 19 Rai	577	262	315
Socio-economic class is a small farm operator - mainly own land from 20 to 39 Rai	336	184	152
Socio-economic class is a medium farm operator - mainly own land more than 40 Rai	151	94	57
Socio-economic class is a farm operator, mainly rent land	234	83	151
Socio-economic class is a landless farm worker or general labour	541	210	331
Socio-economic class is a professional, technical, or managerial worker	753	432	321
Socio-economic class is an entrepreneur	1,551	867	684
Household lives in Bangkok	506	506	-
Household lives in Central	1,998	972	1,026
Household lives in North	1,754	810	944
Household lives in Northeast	2,252	1,023	1,229
Household lives in South	1,279	587	692
Household lives in rural areas	3,543	-	-
Household lives in urban areas	4,246	-	-
Household is affected by labour market shock only	841	488	353
Household is affected by climate shock only	2,609	1,157	1,452
Household is affected by both shock	1,667	929	738

Note: * 1 rai = 0.34

Table 5.4: Definition and Statistic Description of Explanatory Variables, 1999

Variable Labels	Descriptions	SES 1999	
		Mean	SD
Dependent variable: Poverty (P = 1 if poor, 0 otherwise).			
Size	Household size	3.50	1.49
Size_sq	Size-square of household	17.66	15.31
Age	Age of household head (yrs.)	48.40	14.52
Age_sq	Age-square of household head	2446.3	1321.8
Female	Gender of household head (1= female)	.277	.225
Married	If a household head is married (1 = yes, 0 otherwise).	.672	.465
Dependent	Proportion of members whose age are below 15 and above 65 years old	.451	.346
Primary	If a household head's highest education is primary schooling (1 = yes, 0 otherwise).	.744	.482
Secondary	If a household head's highest education is secondary schooling (1 = yes, 0 otherwise).	.084	.054
High_school	If a household head's highest education is high school (1 = yes, 0 otherwise).	.043	.028
University	If a household head's highest education is university (1 = yes, 0 otherwise).	.082	.053
Land5_19rai	If socio-economic class is a farm operator, mainly own land less 5 to 19 Rai (1 = yes, 0 otherwise).	.074	.048
Land20_39rai	If socio-economic class is a farm operator, mainly own land 20 to 39 Rai (1 = yes, 0 otherwise).	.043	.027
Land40more	If socio-economic class is a farm operator, mainly own land 40 Rai or more (1 = yes, 0 otherwise).	.019	.012
Land_rent	If socio-economic class is a farm operator, mainly rent land (1 = yes, 0 otherwise).	.030	.019
Landless	If socio-economic class is a landless farm worker or general labour (1 = yes, 0 otherwise).	.069	.045
Professional	If socio-economic class is a professional, technical & managerial worker (1 = yes, 0 otherwise).	.097	.063
Entrepreneur	If socio-economic class is an entrepreneur (1 = yes, 0 otherwise).	.199	.013
Bangkok	If a household lives in Bangkok (1 = yes, 0 otherwise).	.065	.042
Central	If a household lives in Central (1 = yes, 0 otherwise).	.257	.166
North	If a household lives in North (1 = yes, 0 otherwise).	.225	.146
Northeast	If a household lives in Northeast (1 = yes, 0 otherwise).	.289	.187
Labor_shock	If a household is affected by a labour market shock only (1 = yes, 0 otherwise).	.108	.354
Climate_shock	If a household is affected by a climate shock only (1 = yes, 0 otherwise).	.335	.412
Joint_shock	If a household is affected by both shocks (1 = yes, 0 otherwise).	.214	.453

5.4 Analysis of Empirical Results

This section explains the diagnostic tests and regression results obtained from the estimated regressions of the determinants of poverty. The models are constructed based on three different categories of poverty: general poverty, food poverty and extreme poverty.

5.4.1 Diagnostic Tests for Regression Analysis

To obtain the best-fit model, the same diagnostic tests used in the previous two empirical chapters are utilised in this chapter to detect multicollinearity, model specification error, goodness of fit and heteroskedasticity in the binary probit models.

Using the STATA software package, the Variance Inflation Factors (VIF) for selected quantitative explanatory variables and the Contingency Coefficients for dummy variables are computed to detect multicollinearity in the models. The mean VIF and the contingency coefficients are estimated to be about 4.43 and 0.692 respectively. According to the common rule of thumb proposed by O'Brien (2007) and Mitiku, Fufa and Tadese (2012), the results imply that there is no strong correlation between the selected explanatory variables included in the probit models. Subsequently, the model is tested to determine whether it is correctly specified. Using the STATA software package, the p-value obtained from the Link Test, which regresses the dependent variable on the prediction and the prediction squared, is estimated to be greater than 0.10. This indicates that the model is correctly specified.

Furthermore, the Ramsey's RESET test is applied to detect the problem due to omitted variables. The result shows that the p-value obtained from this test is also greater than 0.10, accepting the hypothesis that the model has no omitted variable at the 1percent level. To detect the problem of heteroskedasticity, the Breusch-Pagen/Cook-Weisberg test and the Likelihood Ratio test are used in this study. The estimated p-values obtained from the two tests are approximately 0.112 and 0.128 respectively. The results imply that there is no serious heteroskedasticity problem in the model because the hypothesis in which the variance of the residuals is homogenous cannot be rejected at the 1percent level.

5.4.2 The Determinants of Poverty and Impact of Crisis

The same regression method utilised in the study of vulnerability and food insecurity is applied in analysing the determinants of poverty. The probit regression model is constructed to examine the effects of a change in each explanatory variable on the probability of a household being poor. The determinants in this study involve the key characteristics of the poor and factors related to the particular crisis. Subsequently, the poverty status of each household - the binary dependent variable - is determined based on three poverty categories: general poverty, food poverty and extreme poverty. Furthermore, the determinants of poverty are distinguished relative to rural and urban areas. The modified OECD equivalence scale is used to compute per equivalent household consumption and the poverty line for each household. The probit regression results based on equation (5.18) for all three poverty categories are shown in Table 5.5. Based on equation (5.19), the second model assumes that the distributional impact of a given shock for all households is not constant. In contrast, the shocks are associated with some household characteristics. The regression results in which the dummy crisis variables are interacted with various household characteristics across all three poverty categories are shown in Table 5.6. The coefficients shown in both tables are estimated in terms of the marginal effects with Z statistics in parentheses. The results clearly show that all probit models tend to give the expected signs of coefficients and significance. The estimation results are discussed based on the *ceteris paribus* condition as follows:

Table 5.5: Determinants of Poverty by Area and Category (MODEL 1)

Variable	Probit Model: whether household is poor					
	General Poverty		Food Poverty		Extreme Poverty	
	Urban	Rural	Urban	Rural	Urban	Rural
Size	.024 (3.87)**	.032 (4.10)**	.045 (5.68)**	.041 (4.32)**	.027 (4.21)**	.038 (3.65)**
Size_sq	-.0005 (-3.60)**	-.0006 (-5.25)**	-.0011 (-8.20)**	-.0010 (-7.64)**	-.0007 (-5.34)**	-.0009 (-6.29)**
Age	.0052 (2.47)*	.0014 (1.98)*	-.0031 (-2.02)*	-.0062 (-2.40)*	-.0005 (-1.98)*	-.0009 (-2.82)**
Age_sq	-.0000 (-2.18)*	-.0000 (-2.52)*	.0000 (1.88)	.0000 (2.45)*	.0000 (2.40)*	.0000 (2.62)**
Female	.0014 (1.98)*	.0032 (2.54)**	.002 (2.10)*	.008 (2.36)*	.0024 (2.13)*	.0047 (4.43)**
Married	-.023 (2.50)*	-.037 (1.99)*	-.034 (1.66)	-.047 (1.98)*	-.058 (2.66)**	-.052 (2.58)**
Dependent	.045 (3.63)**	.052 (2.45)*	.012 (2.32)*	.020 (2.16)*	.073 (2.89)**	.065 (2.75)**
Primary	-.016 (-2.77)**	-.027 (-4.80)**	-.008 (-1.92)	-.012 (-6.75)**	-.032 (1.56)	-.044 (-12.15)**
Secondary	-.028 (-3.39)**	-.031 (-5.36)**	-.012 (-2.33)*	-.040 (-4.47)**	-.035 (-4.09)**	-.048 (-5.57)**
High_school	-.062 (-6.06)**	-.084 (-9.75)**	-.016 (-2.45)*	-.008 (-2.12)*	-.073 (-3.98)**	-.092 (-5.79)**
University	-.103 (-10.80)**	-.124 (-15.49)**	-.020 (-4.33)**	-.037 (-8.26)**	-.050 (-7.80)**	-.061 (-11.13)**
Land5_19rai	-.0049 (-2.88)**	-.0298 (-4.67)**	-.0103 (2.44)*	-.0321 (6.32)**	-.0054 (-2.34)*	.0245 (4.76)**

Land20_39rai	-0.0054 (4.48)**	-0.0321 (6.62)**	-0.0156 (-2.15)*	-0.0324 (3.89)**	-0.0069 (3.33)**	-0.0307 (5.47)**
Land40more	-0.0325 (-7.79)**	-0.0509 (-6.65)**	-0.0304 (-2.61)**	-0.0745 (-4.43)**	-0.0506 (-3.79)**	-0.0545 (-4.21)**
Land_rent	.035 (4.33)**	.041 (7.56)**	.026 (2.13)*	.039 (4.47)**	.021 (3.21)**	.028 (4.22)**
Landless	.079 (12.35)**	.054 (8.67)**	.056 (6.43)**	.065 (8.82)**	.039 (8.44)**	.043 (7.78)**
Professional	-0.0178 (-8.84)**	-0.0189 (-2.35)*	-0.0216 (-6.21)**	-0.0155 (-2.43)*	-0.0105 (-4.21)**	-0.0187 (-2.45)*
Entrepreneur	-0.0189 (-9.86)**	-0.0192 (-5.76)**	-0.0133 (-5.41)*	-0.0321 (-3.23)*	-0.0165 (-5.67)**	-0.0114 (-4.89)**
Bangkok	-0.0433 (-3.89)**		-0.0189 (-2.31)*		-0.0189 (-3.25)**	
Central	-0.0078 (-2.32)*	-0.0052 (-1.27)	-0.0067 (-2.45)*	-0.0143 (-2.21)	-0.0069 (-1.95)	-0.0105 (-1.44)
North	.0254 (2.52)*	.0440 (6.21)**	.0143 (2.56)**	.0389 (2.34)*	.0132 (3.16)**	.0209 (4.57)**
Northeast	.0321 (5.87)**	.0458 (8.44)**	.0196 (3.33)**	.0521 (8.67)**	.0189 (5.85)**	.0567 (9.43)**
Labor_shock	.0615 (9.76)**	.0421 (4.45)**	.0457 (5.89)**	.0354 (4.02)**	.0535 (5.21)**	.0403 (6.34)**
Climate_shock	.0131 (2.24)*	.0202 (4.16)**	.0465 (2.41)*	.0519 (5.43)**	.0261 (3.22)**	.0209 (4.10)**
Joint_shock	.0363 (3.44)**	.0434 (3.78)**	.0398 (4.17)**	.0426 (4.64)**	.0518 (5.43)**	.0534 (5.78)**
Obs.	4,246	3,543	4,246	3,543	4,246	3,543
Pseudo R ² :	0.2348	0.2254	0.2141	0.2985	0.2432	0.2251
Log likelihood Ratio:	-2456.8	-1987.6	-3933.2	-2347.6	-2121.8	-2143.8

Wald chi-square:	988.6	809.5	1114.93	941.23	923.41	899.73
Prob(F):	0.000	0.000	0.000	0.000	0.000	0.000

Note: z-values are listed in parentheses; * and ** denote significance at 5% and 1% levels, respectively.

Table 5.6: Determinants of Poverty by Area and Category (MODEL 2)

Variable	Probit Model: whether household is poor					
	General Poverty		Food Poverty		Extreme Poverty	
	Urban	Rural	Urban	Rural	Urban	Rural
Size	.026 (3.89)**	.035 (4.14)**	.048 (5.70)**	.043 (4.35)**	.029 (4.22)**	.040 (3.69)**
Size_sq	-.0005 (-3.63)**	-.0007 (-5.28)**	-.0011 (-8.24)**	-.0011 (-7.68)**	-.0008 (-5.36)**	-.0009 (-6.32)**
Age	.0055 (2.51)*	.0016 (2.02)*	-.0033 (-2.06)*	-.0065 (-2.42)*	-.0006 (-2.04)*	-.0009 (-2.84)**
Age_sq	-.0000 (-2.22)*	-.0000 (-2.55)*	.0000 (1.91)	.0000 (2.47)*	.0000 (2.43)*	.0000 (2.64)**
Female	.0017 (2.02)*	.0036 (2.55)**	.001 (2.04)*	.006 (2.40)*	.0020 (2.10)*	.0045 (4.40)**
Married	-.021 (2.48)*	-.035 (1.96)*	-.061 (1.22)	-.085 (1.42)	-.049 (2.63)**	-.045 (2.47)*
Dependent	.046 (3.64)**	.065 (2.48)*	.014 (2.33)*	.022 (2.18)*	.076 (2.90)**	.066 (2.77)**
Primary	-.014 (-2.76)**	-.026 (-4.79)**	-.007 (-1.90)	-.033 (-6.74)**	-.030 (1.55)	-.041 (-12.12)**
Secondary	-.029 (-3.40)**	-.033 (-5.37)**	-.014 (-2.34)*	-.043 (-4.48)**	-.038 (-4.10)**	-.026 (-5.58)**
High_school	-.077 (-6.08)**	-.089 (-9.76)**	-.018 (-2.46)*	-.011 (-2.14)*	-.077 (-2.99)**	-.098 (-5.81)**
University	-.112 (-10.82)**	-.131 (-15.51)**	-.026 (-4.34)**	-.041 (-8.27)**	-.057 (-7.81)**	-.070 (-11.15)**
Land5_19rai	-.0046 (-2.87)**	-.0295 (-4.66)**	-.0098 (2.43)*	-.0318 (6.31)**	-.0049 (-2.33)*	-.0240 (-4.75)**

Land20_39rai	-.0059 (4.49)**	-.0324 (6.63)**	-.0159 (-2.16)*	-.0328 (3.90)**	-.0073 (3.34)**	-.0311 (5.48)**
Land40more	-.0354 (-7.35)**	-.0565 (-6.52)**	-.0315 (-1.99)*	-.0753 (-4.21)**	-.0468 (-3.75)**	-.0559 (-4.16)**
Land_rent	.037 (4.36)**	.045 (7.59)**	.028 (2.20)*	.041 (4.54)**	.024 (3.32)**	.030 (4.36)**
Landless	.082 (12.38)**	.062 (8.69)**	.060 (6.47)**	.071 (8.84)**	.068 (8.47)**	.052 (7.79)**
Professional	-.0169 (-8.82)**	-.0176 (-2.33)*	-.0210 (-6.19)**	-.0147 (-2.40)*	-.0097 (-4.20)**	-.0174 (-2.42)*
Entrepreneur	-.0186 (-9.81)**	-.0187 (-5.71)**	-.0129 (-5.36)*	-.0318 (-3.21)*	-.0160 (-5.62)**	-.0108 (-4.82)**
Bangkok	-.0435 (-3.92)**		-.0196 (-2.33)*		-.0210 (-3.28)**	
Central	-.0064 (-2.10)*	-.0040 (-1.22)	-.0058 (-2.40)*	-.0123 (-1.16)	-.0055 (-0.89)	-.0094 (-1.22)
North	.0256 (2.53)*	.0446 (6.22)**	.0147 (2.58)**	.0392 (2.36)*	.0139 (3.18)**	.0214 (4.59)**
Northeast	.0325 (5.83)**	.0465 (8.42)**	.0205 (3.30)**	.0544 (8.41)**	.0195 (5.73)**	.0577 (9.38)**
Labor_shock: S(L)	.0853 (4.24)**	.0506 (2.02)*	.0457 (2.45)*	.0233 (2.17)*	.0315 (2.29)*	.0206 (3.20)**
Climate_shock: S(C)	.0102 (0.70)	.0175 (0.84)	.0216 (0.65)	.0407 (2.12)*	.0210 (1.99)*	.0213 (2.24)*
Joint_shock: S(LC)	.0412 (0.25)	.0447 (1.17)	.0414 (1.96)*	.0332 (2.36)*	.0240 (2.41)*	.0209 (2.13)*
S(L)*Primary	-.006 (-2.24)*	-.004 (-2.10)*	-.002 (-1.20)	-.0003 (-0.92)	-.0102 (-3.64)*	-.0091 (-0.75)

S(L)*Secondary	-.013 (-3.10)**	-.010 (-2.42)*	-.007 (-1.97)*	-.002 (-1.18)	-.0131 (-3.21)**	-.009 (-2.44)*
S(L)*High_school	-.025 (-3.14)**	-.017 (-4.31)**	-.0026 (-0.23)	-.0023 (-0.65)	-.028 (-2.10)*	-.022 (-2.47)*
S(L)*University	-.054 (-3.21)**	-.043 (-2.46)*	-.005 (-0.64)	-.017 (-1.94)	-.026 (-1.36)	-.013 (-1.17)
S(L)*Land5_19rai	.0021 (1.30)	.0083 (1.72)	.0058 (1.35)	.0021 (1.69)	.0102 (1.38)	.0112 (1.44)
S(L)*Land20_39rai	.0008 (1.64)	.0042 (1.75)	.0089 (0.64)	.0065 (1.02)	.0115 (1.46)	.0154 (1.58)
S(L)*Land40more	.0024 (1.92)	.0051 (1.48)	.0021 (1.02)	.0051 (1.42)	.0245 (1.21)	.0202 (1.23)
S(L)*Land_rent	.0032 (1.58)	.0029 (1.82)	.0018 (1.67)	.0049 (1.81)	.0268 (1.42)	.0430 (1.75)
S(L)*Landless	.014 (1.07)	.005 (1.32)	.021 (1.08)	.017 (1.76)	.014 (1.78)	.010 (1.10)
S(L)*Professional	-.0321 (-2.13)*	-.0215 (-1.54)	-.004 (-0.91)	-.006 (-0.43)	-.0104 (-1.23)	-.008 (-1.45)
S(L)*Entrepreneur	-.0336 (-2.23)*	-.0192 (-1.22)	-.013 (-1.41)	-.004 (-0.23)	-.035 (-1.17)	-.024 (-1.69)
S(C)*Primary	.0062 (0.74)	.0045 (0.32)	.0011 (0.92)	.0112 (1.25)	.0230 (0.75)	.0236 (1.29)
S(C)*Secondary	.0141 (1.28)	.0215 (1.12)	.0161 (1.31)	.0217 (0.44)	.0145 (1.79)	.0216 (1.14)
S(C)*High_school	.020 (1.31)	.015 (0.84)	.047 (1.35)	.086 (1.54)	.014 (1.19)	.023 (1.16)
S(C)*University	.044 (2.41)	.0132 (1.26)	.012 (1.47)	.007 (0.94)	.046 (1.07)	.053 (1.29)

S(C)*Land5_19rai	-.0037 (-1.56)	-.0102 (-2.33)*	-.0035 (-1.27)	-.0153 (-1.84)	-.0017 (-1.44)	-.0115 (-2.87)**
S(C)*Land20_39rai	-.0021 (-1.07)	-.0158 (-1.97)*	-.0061 (-2.15)*	-.0025 (-3.56)**	-.0031 (-1.23)	-.0107 (-2.45)*
S(C)*Land40more	-.0043 (-1.60)	-.0096 (-2.12)*	-.0110 (-2.60)*	-.0226 (-4.04)**	-.0097 (-0.49)	-.0138 (-2.23)*
S(C)*Land_rent	.005 (1.96)*	.014 (2.28)*	.0009 (2.10)*	.0064 (2.63)**	.0072 (3.25)*	.0114 (3.33)**
S(C)*Landless	.031 (1.50)	.018 (1.62)	.015 (1.43)	.024 (1.32)	.026 (2.15)*	.018 (2.21)*
S(C)*Professional	.0110 (1.09)	.008 (0.62)	.012 (0.95)	.009 (0.87)	.0127 (1.33)	.006 (1.20)
S(C)*Entrepreneur	.0204 (1.05)	.0089 (1.83)	.034 (1.60)	.008 (0.54)	.071 (1.56)	.129 (1.43)
S(LC)*Primary	-.002 (-1.32)	-.003 (-1.96)*	-.0008 (-0.34)	-.0027 (-1.56)	-.0090 (-1.04)	-.0074 (-2.28)*
S(LC)*Secondary	-.008 (-1.39)	-.007 (-2.15)*	.004 (1.32)	.002 (1.09)	-.0076 (-1.50)	-.0047 (-1.98)*
S(LC)*High_school	-.011 (-1.04)	-.008 (-1.20)	-.0018 (-0.39)	-.0013 (-0.20)	-.0082 (-1.32)	-.0133 (-1.14)
S(LC)*University	-.031 (-1.60)	-.037 (-1.45)	-.003 (-0.76)	-.009 (-1.50)	-.020 (-1.24)	-.006 (-0.39)
S(LC)*Land5_19rai	-.0030 (-1.45)	-.0071 (-1.02)	-.0022 (-1.04)	-.0137 (-1.26)	.0008 (1.07)	.0104 (1.32)
S(LC)*Land20_39rai	.0014 (0.98)	.0135 (1.22)	.0054 (1.00)	.0018 (0.69)	.0095 (1.34)	.0123 (1.21)
S(LC)*Land40more	.0013 (1.65)	.0042 (1.23)	.0032 (1.46)	.0086 (1.79)	.0074 (0.58)	.0093 (1.46)

S(LC)*Land_rent	.0043 (1.75)	.0016 (1.42)	.0029 (1.86)	.0092 (2.27)*	.0033 (1.41)	.0105 (2.20)*
S(LC)*Landless	.026 (1.34)	.010 (1.52)	.006 (1.37)	.018 (1.19)	.022 (1.28)	.015 (1.07)
S(LC)*Professional	-.0109 (-1.04)	-.0106 (-1.02)	-.009 (-1.04)	-.003 (-0.20)	-.0092 (-0.43)	-.002 (-1.19)
S(LC)*Entrepreneur	-.0114 (-1.16)	-.0086 (-1.33)	-.027 (-1.18)	-.012 (-0.56)	-.029 (-1.04)	-.010 (-1.57)
Obs.	4,246	3,543	4,246	3,543	4,246	3,543
Pseudo R ² :	0.2362	0.2268	0.2225	0.2998	0.2447	0.2265
Log likelihood Ratio:	-2445.8	-1980.6	-3928.2	-2335.3	-2110.4	-2122.4
Wald chi-square:	1012.6	825.2	1127.61	954.21	941.20	913.35
Prob(F):	0.000	0.000	0.000	0.000	0.000	0.000

Note: z-values are listed in parentheses; * and ** denote significance at 5% and 1% levels, respectively.

Household Demographic variables

The regression results clearly show that the households of larger families are more likely to face higher probability of being poor for all types of poverty in both rural and urban areas. The difference in the marginal effect is statistically different at the 1 percent level. In addition, the risk of poverty in having an additional member in the household in rural areas is greater than in urban areas with significant non-linear effects. The age of a household head has a slight impact on a reduction of all types of poverty in both rural and urban areas. However, its coefficient is highly significant and its size is found to be different between rural and urban areas. This is possibly because economic activities and employment opportunities are different between rural and urban areas.

With regard to the gender of a household head, the marginal effect of having a female household head is estimated to be positively significant for all types of poverty. However, the coefficient is only highly significant at the 1 percent level for general poverty and extreme poverty criteria in rural areas. These findings are consistent with the results obtained from the probit models in Chapter 3 and 4. Female-headed households in rural areas are more likely to be poor than those residing in urban areas. This is possibly because employment opportunities in rural areas tend to be low-skilled, low-income and low in number. However, being headed by a female does not increase the probability of a household being food poor that much. As previously mentioned in Chapter 4, occupants of female-headed households usually have a larger food share of total household consumption than their male-headed counterparts. This is possibly because women usually have the primary responsibility for food shopping and preparation within their families, particularly for children.

Subsequently, a married household head is found to have lower probability of being poor. The marginal effect of this is estimated to be highly significant for the extreme poverty category in both areas. Married household heads whose spouses are employed tend to have a relatively higher income. In Thailand, the majority of extremely poor households are located in rural areas where agriculture is the main sector. Since agricultural products are labour-intensive, “married” households are more likely to produce a larger amount of agricultural output.

Households with a larger proportion of dependants are found to have a higher likelihood of being poor, particularly in the extreme poverty criteria. Households with more children and elderly people usually have a lower average monthly salary. Therefore, they are less able to adjust during economic crisis and become highly vulnerable to poverty.

Educational Attainment variables

As previously mentioned, education plays an important role in poverty reduction in the long-term. Higher level of household head education significantly lowers the probability of becoming poor for all poverty groups. The marginal effect when a household head has a university degree is significantly greater than the marginal effect of a household head with elementary or secondary schooling only. Similar results are obtained from examining the determinants of poverty and vulnerability in which the marginal effect of education is estimated to be slightly higher in rural than urban areas. The highly significant negative marginal effect of education on extreme poverty criteria confirms that education is a key determinant in chronic poverty reduction, particularly in rural areas.

Household's Socio-Economic Class variables

The household socio-economic class indicates a household's main source of livelihood, occupational status and type of economic activity. The socio-economic class of a household is determined by the household's main income earner, which is usually a household head. However, for some households, this classification is determined on the basis of the occupation of household members if their earnings represent the main source of livelihood. Among farm operators who mainly own land, households that own more land tend to be less poor. For instance, farm operators who own land of 40 rai or more have a significantly much lower chance of becoming poor than those who own land of between 5 and 19 rai. While farm operators who mainly own land have the lower probability of becoming poor, households that are classified among farm tenants and landless farm workers are more likely to be poor for all dimensions of poverty. In addition, the marginal effect of being a landless farm worker is significantly larger than the marginal effect of being a tenant cultivator. Furthermore, the size of the marginal effect is estimated to be significantly larger in rural than urban areas. These results imply that land

ownership is a crucial factor in eradicating all types of poverty, particularly in rural areas.

Households that are mainly involved in non-agricultural sectors are less likely to be poor in both areas for all poverty types. This finding is consistent with the results reported in the previous two chapters in which the negative marginal effects of non-agricultural occupations on poverty are estimated to be larger in urban than rural areas. These results imply that urban workers who are highly skilled and educated are more likely to escape poverty than those who live in rural areas. One possible explanation is that the highly skilled labour market is limited in rural areas whereas the demand for highly-skilled labour is relatively high in urban areas.

Household Geographic Location Variables

The marginal effects of regional dummy variables are estimated to be significantly negative only for Bangkok and the Central region. Residents in the North and Northeast regions are more likely to become poor at all poverty levels in both rural and urban areas. The results are similar to the estimation of the probit regression in Chapter 3 in which regional difference has a significant influence on household poverty. While being in Bangkok causes the largest decline in the probability of becoming poor, residents in the rural Northeast face the highest risk of falling below all types of poverty lines. Furthermore, focusing on poverty in the Northeast region, the results show that rural households in this region are more likely to fall below the extreme poverty line than other levels of poverty. This finding is in line with the study by the World Bank (2001), which indicates that most of the poor live in the Northeast region. Even though several pro-poor programs have been initiated by the government to target the poor in this region since the first National and Social Development Plan in 1961, the probit regression results obtained from the previous two chapters clearly show that rural Northeast households still face the highest risk of being vulnerable to poverty and food insecure in 2010.

Household Crisis-Related Shock Variables

The probit estimates of model (1) show that all crisis-related shocks have the significant positive marginal effects on the probability of being poor in all three poverty categories (Table 5.5). For instance, the positive marginal effect of 0.0615 for the labour market shock variable in urban areas under the general poverty criteria

implies that an individual residing in a household affected by labour market shock faces an increase in the probability of being poor of 6.15 percent. Subsequently, urban households that are affected by climate shock and joint shock experience a positive increase in general poverty of 1.31 and 3.63 percent respectively. The results imply that the effect of joint shock relative to labour market shock alone is smaller. The same result is obtained in the study by Datt and Hoogeveen (2003) on the Philippines. The effect of joint shock is usually expected to be larger than that of a single type of shock. However, the authors argue that this contradictory result is consistent when a large number of households seriously suffer from labour market shock, while others are moderately or slightly affected by both shocks.

Considering the differences between rural and urban areas, the marginal effects of shocks are estimated to be slightly larger in rural than urban areas for climate and joint shocks. As previously mentioned, rural households are mainly engaged in the agricultural sector. Therefore, they are more likely to suffer from shocks related to agricultural activities, while urban households are mostly affected by shock that mainly affects the non-agricultural sector. Comparing three different poverty groups and crisis types, labour market shock has a relatively strong effect on the general poor group, especially in urban areas. On the other hand, climate shock has the largest effect on the food poor, particularly in rural areas. In the case of joint shock, its impact is more severe for those who are extremely poor. These results appear consistent with the findings in Chapter 4 on food insecurity. The probit estimates in Chapter 4 show that the negative marginal effects of cultivated land and home food production on household vulnerability to food insecurity are significantly larger in rural than urban areas. This implies that rural households are more sensitive to food poverty than urban households.

The estimated results of model (1) are quite significant and consistent. However, according to Datt and Hoogeveen (2003), this model cannot differentiate the impact of the crisis across the population. This is because it assumes the constant effects of the crisis for all households. Table 5.6 presents the probit estimates obtained from model (2). The interaction terms in model (2) are created to reflect how household characteristics influence the impact of crisis-related shocks against different poverty criteria. The interaction terms between educational attainment and the crisis dummy

variables are used to indicate the variation in the effect of the crisis on poverty due to different levels of education. The marginal effect of the interaction term between labour market shock and educational attainment is negative and statistically significant only for general poverty and extreme poverty, particularly in urban areas. This implies that labour market crisis reduces the effect of education or returns to education in these two poverty groups. In addition, the impact is larger at the higher level of education. The parameter is not significant for the food poor because the effect of educational endowment tends to be much stronger on non-food poverty than food poverty. In contrast, the marginal effects of the interaction term between climate shock and education are estimated to be positive and insignificant. In other words, this indicates that climate shock does not significantly reduce the impact of education on all poverty groups. This is possibly because weather-related shock is barely related to returns to education. The interaction terms between joint shock and education are mostly insignificant, except for the general poor and extremely poor in rural areas. Even though they are not statistically significant, this positive sign still implies that joint shock reduces the impact of education at the level below upper secondary schooling.

Turning to the interaction terms between household socio-economic class and the crisis, the results show that labour market crisis does not affect the influence of land ownership-related variables on poverty. However, the parameters are estimated to be significantly negative for an urban household of a higher socio-economic class that is supported by a professional, technician or entrepreneur, for example. In other words, labour market crisis reduces the impact of non-agricultural jobs on poverty. However, its impact is only significant for the general poverty group in urban areas. This is possibly because high-skilled jobs are concentrated more in urban than rural areas. Most urban poor are more likely to fall into general poverty and labour market shock directly affects the income of households in this high-skilled socio-economic class. With respect to the impact of climate shock, its interaction with the variables related to land ownership appears statistically significant and negative for rural and urban food poor households. However, for other poor groups, climate shock only reduces the impact of land ownership on the general poor and extremely poor in rural areas.

In contrast, climate shock does not significantly reduce the impact of high-skilled socio-economic class membership on all poverty groups. The results are consistent with the fact that natural disasters, or weather-related shocks, are strongly associated with land and food poverty. Land endowment is the main source of food production, particularly in rural areas where agriculture is the main sector. Therefore, the effects of climate shock and land ownership are stronger on food poverty than other types of poverty. In addition, climate shock significantly increases the impact of being a tenant cultivator on all poverty groups, particularly for the rural food poor and extremely rural poor. In other words, being a tenant cultivator increases the chance of becoming poor even more in the environment where a climate-related shock occurs. Because non-agricultural activities are less likely to be associated with drought or flood crises, the parameters of interaction terms between high skilled socio-economic classes and climate shock are found to be insignificant. Regarding joint shock, its interaction terms with landholding and high-skilled socio-economic classes are insignificant for all poverty groups. However, its interaction with the household socio-economic class pertaining to tenant cultivator is significantly positive for the rural food poor and extremely rural poor. This implies that joint shock increases the impact of being a tenant cultivator on food poverty and extreme poverty in rural areas. One possible explanation is that households that mainly rely on farm income and have to rent land are more likely to earn less farm profits. In addition, they are worse off during weather-related crises than farmers who cultivate on their own land. As a consequence, these tenant cultivators usually try to earn extra income from non-agricultural activities, such as woodworking, painting and textile work, during the off-season. When joint shock occurs, they suffer severely from a large fall in their main income from farming, as well as their income from off-farm jobs.

In the next section, the poverty profile presents the impact of all crisis-related shocks on poverty in terms of the difference in poverty indicators between the pre- and post-crisis periods. As previously stated in the methodology section, by applying the FGT indices, poverty is measured as a headcount index, poverty gap index and squared poverty gap index or against a scale of severity of poverty.

5.5 The Poverty Profile: The Pre – and Post – Crisis Periods

This section presents the poverty profile between the pre-and post-crisis periods, which is constructed based on the results obtained from the previous section and household SES data in 1996 and 1999 (NSO 1996a, 1999). The poverty profile represents household poverty statistics across different subgroups of the population. Various types of poverty indicators are estimated and compared across the two periods – before and after the crisis. The key determinants obtained from the regression analysis are summarised in this section to illustrate the differences in household characteristics between poor and non-poor households based on different dimensions of poverty. Furthermore, using the 1999 SES (NSO 1999), the response of households towards the crisis and various forms of government welfare, which aim to help the poor, are discussed in this section.

5.5.1 Poverty Incidence in the Pre- and Post- Crisis

As previously mentioned, the study of poverty in this chapter categorises poverty into three groups: general poverty; food poverty and extreme poverty. Table 5.7 illustrates the poverty incidence measured by the FGT indices. At the national level, the three poverty indices substantially increased between 1996 and 1999 in all dimensions of poverty. For instance, for the general poor group, the headcount index increased from 35.31percent to 40.68 percent. The percentage change in poverty is largest among households that are extremely poor, followed by the food poor and general poor respectively. This indicates that the crisis has a strong impact on all poverty groups.

Table 5.7: Poverty Incidence by Category in 1996 and 1999

Poverty types	1996			1999		
	Head Count	Poverty Gap	Poverty Severity	Head Count	Poverty Gap	Poverty Severity
General Poor	35.31	8.69	3.06	40.68	10.64	3.87
Food Poor	5.10	1.37	0.42	7.23	1.86	0.74
Extremely Poor	2.71	0.62	0.25	3.98	1.23	0.42

Source: Author's calculation.

Considering poverty at the regional level, Table 5.8 shows the poverty disparity among regions between the pre-and post-crisis periods. Poverty has remained lowest

in Bangkok and highest in the Northeast region for all dimensions of poverty. The percentage of households classified as extremely poor is lower than of those who are food poor in all regions. While the proportion of the population that is either generally poor or extremely poor is higher in the North than in the South, food poverty is more severe in the South than in the North. This contradictory finding is in line with the results obtained from the profile of vulnerability to food insecurity in which the average daily household consumption in the North is estimated to be much higher than in the South. This is possibly because the amount of home-produced food is relatively large in the rural North where there are many subsistence rice farmers.

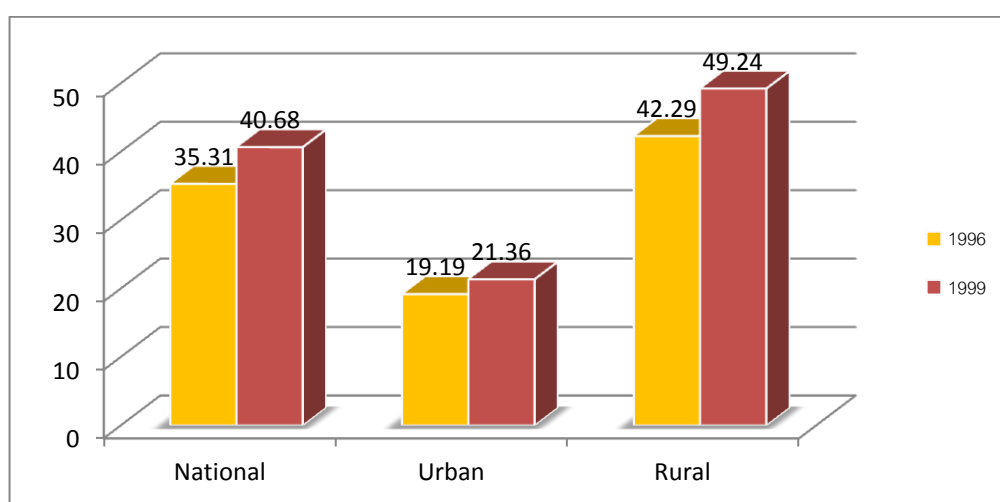
Table 5.8: Poverty Incidence by Region in 1996 and 1999

Poverty	Region				
	Bangkok	Central	North	Northeast	South
1996					
General Poverty					
Headcount ratio	4.28	26.35	40.21	47.73	35.91
Poverty gap	1.43	7.12	10.83	19.9	11.87
Poverty severity	0.72	2.84	4.33	5.03	5.51
Food Poverty					
Headcount ratio	0.60	3.69	5.03	6.68	5.63
Poverty gap	0.23	1.12	1.88	3.14	1.71
Poverty severity	0.04	0.39	0.75	0.69	0.59
Extreme Poverty					
Headcount ratio	0.34	2.11	3.22	3.82	2.87
Poverty gap	0.18	0.91	1.39	2.55	1.52
Poverty severity	0.07	0.23	0.36	0.41	0.45
1999					
General Poverty					
Headcount ratio	5.71	28.23	44.15	57.46	41.43
Poverty gap	1.90	7.64	11.89	15.60	13.75
Poverty severity	0.95	2.98	4.76	6.25	5.36
Food Poverty					
Headcount ratio	0.80	3.95	5.80	8.04	6.19
Poverty gap	0.30	1.21	1.87	2.46	2.16
Poverty severity	0.13	0.41	0.65	0.86	0.73
Extreme Poverty					
Headcount ratio	0.46	2.26	3.53	4.60	3.31
Poverty gap	0.24	0.98	1.52	2.00	1.76
Poverty severity	0.08	0.24	0.39	0.51	0.44

Source: Author's calculation.

Considering poverty at the community level, the poverty indices in rural areas are substantially higher than in urban areas. As shown in Figure 5.1, before the Asian crisis, the percentage of the poor was 19.19 percent in urban areas and 42.29 percent in rural areas in 1996. The difference in poverty between rural and urban areas has become much larger in the post crisis period. This indicates that the crisis has widened the poverty gap between rural and urban areas.

Figure 5.1: Poverty Headcount by Area in 1996 and 1999 (% of Total Poor)



Source: Author's calculation.

Turning to the income inequality problem, as shown in table 5.9, income inequality is higher in urban than in rural areas. At the regional level, unlike poverty incidence, income inequality was highest in the North during the pre-crisis period. However, the Gini index becomes highest in the South during the post-crisis period. While residents in the Northeast region face the highest increase in poverty, residents in the South suffer most from income inequality. Income inequality is not the only problem in the South: social inequality is also a major concern in the Southern provinces where most households are Thai Muslims. There are differences based on belief and race between Thai-Buddhists and Muslim Malays. Unfair treatment involving human right issues and economic development in the provinces where ethnic Malays live has led to insurgency. Recently, hundreds of soldiers were killed in the South from an attack on an army camp and car bombing carried out by Muslim separatists. This issue demands further national research priorities in order that the living standards of poor Thai Muslims in the rural South can be improved.

Table 5.9: Income Inequality in 1996 and 1999 (Gini Coefficient)

	1996	1999
Kingdom	0.511	0.523
Urban	0.459	0.461
Rural	0.443	0.448
Bangkok and Metropolitan	0.404	0.408
Central	0.436	0.458
North	0.465	0.467
Northeast	0.461	0.469
South	0.457	0.493

Source: Author's calculation.

5.5.2 Key Characteristics of Poverty in Thailand

As mentioned earlier, the estimated parameters obtained from the previous two empirical chapters clearly show that vulnerability, food insecurity and poverty are not the same, but they are closely related and do share similar household and community characteristics. As shown in Table 5.10, the composition of poor households is different from the non-poor. In addition, it varies across the definition of poverty.

Table 5.10: Household Demographic Factors by Poverty Type in 1999

Factors	General Poor	Food Poor	Extremely Poor	Non-Poor
Household size	5.0	5.2	5.4	3.6
Dependency	1.2	1.5	1.5	0.8
Age of head	47.8	48.5	52.9	46.7
Female Head (%)	20.9	19.2	21.6	19.7
Married Head (%)	58	54	49	65

Source: Author's calculation.

These results confirm an analysis of the determinants of poverty, discussed earlier in the previous section, that household demographics significantly affect poverty. The size of poor households in all poverty categories tend to be larger and have a higher dependency ratio than non-poor households. Subsequently, poor households are more

likely to be headed by an elderly person or single parent than the non-poor ones. Interestingly, the percentage of female household heads is lowest in the food poor group. This indicates that a household headed by a female is less likely to fall into food poverty than other poverty types. The results are consistent with the analysis of vulnerability to food insecurity in which the female head is more concerned about food preparation and food safety of household members than their male counterparts.

Educational attainment is another crucial factor affecting poverty pre-and post-crisis. Table 5.11 clearly shows that poor households are more likely to have a lower level of education. Most of the extremely poor households, approximately 88.5 percent, are headed by a person who finishes only primary schooling. Households headed by a person with a bachelor's degree or higher level of education are most likely to be in the non-poor category. The results are consistent with the marginal effect of education variables obtained from the regressions in which higher level of education significantly reduces poverty in all dimensions. Furthermore, the unemployment rate computed by the NSO (NSO 1996b, 1998) during the pre-and post-crisis periods confirms the adverse effect of the labour market crisis on poverty. As shown in Table 5.12, the Asian Crisis in 1997 caused the unemployment rate to increase at the national level from 1.3 percent in 1996 to 4.1 percent in 1998.

Table 5.11: Household Head's Educational Attainment by Poverty Type in 1999 (%)

Education	General Poor	Food Poor	Extremely Poor	Non-Poor
Primary School	79.3	83.4	88.5	78.6
Secondary School	4.3	2.2	1.4	6.5
High School	0.4	1.7	0.7	2.3
University	0.3	0.1	0.04	5.1

Source: Author's calculation.

The various unemployment rates relative to level of education figures in Table 5.12 explicitly show that the negative effect of the crisis on education tends to be stronger among labourers with secondary schooling and vocational education or diploma. The majority of un-skilled and semi-skilled labourers finish education at these levels. In addition, workers with a bachelor's degree or higher seem to be better off than

others. Thus, the results imply that the low-skilled labour force tends to have suffered more from the adverse impact of the 1997 crisis than highly skilled employees.

Table 5.12: Unemployment Rate in 1996 – 1998 (%)

Level	1996	1998	% change
Whole Kingdom	1.3	4.1	68
Primary or lower	1.4	3.6	61
Lower Secondary	1.7	4.7	64
Upper Secondary	2.0	5.6	64
Vocational & Diploma	2.3	6.5	65
Bachelor's degree or higher	1.6	4.0	60

Source: Calculated using the Labour Force Survey (NSO 1996b, 1998).

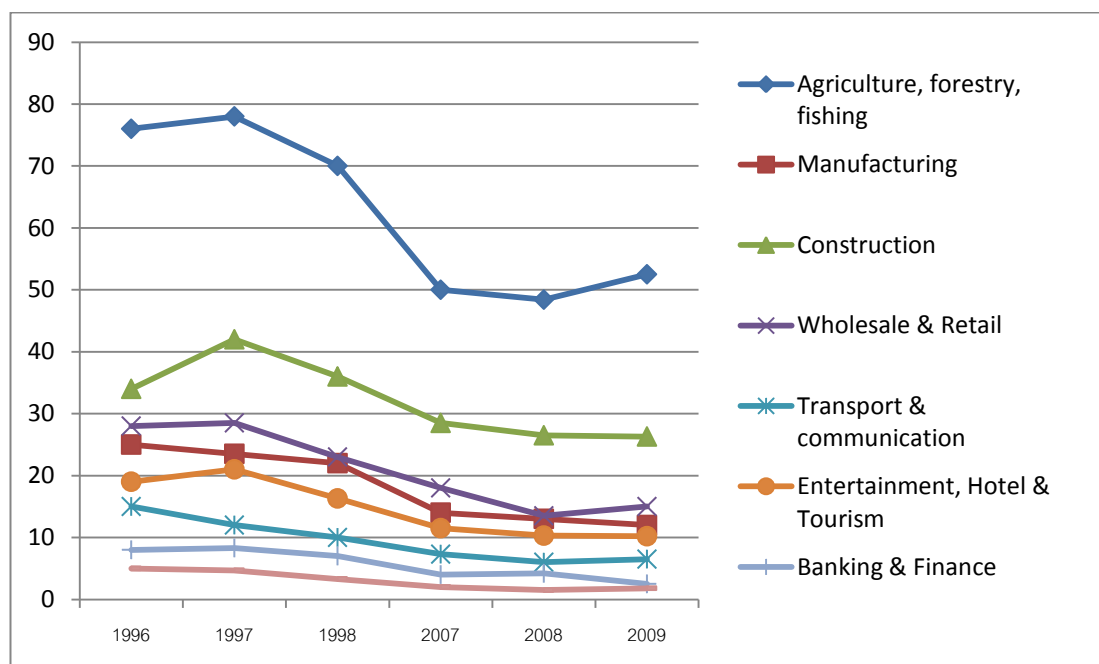
Turning to the socio-economic groups, as shown in Table 5.13, households dependent on low-skilled workers are most likely to be food poor, while those dependent on high-skilled workers tend to be non-poor. Those who are economically inactive are concentrated in the extremely poor group, which is the poorest category. Focusing on agriculture, landless farm workers, tenants and small-scale farmers are somewhat equally distributed between the general poor and extremely poor groups. Only large-scale farmers are concentrated in the general poor category. This indirectly implies that an increase in land size farmed tends to reduce the severity of poverty in the agricultural sector. Additionally, food poverty is more severe among those who are trapped in lowly paid or low-skilled jobs in the non-agricultural sectors. Thus, the results confirm the importance of land endowment on poverty and food insecurity. Similarly, the data calculated from the labour force survey in Figure 5.2 clearly shows that the largest percentage of workers whose earnings are below minimum wages is in the agricultural sector. The effects of the Global Financial Crisis seem to have been less severe than those of the Asian financial crisis. The table confirms that agricultural workers are more likely to be persistently poor because their percentages remained at the highest level during both the 1997 Asian crisis and the 2008 Global Financial Crisis. Apart from agriculture, the sectors most affected by both crises were construction, manufacturing and services.

Table 5.13: Socio-Economic Groups by Poverty Type in 1999 (%)

Socio-economic group	General Poor	Food Poor	Extremely Poor	Non-Poor
Small farmers	4.2	2.8	3.9	2.6
Large farmers	8.2	2.4	2.8	3.7
Farm tenants	4.9	1.6	4.7	3.3
Farm workers	11.4	10.2	12.1	8.4
Low-skilled workers	21.9	29.4	14.3	19.6
High-skilled workers	18.2	14.8	1.6	24.7
Inactive	12.6	11.3	13.8	11.8

Source: Author's calculation.

Figure 5.2: Workers Earning Below the Minimum Wages by Sector (%)



Source: Calculated from the Labour Force Survey (NSO 1996b, 1997, 1998, 2007, 2008, 2009).

5.5.3 Household Responses and Roles of Government during the Crisis

The 1997 Asian Crisis changed the consumption patterns of many Thai households, especially the poor. The 1999 SES contains information on household responses to the crisis (NSO 1999). In the survey, households that experience a decrease in their

total income can select more than one choice of solution to solve their problems due to the crisis. Figure 5.3 illustrates the reaction of households during the crisis period. The majority of households apparently changed their consumption patterns during the crisis, approximately 84 percent of the total population. The percentage of households being supported or receiving loans from people outside their families was substantially higher than of those who received support or borrowed loans from the government. Moreover, many households chose to rely on themselves, by withdrawing savings, working harder to earn more income and using self-prescription or changing from private to public hospital when family members became sick during the crisis. For instance, around 24.26 percent of the total population with decreased income decided to withdraw their own savings, while only 7.96 percent sought help from government funds. This implies that only a small number of households received support from the government during the 1997 crisis. Considering the poor's responses, very few of them participated in the government employment generation program. In contrast, a large number of poor households chose to migrate for a job and borrow loans from people outside their families. This indicates that the government's role in mitigating the impact of the crisis in 1997-98 was quite ineffective and insufficient.

Table 5.14 clearly shows that, among the poor households, the percentage of those who decide to cut down their expenditure and change their eating patterns during the crisis is largest in the extremely poor group, followed by the food poor and general poor respectively. Furthermore, the most popular means to solve the income problem among the extremely poor group are changing consumption patterns, working harder and migrating for a job. For the food poor group, their most frequently used survival methods during the crisis are changing consumption pattern, working harder and borrowing loans from people outside households. The choices of the general poor are quite different from other groups. Instead of relying on themselves, the general poor households mostly borrow from people outside their families or from government funds. The results imply that the extremely poor have no credit to borrow money, while the food poor do not have enough credit to qualify for loans from the government. In other words, only the general poor have sufficient credit to take out loans and pay for the interest rate. Furthermore, the extremely poor are less likely to be supported by the government than other poor groups. For example, the share of

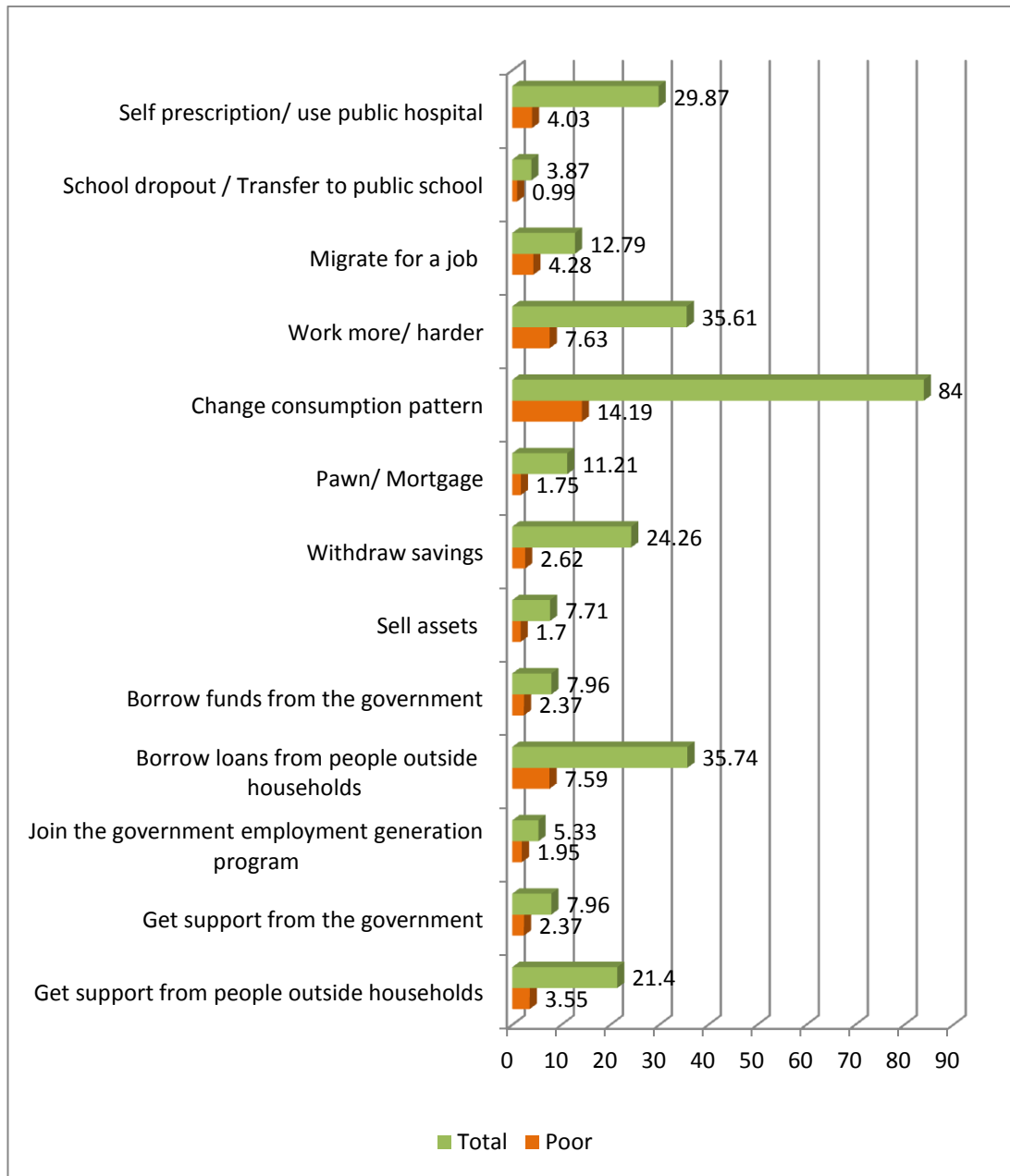
the general poor participating in the government employment generation program is twice as high as the share of the extremely poor group.

Subsequently, the extremely poor are less likely to rely on their assets and savings because they are living a great distance from the poverty line. Apart from receiving the least financial and government employment support, the extremely poor benefit less from government healthcare. More than half of the poor who have to reduce their health expenditure are in the extremely poor category. They have to depend mainly on self-prescription or change from private to public hospitals. These results indicate that government programs failed to target the right group of the poor during the 1997 crisis. In other words, the extremely poor should receive the most government support during a crisis, not other poor groups.

The crisis seems to have had only a small impact on the education of children in poor families. The percentage of poor households withdrawing their children from school or transferring them from private to public schools was approximately 0.99 percent, which is quite low. In addition, the percentage withdrawing from school or transferring to public school tends to be equally distributed among the three poor groups. This implies that labour market shock prevents young people from earning extra income to support their families after they leave school to find jobs. According to Natenuj (2002), dropping out of school seems to be the last choice for decreased income households in solving their financial difficulties during economic crisis. This is possibly because parents realise that education can considerably enhance the living standards of their children in the future.

Apart from withdrawing children from school, some households that cannot afford school fees and other related expenses decide to transfer their children from private to public school. Public schools in Thailand normally charge much lower tuition fees than private schools. In addition, many public schools in rural areas offer free school lunch for poor students as part of the government's education support programs. The program not only provides lunch but also includes milk and some supplementary food for students. As a result, parents pay less money for their children's education and more children are sent to school.

Figure 5.3: Household Reactions to the Financial Crisis (%)



Source: Adapted from 1999 SES (NSO 1999).

Table 5.14: Reaction of Households with Decreased Income during the Crisis (%)

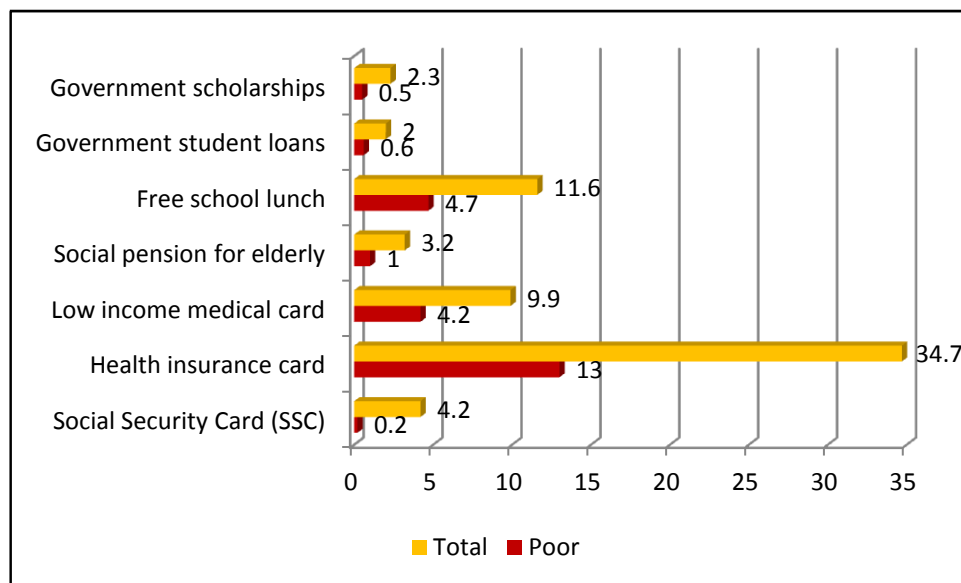
Household's decisions	General Poor	Food Poor	Extremely Poor	Non-Poor
Get support from people outside households	1.20	1.26	1.09	17.85
Get support from the government	1.85	1.14	0.56	5.59
Join the government employment generation program	0.88	0.65	0.42	3.38
Borrow loans from people outside households	5.49	4.23	0.87	28.15
Borrow funds from the government	4.98	3.42	0.70	9.20
Sell assets	1.05	0.38	0.27	6.01
Withdraw savings	1.62	0.75	0.25	21.64
Pawn/ Mortgage	0.38	0.62	0.75	9.46
Change consumption pattern	3.40	4.60	5.19	69.81
Work more/ harder	2.24	3.45	3.80	27.98
Migrate for a job	1.05	1.36	2.87	8.51
School dropout / Transfer from private to public school	0.33	0.31	0.35	2.88
Self-prescription/ use public hospital	0.63	1.32	2.08	25.84

Source: Adapted from 1999 SES (NSO 1999).

However, as previously discussed in Chapters 3 and 4, most of the main pro-poor programs provided by the government in 2010 have been found to be less effective in targeting the right vulnerable groups. In this chapter, similar results are obtained by classifying the poor into three different categories based on the 1999 SES data (NSO 1999). Figure 5.4 illustrates the percentage of households receiving social welfare in 1999. The results show that less than half of the total population benefited from social welfare in that year.

Regarding the health care of citizens, almost 41 percent of the total population was estimated to be poor, whereas 34.7 percent of the total population owned a health insurance card. In addition, only 9.9 percent received a low income medical card. Furthermore, approximately 4.2 percent of the population had a social security card, but less than 1 percent of beneficiaries were poor. The results indicate that government health programs do not efficiently benefit the low income and poor households during a crisis.

Figure 5.4: Percentage of Households Receiving the Social Welfare in 1999



Source: Adapted from 1999 SES (NSO 1999).

Even though education is estimated to be a crucial factor in mitigating poverty, not many poor households are supported by government education programs. For instance, as can be seen in Figure 5.4, approximately 2 percent of the population was eligible for student loans and government scholarships in 1999, whereas less than 1 percent was poor. The free school lunch program aims to encourage low income

parents to send their children to school. However, around 11.6 percent of the total population was eligible for this program, while only 4.7 percent of them were from poor households. As previously mentioned, households containing a large number of children and elderly people are more vulnerable to poverty. However, less than half of the population who receive the age pension is poor.

Table 5.15 illustrates the share of poor households eligible for social welfare in poverty categories for 1999. The table confirms the results obtained from Chapter 3 and 4, showing that most beneficiaries are low vulnerable or nearly poor households. For instance, the free school lunch program is expected to mainly target food poor and extremely poor households because the percentage of child malnutrition in these two groups is relatively high. However, the results show that most households that participate in the free school lunch program and other education programs are the general poor. The low income medical card is the only health care program that efficiently benefits the poorest group. However, the share of poor households eligible for the program is much smaller than the share of beneficiaries who are non-poor. Moreover, the social pension for elderly should mostly benefit the extremely poor group because the dependency ratio of households in this group is highest. However, the 1999 results show that the program benefited all poor groups equally instead of targeting the poorest households. Overall, the results imply that most government welfare cannot effectively mitigate the impact of crisis on poverty.

Table 5.15: Poor Households Receiving Social Welfare by Poverty Category, 1999

Social Welfare	General Poor	Food Poor	Extremely Poor	Non-Poor
Social Security Card (SSC)	0.1	0.1	0	4
Health insurance card	6.3	4.2	2.5	21.7
Low income medical card	0.36	1.64	2.2	5.7
Social pension for elderly	0.35	0.34	0.31	2.2
Free school lunch	2.4	1.5	0.8	6.9
Government student loans	0.26	0.2	0.14	1.4
Government scholarships	0.22	0.16	0.12	1.8

Source: Adapted from 1999 SES (NSO 1999).

5.6 Conclusion

The main objectives of this chapter are to estimate the impact of crisis on different dimensions of poverty and examine whether or not crisis-related shocks affect the key determinant of poverty, using interaction terms in the regression models. In other words, the impact of a crisis is expected to vary across different poverty groups and household socio-economic status. Apart from poverty categories, the impact of crisis on household poverty is expected to depend on crisis types. In this study, the crises are classified into three groups: labour market shock, climate shock and joint shock, which combines labour market shock with climate shock. Subsequently, a poverty profile is constructed to illustrate changes in poverty incidence before and after a crisis. Furthermore, the key characteristics of poverty based on three dimensions of poverty are examined. In the first poverty group, households are classified as general poor if they live below the total household poverty line. The total poverty line is calculated by combining the food poverty line with the non-food one. In other words, households are classified as general poor if their per equivalent consumption expenditures are above the total poverty line even though their consumption might be below the food or non-food poverty line. In the second group, households where per equivalent consumption expenditures are less than the per equivalent household food poverty line are considered to be food poor. Lastly, for the third group, households are defined as extremely poor if they live below the food and non-food poverty lines.

The empirical results suggest that all three crisis-related shocks have significant effects on all dimensions of poverty. Labour market shock, which represents job losses and decreased wage rates, is estimated to be positively related to the probability of being poor. However, the size of the coefficient is significantly larger in urban than rural areas for all poverty types. In contrast, climate shock has a significant impact only on the extremely poor and rural food poor. Subsequently, joint shock significantly increases the likelihood of being food poor and extremely poor in both rural and urban areas. However, it has no significant impact on the general poor. The results imply that urban households are more vulnerable to labour market shock than rural households, while climate shock and joint shock tend to be more serious among the food poor and extremely poor, particularly in rural areas.

Furthermore, some interaction terms between crisis-related shocks and household characteristics are estimated to be significant. For instance, labour market shock is

found to significantly reduce returns to education, especially for general poor households. In contrast, climate shock does not significantly lower returns to education, but it reduces the impact of land endowment on poverty. Joint shock is found to significantly lower returns to education as well as the impact of land endowment on poverty in rural areas. In other words, education seems to have a stronger impact on urban than rural poverty, whereas land ownership is more likely to be a crucial factor in reducing rural poverty.

Turning to the poverty profile, the estimated results show that poverty incidence changed between pre-and post-crisis periods. The headcount ratio, poverty gap and poverty severity substantially increased from 1996 to 1999 (NSO 1996, 1999). The results show that crisis increases the poverty gap between rural and urban areas. Subsequently, there are poverty and inequality disparities among regions. Poverty is estimated to be lowest in Bangkok and highest in the Northeast region for all dimensions of poverty. At the community level, poverty incidence is substantially higher in rural than urban areas. In contrast, inequality is found to be higher in urban than rural areas. While Northeast residents have the highest chance of becoming poor, residents in the South suffer most from income inequality. Furthermore, the results clearly show that household demographics, educational attainment and socio-economic class significantly affect poverty in all dimensions. With respect to education level, low-skilled workers who finish secondary schooling suffer more from the adverse impacts of a crisis than high-skilled workers. Workers who have a bachelor's degree have a lower risk of being unemployed during a crisis. Furthermore, agricultural workers were more likely to earn wages below the minimum level than workers in other sectors during the 1997 Asian crisis and the 2008 global financial crisis. Other sectors that were greatly affected by both crises are construction, manufacturing and services.

Regarding the reactions of households during crisis, a large number of the population has to change their consumption pattern, work harder and borrow loans from people outside their households. Many poor households have to migrate for better paying jobs in big cities. In addition, many of them have to rely on themselves by using self-prescription of treatment/medication instead of going to see a doctor. Different poverty groups tend to react differently during a crisis. The general poor households

are more likely to withdraw their savings and sell assets, while other poorer groups tend to find money by pawning possessions or mortgage adjustments. Furthermore, the results show that poor households receive less support from the government than the non-poor. In other words, most government programs during crisis periods do not effectively benefit the poor households, particularly the extremely poor. The government's failure to target the right poor group made it impossible to successfully mitigate the impact of the crisis on poverty between 1997 and 1998. This chapter compares poverty estimates before and after the crisis. It also compares results with the findings of the previous two empirical chapters. The links between each empirical chapter, policy implications, research limitations and suggestions for future research are presented in the concluding chapter.

Chapter 6

Conclusion and Policy Implications

6.1 Introduction

Vulnerability and food security have become important global issues in poverty literature since the World Food Summit in 1996, which aimed to reduce the number of undernourished people in the world by one half by 2015 (FAO 1996). Poverty is closely related to vulnerability, but they are not the same. Early studies have focused on measuring current poverty or a household's current status of being poor. However, recent studies on poverty have focused more on measuring the current risk that a household will fall into poverty at some point in the future. Vulnerability is a flexible concept. It has been differently defined by many researchers in various dimensions, such as vulnerability to poverty, vulnerability to food insecurity, vulnerability to climate change and vulnerability to environmental hazards.

Poverty is a persistent problem in many developing countries including Thailand. Being able to identify the most vulnerable groups and the characteristics correlated with poverty movements would help policy makers understand the key micro-level binding constraints to poverty reduction. As a result, better development strategies can be implemented to protect people who are at risk of poverty. However, studies on vulnerability and the profile of vulnerability are rarely available in many developing countries due to the lack of long panel data. In Thailand, just as in many developing countries, reliable panel data at household level is scarce and only cross-sectional survey data is available. Apart from poverty, food insecurity is also a major concern in less-developed and developing countries where there is insufficient safe and nutritious food to meet individual dietary needs at all times. Poverty is closely related to food insecurity. In other words, poverty is the main cause of food insecurity because poor households are most likely to have lack of access to safe and sufficient food for all household members.

To examine the appropriate method to measure vulnerability and its determinants in Thailand, given there is a lack of panel data, this thesis develops two main frameworks to measure vulnerability related to poverty at household level. First, vulnerability to poverty is measured based on the "Expected Poverty" approach

proposed by Chaudhuri, Jalan and Suryahadi (2002) in which the standard Foster-Greer-Thorbecke (FGT) measures are adopted to estimate household vulnerability to poverty in terms of its expected value of poverty. This method is particularly designed for cross-sectional data, assuming that a household's cross-sectional variability reflects its temporal variability. Sensitivity analysis is conducted using various types of poverty line in order to determine the most appropriate critical vulnerability threshold. The second framework focuses on measuring household vulnerability to food insecurity -the uncertainties associated with future food insecurity. The Expected Poverty approach is applied to measure vulnerability to food insecurity by developing a specific household food security line to represent a critical vulnerability threshold for each household. Furthermore, crisis-related shocks are believed to be one of the major obstacles to effective poverty reduction in many developing countries. Therefore, this thesis also examines the impact of large-scale crisis on household poverty. Crisis-related shocks are classified into three main groups: labour market shock, climate shock and joint shock. Joint shock combines the labour market shock with climate shock to examine the difference between the impact of single and the combined shocks on poverty. These three shocks are the main shocks that frequently occur in most developing countries. Subsequently, different dimensions of poverty are considered in determining the crucial factors affecting poverty. In other words, poverty is categorised into three groups: "general poverty", "food poverty" and "extreme poverty". Households are considered to be "general poor" if their consumption expenditures per equivalent are below their total poverty line per equivalent. The total poverty line combines the food poverty line with the non-food one. "Food poor" households are those who are living below the food poverty line only. Lastly, poor households that are defined as "extremely poor" are those who are living under both the food and non-food poverty lines. In other words, the extremely poor are usually the chronically poor or people who have been poor for a long period of time.

The main contributions of this thesis are as follows: (1) it measures household vulnerability to poverty under the expected poverty approach, which allows the use of cross-sectional data in analysing vulnerability; (2) it is the first study that examines the determinants of vulnerability to poverty in Thailand and constructs the most recent profile of household vulnerability to poverty in Thailand; (3) it is the

first study that measures household vulnerability to food insecurity and constructs the first and most recent profile of vulnerability to food insecurity in Thailand; (4) it is the first study that estimates the distributional impact of various crisis-related shocks on different dimensions of poverty in Thailand; and (5) it provides more intensive empirical research and policy analysis on different dimensions of vulnerability at the household level.

6.2 Major Findings

This thesis provides empirical analyses of the measures and determinants of vulnerability related to poverty at household level and the impact of large-scale crisis on poverty in Thailand. Several findings obtained from this study contribute to the research in the area of poverty studies, which aims to analyse poverty persistence in the least developed and developing countries. The results are particularly useful for analysing poverty in Asian countries where agriculture is the main sector. Most of the results are consistent with the theoretical and empirical evidence in the poverty literature. Therefore, this study suggests the *ex ante* poverty measure from two different perspectives, poverty and food insecurity, for policy makers in Thailand. Vulnerability measures are necessary in Thailand and other countries where poverty incidence remains a major problem and the large number of people at risk of poverty continues to grow, particularly in rural areas. The findings of this thesis are summarised in the following sub-section.

6.2.1 Measurement and Determinants of Vulnerability to Poverty

The first empirical analysis (Chapter 3) on vulnerability to poverty presents a vulnerability to poverty incidence measured at the household level in 1996, 2002 and 2010 based on the expected poverty approach. The 1997 Asian financial crisis and the Global Financial Crisis of 2007-2008 took place during this time period. The expected poverty approach measures vulnerability to poverty in terms of a risk or a probability of falling into poverty at some point in the future. By applying this method, household consumption distribution is estimated according to the assumption that cross-sectional variation reflects inter-temporal variation in the level of consumption. The estimated results show that the observed poverty rate in Thailand has declined over time from 1996 to 2010. However, poverty remains a problem in Thailand as approximately 20 percent of the population is estimated to be

vulnerable today. Half of the total vulnerable households are estimated to be highly vulnerable to poverty -having more than a 50 percent likelihood of falling into poverty.

Furthermore, the percentage of the population who are transient poor is greater than that of the chronically poor. This implies that the number of poor households that move in and out of poverty is greater than the number of those who remain poor over an extended period of time. In other words, even though there has been an impressive fall in the number of the total poor in Thailand, the problem remains in the proportion of households that are currently non-poor but at high risk of falling into poverty in the near future. Interestingly, more rural households are found to move in and out of poverty than urban households during a crisis. In contrast, the rural poor are more likely to remain poor for a few more years than the urban poor after the recovery period. The results imply that rural households are usually more vulnerable to chronic poverty and more sensitive to the adverse impact of a crisis than urban households. The findings are consistent with the poverty literature that geographical factors affect household poverty status and chronic poverty is usually substantially high in rural areas. Subsequently, the results from a sensitivity analysis show that vulnerability estimation depends on the choice of poverty and vulnerability thresholds. The results suggest using the vulnerability line of 0.5 and the household specific poverty line in order to obtain the most accurate estimation of household vulnerability to poverty.

Two separate regressions are carried out for urban and rural areas to examine the structural difference in analysing the determinants of vulnerability to poverty. The results show that household demographics and compositions, educational attainment, main occupation or socio-economic class, land ownership and regional difference have significant impacts on household vulnerability to poverty in both rural and urban areas. Subsequently, the results confirm the structural difference in which the effects of some household characteristics (education, landholding, age of household head, for example) on poverty are larger in rural than in urban areas. This finding is in line with existing studies on rural poverty in which there are differences between rural and urban areas in the nature of economic activities, household demographics, employment, social norms and institutions (See, for example, Suryahadi, Widyanti

and Sumarto 2003; Dao 2004; Dercon 2006; Khan, Azid and Toseef 2012). Rural households that mainly rely on income from agricultural activities are found to have the highest risk of being vulnerable to poverty.

The profile of vulnerability to poverty shows that rural households are more likely to be vulnerable to poverty than urban households. The poorest Thai households living in rural areas are almost three times more vulnerable than those living in urban areas. Subsequently, there are persistent disparities among regions within the country in which vulnerability to poverty is estimated to be highly concentrated in the Northeast region. This finding is in line with the poverty profile conducted by the NESDB (1998) in which the Northeast region accounts for one third of the total population, while housing more than half of the total poor. The findings on examining the effectiveness of government pro-poor programs in targeting the poor and vulnerable households shows that most programs are not capable of efficiently benefiting poor and vulnerable households.

6.2.2 Measurement and Determinants of Vulnerability to Food Insecurity

The second empirical analysis (Chapter 4) on household vulnerability to food insecurity presents the vulnerability to food insecurity incidence in 2010. By adopting the same approach used in the first empirical chapter, the results show that even though Thailand is one of the world leaders in rice exports, many households are still affected by food insecurity. The share of the chronically food insecure is less than the share of the transient food insecure. In other words, households are more likely to be temporarily food insecure than remaining in food insecurity over an extended period of time. The result is similar to poverty incidence estimated at the national level in which the share of the chronic poor is less than the share of the transient poor. While the study of vulnerability to poverty shows that the observed poverty rate is greater than the vulnerability rate, the share of households considered to be vulnerable to food insecurity is greater than the share of those who are currently food insecure. The results indicate that vulnerability becomes a more serious problem when it is associated with food insecurity rather than with poverty.

The proportion of households vulnerable to food insecurity is estimated to be greater than the share of those who are currently insecure in food. Thus, even though the percentage of households that are currently insecure in food is not very high, the

problem rests with households still at high risk of becoming food insecure in the near future. At the community level, households that are highly vulnerable to chronic food insecurity are concentrated in rural areas. In contrast, the number of households vulnerable to frequent food insecurity, as compared with those that are vulnerable to chronic food insecurity, is relatively larger in urban areas. This finding is similar to the vulnerability to poverty estimates in which urban households are more vulnerable to transient poverty, while rural households are more likely to be persistently poor.

Regarding the determinants of vulnerability to food insecurity, the results show that household characteristics that significantly affect vulnerability to poverty also have significant impacts on vulnerability to food insecurity. Surprisingly, however, the gender of a household head variable yields different results. When analysing the determinants of poverty, being headed by a female significantly increases the probability of a household becoming poor in rural areas. However, its effect is insignificant for urban female-headed households. This finding is consistent with the results found in many existing studies on the determinants of poverty. In contrast, when focusing on food, urban female-headed households have a significantly lower probability of becoming food insecure, while the same effect is negative but insignificant for rural female-headed households. The contradictory result emphasises the important role of females in preparing food for family members. The result is in line with the profile of vulnerability to food insecurity in that the food share of total household consumption is greater for female-headed households than for their male-headed counterparts. One possible explanation for the finding that only *urban* female household heads can reduce the risk of being insecure in food is that they usually have better education and knowledge about the nutritional needs of the household than *rural* female household heads. Other significant factors influencing household food security status in both rural and urban areas are the values of home-produced food, profits from farming, access to financial credit, housing and health conditions and regional difference. The remittance variable is found to be significant only in rural areas. In addition, the findings confirm the structural differences in which the positive effects of landholding and other agriculture-related variables are larger in rural than urban areas. This implies that food insecurity can be effectively mitigated by enhancing agricultural conditions and supplies.

The profile of vulnerability to food insecurity shows that the percentage of vulnerable households is slightly higher in rural than urban areas, even though food consumption is relatively higher in rural areas. This is possibly because a large number of households in the rural Northeast are still at high risk of being chronically food insecure. The rural-urban income gap and the difference in the share of consumption expenditure on food between urban and rural areas are substantially large in Thailand. Similar results are found in examining the effectiveness of government programs targeting food insecure households as well as those who are highly vulnerable to food insecurity. The finding shows that most government programs failed to reach the high vulnerable groups because more than 50 percent of the total beneficiaries are low vulnerable households.

6.2.3 Impact of Crisis on Poverty

The impact of financial crisis on poverty in Chapter 5 is estimated using the special 1999 SES data (NSO 1999), which contains extra information on household income losses due to the 1997 Asian crisis. This study applies the methods proposed by Datt and Hoogeveen (2003) and Kakwani (2010), which categorises crisis-related shocks and poverty into groups. The results show that the population suffering from the three main types of shocks (labour market shock, climate shock and joint shock) account for more than 60 percent of the overall Thai population. The probit estimates show that household characteristics and crisis-related shocks significantly affect household poverty. The marginal effects of all three shocks are significantly positive. This indicates that crisis shock significantly increases the probability of being poor in all three poverty categories: general poverty, food poverty and extreme poverty. The effect of joint shock relative to labour market shock alone is estimated to be lower. The results are similar to what Datt and Hoogeveen (2003) found in their study for the case of the Philippines. The effect of joint shock is usually expected to be greater than that of a single type of shock. However, the authors argue that this contradictory result is consistent if a large number of households suffer greatly from the labour market shock, while others are moderately or slightly affected by both types of shocks.

The marginal effects of climate shock and joint shock are larger in rural than urban areas. In addition, the impact of crisis shocks seems to vary across poverty groups.

The results show that the impact of labour market shock is significantly larger on the general poor group in urban areas than other groups. Climate shock has the largest impact on the rural food poor, while the effect of joint shock is more severe in the extremely poor group. The results imply that rural households are more sensitive to food poverty than urban households. In addition, rural households are more likely to suffer from shocks related to agricultural activities while urban households are mostly affected by a shock that mainly influences the non-agricultural sector.

Crisis shocks are found to have a strong influence on education for some poverty groups. Labour market crisis significantly reduces the impact of education on reducing general poverty and extreme poverty, particularly in urban areas. Climate shock does not significantly reduce returns to education for all poverty groups, while joint shock only reduces the returns to education at the level below upper secondary schooling. This is possibly because weather-related shock is only slightly related to the returns to education. Regarding the effect of crisis on household socio-economic classes, the results show that labour market crisis significantly reduces the effect of high-skilled occupations on mitigating general poverty in urban areas. Climate shock significantly lowers the impact of land endowment on poverty, especially for the rural food poor. Because land is the main factor in food production, this finding is in line with the fact that weather-related shocks are closely associated with land and food poverty. Farmers who are tenant cultivators are more likely to earn less farm profits. They are a lot worse during weather-related crises than farmers who cultivate their own land.

Furthermore, the poverty profile shows that crisis has a strong influence on all dimensions of poverty. Poverty has remained lowest in Bangkok and highest in the Northeast region for all three poverty categories. The percentage change in poverty between the pre-and post-crisis periods is largest among households that are extremely poor, followed by the food poor and general poor respectively. The findings imply that a crisis raises poverty in the poorest group more than other groups. The difference in poverty between rural and urban areas has become much larger in the post crisis period. This indicates that the crisis has widened the poverty gap between rural and urban areas. The percentage of workers whose earnings are below the minimum wage is estimated to have been largest in the agricultural sector

during the 1997 Asian crisis and the 2008 global financial crisis. These findings confirm that workers in agriculture are persistently poor. Other sectors greatly affected by both crises are construction, manufacturing and services.

Finally, the majority of households, approximately 84 percent of the total population of Thailand, apparently changed their consumption patterns during the 1997 Asian crisis (NSO 1999). Poor households did not receive sufficient support from the government and most pro-poor programs inadequately targeted the poor groups. As a consequence, most poor households had to rely more on themselves during the crisis, such as withdrawing their savings and working harder to earn more income, in order to survive. The poor not only have to reduce their food consumption in a crisis but also have lower health quality. They had to use self-prescription and change from private to public hospital when family members become sick during the 1997 Asian crisis.

6.3 Policy Implications

The empirical findings offer several potential policies to mitigate household poverty and the impact of crisis on poverty. Firstly, the study on vulnerability to poverty finds that many households are still highly vulnerable to poverty even though the observed poverty rate has gradually declined over a decade. Therefore, policy makers and the Thai government should not only implement policies that aim to reduce current poverty but also help protect those who are highly vulnerable to poverty. In other words, households that are not currently poor, but still face a high risk of becoming poor, should be eligible for the government pro-poor programs as well.

To determine who faces a high risk of poverty, apart from measuring current poverty incidence, the government should keep accurate records of vulnerability to poverty estimates. In addition, the categorisation of vulnerability to poverty into different subgroups would help policy implementation become more efficient. For instance, distinguishing between vulnerability to chronic poverty and vulnerability to transient poverty is helpful in implementing different treatments of poverty reduction. This finding shows that agriculture is the main source of income in rural areas and rural households face a higher risk of becoming chronically poor than urban households. In addition, the vulnerability profile shows that rural farmers face the highest risk of

becoming poor. Therefore, any government program that supports the rural poor should aim to develop agricultural productivity and farm techniques in the long term. For example, the micro credit program, land reform, irrigation and soil development should be offered as a priority to rural chronic poor households. On the other hand, farmer education is a crucial factor in raising farm productivity and profits even without new farm technology. Therefore, poor farmers with education less than upper secondary schooling should be given technical assistance and training opportunities. Focusing on the urban poor, emergency loans and long-term government funds, such as mortgage lending and loans for Small and Medium Enterprises (SMEs), should be offered as a priority to both transient poor and high vulnerable non-poor households.

Secondly, the study on vulnerability to food insecurity finds that the percentage of households that are highly vulnerable to food insecurity is greater than the percentage of those that are currently food insecure. This indicates that policy makers should not focus only a single dimension of vulnerability. In other words, vulnerability in Thailand should be defined and measured in relation to both poverty and food insecurity. As a result, households that are currently food secure, but still face a high risk of becoming insecure in food should be eligible for government pro-poor programs as well. In addition, by distinguishing chronic food insecurity from transient food insecurity, policy makers can implement different strategies to alleviate food insecurity between rural and urban areas.

Subsequently, the finding shows that the share of the observed chronically food insecure households is less than the share of those who are currently transient food insecure. On the other hand, the share of households highly vulnerable to chronic food insecurity is estimated to be larger than the share of those that are highly vulnerable to transient food insecurity. The results suggest that the government should give higher priority to those who are currently transient food insecure and vulnerable to chronic food insecurity. Urban households are more likely to be transient food insecure, while rural households are at risk of chronic food insecurity. Land is the main source of food production. Since vulnerability is estimated to be highest for landless farm workers, rural areas should have more priority in policy directed at the allocation and redistribution of rights in farmland. In urban areas,

construction and manufacturing workers have a very high risk of becoming insecure in food. As a consequence, urban areas should have more priority in any improvement of labour welfare benefits, such as food stamps, supplemental nutrition assistance, food safety and sanitation. Furthermore, safe water supply, housing condition and health status are found to significantly reduce vulnerability to food insecurity in both rural and urban areas. Therefore, the government should promote policies that lead to infrastructure sustainability, such as an increase in access to clean drinking water, safe water pipes and free vaccinations.

Thirdly, findings from the last empirical chapter show that the effect of a single shock is larger than a joint shock. Labour market shock has a larger effect on poverty in urban than rural areas. In contrast, the marginal effects of climate and joint shocks are estimated to be slightly greater in rural than urban areas. This implies that the economic priority of the government for urban areas should be to improve the labour market by helping workers who suffer from wage cuts and job losses, particularly for extremely poor workers. Potential policies in reducing unemployment must be directed at unemployment insurance, government job centres, training and retraining schemes and financial support for jobseekers migrating to areas where living costs are high. In rural areas, climate disasters severely affect the food poor and extremely poor and push them into deeper poverty. The priority of the government is to implement policies that reduce the risk of weather-related crisis. Early warning and government investment in comprehensive natural disaster management can minimise losses. Furthermore, the government should conduct a study to identify areas and communities that are highly vulnerable to climate shocks for more effective evacuation and adaptation.

Subsequently, the findings show that households choose to rely on themselves, such as by changing their eating patterns, working harder and withdrawing savings, rather than getting support from the government during a crisis. This is because government programs do not effectively target the poor. A large number of non-poor or nearly poor households are supported, but only a few poor households are eligible for the programs. To effectively mitigate the impact of large-scale crisis on poverty, policy makers and the government should clearly identify vulnerable groups before they transfer welfare to the needy.

6.4 Limitations and Focus for Future Research

The empirical results obtained from this study provide some useful insights for research on measurements and determinants of vulnerability related to poverty. The findings are beneficial for the poor if policy makers and the government ensure an appropriate method of identifying the poor and vulnerable groups before implementing any pro-poor policy in Thailand. While this study could be applied in many instances, it contains some noteworthy limitations and suggestions for further research, which should be considered in interpreting the results. One of the main limitations in this study is the lack of data. As previously discussed in the literature review section in Chapter 3, existing studies usually measure vulnerability to poverty based on three main approaches: the expected poverty approach, the expected low utility approach and the uninsured exposure to risk approach. Measuring and comparing the estimated vulnerability based on these three different approaches could help in identifying the most accurate method of vulnerability to poverty. However, only the expected poverty approach can be applied in this study because other approaches require large panel data, which is not available in Thailand and is also rarely available in other developing countries. Furthermore, the measure of vulnerability to food insecurity was only measured using a single year of data in 2010, which was the period after the global food crisis took place in 2008. It would be better to estimate vulnerability to food insecurity before and after the crisis (for the years 2006 and 2009) and examine the annual percentage change in household vulnerability to food insecurity. Unfortunately, this thesis only has access to four years household data (1996, 2002, 2010 and 2011). Household data for each year is collect from more than 20,000 households and this study needs to convert total food consumption of each household to per equivalent calorie intakes because vulnerability is measured at the household level. Processing huge raw data files with more than 100,000 observations to form three main empirical analyses is excessively time-consuming for a thesis done by one person in a limited time of study. As a result, this thesis only focuses on creating the most recent profile of household vulnerability to food insecurity.

Another limitation in this study is the limited choices of equivalence scales used in the sensitivity analysis. Only the most commonly used methods in calculating the equivalence scales are applied in this study to examine the most accurate estimation

of household vulnerability. This study uses the same choice of equivalence scales in testing the sensitivity of estimated vulnerability in Chapters 3 and 4. However, the equivalence scales created when the definition of household needs is confined to food baskets alone may differ from the equivalence scales that are estimated when household necessities also include non-food items, such as clothing and shelter. There are various Engel estimation methods of equivalence scales proposed in many existing empirical studies, constructed around the income needs of different household sizes and consumption patterns in a particular country. As a result, further study should construct a country's specific scales, taking into account a basket of necessities defined in that particular country.

Finally, there is a limitation in the explanatory variables used in analysing the determinants of vulnerability to poverty and food insecurity. The SES data contains a lot of household information, which can be used as the key characteristics of the poor. However, some community characteristics that are estimated to significantly influence poverty in some empirical studies cannot be included in this study because they are not recorded in the survey; for example, membership of co-operatives or NGOs and the average travel time or distance to the nearest market, health centre, bank, church, library or bus stop. Access to services and utilities is considered to be a crucial factor for the persistently poor in escaping poverty. With this information at the household level, the infrastructure index and social capital index can be constructed in the estimated models.

Even though this study contains some limitations that cannot be easily resolved, this thesis provides important and insightful contributions to the empirical literature on poverty and food security at the household level, particularly for the Thai government. Most previous studies focus on measuring the current state of poverty to analyse poverty in a particular country. However, unlike other studies, this study focuses on measuring both the current state of household poverty and its vulnerability. Furthermore, vulnerability to food insecurity is estimated in this study to illustrate the close relationship between poverty and food insecurity. By categorising poverty and food insecurity into chronic and transient groups, the empirical findings in this study offer valuable policy suggestions for the Thai government and policy makers to effectively target a particular group of the poor.

APPENDICES

APPENDIX to Chapter 3

Appendix 3.1: Definition and Statistic Description of Independent Variables in 1996

Variable Labels	Descriptions	1996	
		Mean	SD
Log_exp	Log of per capita household consumption expenditure.	7.840	.583
Size	Household size.	3.821	1.822
Size_sq	Size-square of household.	18.253	17.161
Age	Age of household head (yrs.).	47.230	15.234
Age_sq	Age-square of household head.	2232.65	1216.34
D_female	Gender of household head (1= female).	.421	.225
Elderly	Number of elderly in a household.	2.611	1.742
Dependency	Ratio of dependents \leq 15 years old to the total number of household members.	.452	.321
D_primary	If a household head's highest education is primary schooling (1 = yes, 0 otherwise).	.744	.512
D_secondary	If a household head's highest education is secondary schooling (1 = yes, 0 otherwise).	.127	.276
D_highschool	If a household head's highest education is high school (1 = yes, 0 otherwise).	.110	.292
D_university	If a household head's highest education is university (1 = yes, 0 otherwise).	.082	.145
Assets	Total household's fixed asset value (million baht).	.014	.278
Land	Total cultivated landholding of household.	2.551	1.541
D_land5_10rai	If socio-economic class is a farm operator, mainly own land less 5 to 19 Rai (1 = yes, 0 otherwise).	.026	.193
D_land11_29rai	If socio-economic class is a farm operator, mainly own land 20 to 39 Rai (1 = yes, 0 otherwise).	.098	.284
D_land30more	If socio-economic class is a farm operator, mainly own land 40 Rai or more (1 = yes, 0 otherwise).	.014	.102
D_tenant	If socio-economic class is farm operator, mainly rent land (1 = yes, 0 otherwise).	.044	.193
D_landless	If socio-economic class is landless farm workers or labourers (1 = yes, 0 otherwise).	.083	.324
D_professional	If socio-economic class is professional, technical and managerial (1 = yes, 0 otherwise).	.151	.324
D_entrepreneur	If socio-economic class is an entrepreneur (1 = yes, 0 otherwise).	.091	.172
D_bangkok	If a household lives in Bangkok (1 = yes, 0 otherwise).	.076	.154
D_central	If a household lives in Central (1 = yes, 0 otherwise).	.261	.431
D_north	If a household lives in North (1 = yes, 0 otherwise).	.222	.367
D_northeast	If a household lives in Northeast (1 = yes, 0 otherwise).	.279	.424

Appendix 3.2: Definition and Statistic Description of Independent Variables in 2002

Variable Labels	Descriptions	2002	
		Mean	SD
Log_exp	Log of per capita household consumption expenditure	8.542	.454
Size	Household size	3.413	1.670
Size_sq	Size-square of household	17.136	16.424
Age	Age of household head (yrs.)	48.941	14.923
Age_sq	Age-square of household head	2597.12	1475.21
D_female	Gender of household head (1= female)	.300	.214
Elderly	Number of elderly in a household	2.330	1.501
Dependency	Ratio of dependents ≤ 15 years old to the total number of household members.	.428	.236
D_primary	If a household head's highest education is primary schooling (1 = yes, 0 otherwise).	.628	.495
D_secondary	If a household head's highest education is secondary schooling (1 = yes, 0 otherwise).	.140	.282
D_highschool	If a household head's highest education is high school (1 = yes, 0 otherwise).	.093	.125
D_university	If a household head's highest education is university (1 = yes, 0 otherwise).	.090	.173
Assets	Total household's fixed asset value (million baht)	.026	.325
Land	Total cultivated landholding of household	2.272	1.228
D_land5_10rai	If socio-economic class is a farm operator, mainly own land less 5 to 19 Rai (1 = yes, 0 otherwise).	.025	.167
D_land11_29rai	If socio-economic class is a farm operator, mainly own land 20 to 39 Rai (1 = yes, 0 otherwise).	.065	.159
D_land30more	If socio-economic class is a farm operator, mainly own land 40 Rai or more (1 = yes, 0 otherwise).	.017	.134
D_tenant	If socio-economic class is farm operator, mainly rent land (1 = yes, 0 otherwise).	.035	.162
D_landless	If socio-economic class is landless farm workers or labourers (1 = yes, 0 otherwise).	.054	.137
D_professional	If socio-economic class is professional, technical & managerial (1 = yes, 0 otherwise).	.140	.262
D_entrepreneur	If socio-economic class is an entrepreneur (1 = yes, 0 otherwise).	.087	.195
D_bangkok	If a household lives in Bangkok (1 = yes, 0 otherwise).	.055	.112
D_central	If a household lives in Central (1 = yes, 0 otherwise).	.298	.502
D_north	If a household lives in North (1 = yes, 0 otherwise).	.229	.378
D_northeast	If a household lives in Northeast (1 = yes, 0 otherwise).	.260	.365

Appendix 3.3: Definition and Statistic Description of Independent Variables in 2010

Variable Labels	Descriptions	2010	
		Mean	SD
Log_exp	Log of per capita household consumption expenditure	8.736	.421
Size	Household size	3.265	1.451
Size_sq	Size-square of household	16.312	15.783
Age	Age of household head (yrs.)	48.750	14.802
Age_sq	Age-square of household head	2465.42	1363.68
D_female	Gender of household head (1= female)	.312	.258
Elderly	Number of elderly in a household	2.157	1.415
Dependency	Ratio of dependents ≤ 15 years old to the total number of household members.	.345	.238
D_primary	If a household head's highest education is primary schooling (1 = yes, 0 otherwise).	.537	.412
D_secondary	If a household head's highest education is secondary schooling (1 = yes, 0 otherwise).	.085	.192
D_highschool	If a household head's highest education is high school (1 = yes, 0 otherwise).	.084	.232
D_university	If a household head's highest education is university (1 = yes, 0 otherwise).	.073	.116
Assets	Total household's fixed asset value (million baht)	.038	.372
Land	Total cultivated landholding of household	2.152	1.031
D_land5_10rai	If socio-economic class is a farm operator, mainly own land less 5 to 19 Rai (1 = yes, 0 otherwise).	.021	.148
D_land11_29rai	If socio-economic class is a farm operator, mainly own land 20 to 39 Rai (1 = yes, 0 otherwise).	.059	.142
D_land30more	If socio-economic class is a farm operator, mainly own land 40 Rai or more (1 = yes, 0 otherwise).	.019	.168
D_tenant	If socio-economic class is farm operator, mainly rent land (1 = yes, 0 otherwise).	.040	.194
D_landless	If socio-economic class is landless farm workers or labourers (1 = yes, 0 otherwise).	.050	.128
D_professional	If socio-economic class is professional, technical & managerial (1 = yes, 0 otherwise).	.115	.189
D_entrepreneur	If socio-economic class is an entrepreneur (1 = yes, 0 otherwise).	.117	.318
D_bangkok	If a household lives in Bangkok (1 = yes, 0 otherwise).	.060	.175
D_central	If a household lives in Central (1 = yes, 0 otherwise).	.253	.457
D_north	If a household lives in North (1 = yes, 0 otherwise).	.260	.448
D_northeast	If a household lives in Northeast (1 = yes, 0 otherwise).	.283	.489

APPENDIX to Chapter 4

Appendix 4.1: Recommended Daily Energy Allowances for Healthy Thai People

Span of Age	Age	Weight (Kg)	Height (cm.)	Energy (Kcal)
	(Months)			
Infants	Less than 3	4	55	Breast feeding
	3-5	6	59	600
	6-8	7	67	650
	9-11	8	70	800
	(Years)			
Children	1-3	12	84	1200
	4-6	16	106	1456
	7-9	22	121	1600
Boys	10-12	29	135	1850
	13-15	42	154	2300
	16-19	54	166	2400
Girls	10-12	31	138	1700
	13-15	44	152	2000
	16-19	48	155	1850
Men	20-29	58	166	2800
	30-39	58	166	2750
	40-49	58	166	2750
	50-59	58	166	2750
	60+	58	166	2250
Women	20-29	50	155	2000
	30-39	50	155	2000
	40-49	50	155	2000
	50-59	50	155	2000
	60+	50	155	1850
Pregnant				+300
Lactating 0-5 months postpartum				+500
Lactating 6+ months postpartum				+500

Source: Nutrition Division, Ministry of Public Health. Thailand (1989).

Appendix 4.2: Simplified Chart of Average Heights by Age and Gender for Thai People

Age		Male (cm.)	Female (cm.)	Age		Male (cm.)	Female (cm.)
years	months			years	months		
	1	53.0	52.5	5	0	108.3	107.6
	2	55.8	55.2	6	0	114.4	113.9
	3	58.6	57.7	7	0	124.9	119.8
	4	61.1	60.1	8	0	125.2	124.8
	5	63.4	62.3	9	0	130.3	130.1
	6	65.5	64.4	10	0	135.0	136.2
	7	67.4	66.2	11	0	139.5	143.0
	8	69.1	67.9	12	0	145.6	148.8
	9	70.7	69.5	13	0	153.2	152.7
	10	72.2	70.9	14	0	160.5	154.7
	11	73.5	72.2	15	0	164.7	156.0
1	0	74.8	73.4	16	0	167.5	156.6
2	0	87.0	84.7	17	0	169.2	156.9
3	0	95.0	94.1	18	0	169.4	157.0
4	0	102.0	101.1	19+	0	169.6	157.0

Source: Nutrition Division, Ministry of Public Health. Thailand (2000).

Appendix 4.3: Energy per kilogram of Body Weight for Different Age and Gender

Age		Daily energy per kilogram (kcal)	
years	months	Boys	Girls
	0-1	113	107
	1-2	104	101
	2-3	95	94
	3-4	82	84
	4-5	81	83
	5-6	81	82
	6-7	79	78
	7-8	79	78
	8-9	79	78
	9-10	80	79
	10-11	80	79
	11-12	81	79
1-2	0	82.4	80.1
2-3	0	83.6	80.6
3-4	0	79.7	76.5
4-5	0	76.8	73.9
5-6	0	74.5	71.5
6-7	0	72.5	69.3
7-8	0	70.5	66.7
8-9	0	68.5	63.8
9-10	0	66.6	60.8
10-11	0	64.6	57.8
11-12	0	62.4	54.8

12-13	0	60.2	52.0
13-14	0	57.9	49.3
14-15	0	55.6	47.0
15-16	0	53.4	45.3
16-17	0	51.6	44.4
17-18	0	50.3	44.1

Source: Human energy requirements (2004).

Appendix 4.4: Equations for estimating Basal Metabolic Rate (BMR)

Age (years)	Male		Female	
	BMR: kcal/day	S.E. *	BMR: kcal/day	S.E. *
< 3	59.512kg – 30.4	70	58.317kg – 31.1	59
3-10	22.706kg + 504.3	67	20.315kg + 485.9	70
10-18	17.686kg + 658.2	105	13.384kg + 692.6	111
18-30	15.057kg + 692.2	153	14.818kg + 486.6	119
30-60	11.472kg + 873.1	167	8.126kg + 845.6	111
≥ 60	11.711kg + 587.7	164	9.082kg + 658.5	108

* S.E. = standard error of estimation

Source: Schofield (1985).

Appendix 4.5: Classification of Physical Activity Levels (PAL)

Category	Economic activity/ Occupational work	PAL Values
Very light	Unemployed; retired; musician; arts & culture; writer; student	1.40 - 1.59
Lightly active	Tailor; hairdresser; transportation; wholesale & retail; caring for children	1.60 - 1.79
Moderately active	Cleaning; electrical; restaurants & hotels	1.80 - 1.99
Quite active	Gardening; carpentry; painting; fishery	2.00 - 2.19
Very active	Athlete; manufacturing; transportation	2.20 - 2.29
Extremely active	Construction; mining; agriculture; arm forces	2.30 – 2.40

Source: Human energy requirements (FAO 2004).

Appendix 4.6: Commodity Group of Food and Beverage Expenditures

No.	Commodity Group of Food and Beverages
1	Rice, flour and cereal products
2	Meats and poultry
3	Fish and aquatic animals
4	Eggs and dairy products
5	Oil and fat
6	Fruits and nuts
7	Vegetables
8	Sugar and sweets
9	Seasonings and condiments
10	Non-alcoholic beverages (Prepared & consumed at home)
11	Prepared-food consumed at home
12	Food and non-alcoholic beverages away from home

Source: National Statistical Office (2010, 2011). REC 12: SUB 01.

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