Impact of EU-ASEAN Trade Liberalisation on Food Security in ASEAN

By

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Doctor of Philosophy (PhD) in Economics

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Abstract

Impact of EU-ASEAN trade liberalisation on food security in ASEAN

Chayoot Wana

This thesis aims at estimating empirically the impact of EU-ASEAN trade liberalisation on food security in ASEAN with a specific focus on people who live below the international poverty line. The contributions obtained from this study are that this study investigates the projected food security situation in ASEAN countries after the EU-ASEAN trade liberalisation is implemented, taking the effects of non-tariff barrier elimination into account in order to compare the effects between the elimination of TBs only and the elimination of both TBs and NTBs for each ASEAN country. In addition, the combination of the GTAP model and the Food Security Assessment model is first introduced in this study.

The results from the GTAP model indicate that the EU-ASEAN trade liberalisation can create production expansion for net food exporting countries such as Thailand and Vietnam while net food importing countries such as Malaysia and the Philippines are estimated to encounter contraction in food production and to depend on more imports. In addition, the elimination of both TBs and NTBs is expected to result in more positive effects than that of TBs elimination only; however, after both TBs and NTBs are eliminated, the Philippines is projected to experience negative effects due to a large decrease in rice imports.

Another important issue is the low nutritional energy level obtained from food consumption by ASEAN people who live below the poverty line. This potential threat to food security generally occurring in the lower-income countries results from income inequality. In the Philippines and the group of other ASEAN countries including Brunei, Cambodia, Laos PDR and Myanmar, poverty rates are at the highest level, accounting for 26.5 and 26 percent respectively. These results translate into low purchasing power for lower income households. As a result, nutritional energy has been consumed by those people at a level below the minimum dietary energy requirement (MDER). Even though the free trade agreement is expected to increase their food consumption, the nutritional energy consumption level just rises over the MDER and it is still far from reaching the average dietary energy requirement (ADER). In other word, the consumption gap between people with good livelihoods and those in poverty is still wide.
Declaration

This is to declare that the work as presented in this thesis is my own work and neither copied nor plagiarised from other sources. All material sourced from other literature is referenced accordingly. I hereby declare that I have not submitted this material either in whole or in part for a degree at this or any other institution.

Chayoot Wana

3rd November 2014
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First and foremost I wish to express my deep thanks to Professor Bernadette Andreosso O’Callaghan, my excellent supervisor who devoted her time and patience to my thesis throughout years of study. Her advice, encouragement and supports are really valuable and unforgettable to me.

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Chayoot Wana

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<td>ADB</td>
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<td>ADER</td>
<td>Average dietary energy requirement</td>
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<td>AGE</td>
<td>Applied General Equilibrium</td>
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<td>ASEAN</td>
<td>Association of South East Asian Nations</td>
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<td>AusAID</td>
<td>Australian Agency for International Development</td>
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<td>AVEs</td>
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<td>BULOG</td>
<td>Badan Urusan Logistik (The Bureau of Logistics)</td>
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<td>CAP</td>
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<td>CDE</td>
<td>Constant Difference of Elasticity</td>
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<td>CES</td>
<td>Constant elasticity of substitution</td>
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<td>cif</td>
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<td>DAFNE</td>
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<td>EFTA</td>
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<td>ELES</td>
<td>Extended linear expenditure system</td>
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<td>GDP</td>
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<td>GEMPACK</td>
<td>General Equilibrium Modelling Package</td>
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<td>GMS</td>
<td>Greater Mekong Sub-region</td>
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<td>Acronym</td>
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<td>kcal</td>
<td>kilocalorie</td>
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<td>LIFDC</td>
<td>Low Income Food Deficit Countries</td>
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<td>MDER</td>
<td>Minimum dietary energy requirement</td>
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<td>MTAX</td>
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<td>Malaysia</td>
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<td>NAP</td>
<td>National Agricultural Policy</td>
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<td>NFA</td>
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<td>NTBs</td>
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<td>NTS</td>
<td>Non-Traditional Security</td>
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<tr>
<td>OLS</td>
<td>Ordinary least square</td>
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<td>PDD</td>
<td>Primary Production Department</td>
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<td>PhilFSIS</td>
<td>Philippine Food Security Information System</td>
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<td>Private household expenditures</td>
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<tr>
<td>TCP</td>
<td>Technical Cooperation Programme</td>
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<td>United Nations Development Program</td>
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<td>USDA</td>
<td>United States Department of Agriculture</td>
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<td>VDFA</td>
<td>Value of Domestic Firm purchases at Agent’s prices</td>
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Chapter 1 Introduction

1.1 Background

Although energy prices have been trending upwards continuously for many years, the world is now facing a new problem that may be more severe. The problem is a substantial long-term rise in food prices and this may lead to food shortages. Food security has therefore become important again at both the national and international levels.

International food prices have increased significantly since 2000, especially wheat prices which have risen by over 200 percent (FAO, 2013) due to a decrease of food production in some regions. The continuous and volatile increase in oil prices for consecutive years has impacted on both production and transport of agricultural products. Oil price changes stimulate planning on alternative energy sources resulting in reduced food crop areas and their replacement with more energy plants to support this policy; meanwhile, higher energy prices also affect agricultural and industrial production costs. Changes in climate called “global warming”, furthermore, also affect various agricultural products. Despite developments in agricultural technology, agriculture still mainly depends on natural conditions. Other factors such as global population growth and strong economic growth in some developing countries, particularly China and India whose combined population amounts to nearly half of the world population (United State Census Bureau, 2013); these factors result in higher consumer food demands that also raise world food prices.

According to FAO statistics (FAO, 2013), FAO annual food price indices consisting of cereal, meat, dairy, oils and sugar have increased dramatically over the 2000-12 period. The index stood at 90 in 2000 and rose to over 200 in 2012. While the price indices of cereal, meat, dairy and oils have increased in a similar pattern, the sugar price index has soared since 2007, reaching a peak of over 350 in 2011.
Among many factors affecting food security, a dramatic rise in international trading in agricultural commodities (UNDP, 2009) is another major factor, especially through Free Trade Agreements (FTAs). Originating from the theory of comparative advantage, FTAs have become increasingly an option for many regions nowadays. For the Association of South East Asian Nations (ASEAN), its members are looking forward to the conclusion of an EU-ASEAN free trade agreement (EU-ASEAN FTA), although the negotiations have been delayed due to problems in some countries.

The EU and ASEAN have had a close relationship in terms of economic affairs, trade and investment for a long time. In 2011, ASEAN exports to the EU were over 95.2 billion euro and imports more than 69.0 billion euro (Eurostat, 2012); therefore, the EU has become the second largest export market and the third largest trading partner of ASEAN (11.2 percent of total international trade). Additionally, the EU has also been an important source of funds for investing in ASEAN with 22 percent of total foreign direct investment in ASEAN (ASEAN Secretariat, 2010). The main exports from ASEAN to the EU are machinery and transport equipment, as well as chemicals, textiles and clothing. The ASEAN main imports from the EU are chemical products, machinery and also transport equipment. Both regions expect to benefit from the EU-ASEAN free trade agreement, especially ASEAN which is a poorer region.

Even though the economic theory of international trade states that if trade tariffs are reduced, welfare in each country will be improved and the economy will be more efficient because each country produces according to its own expertise, the real-world does not perfectly follow international trade assumptions. Trade liberalisation policies can affect economic systems positively, but side-effects in both the short and long term such as increasing trade deficits, loss of certain products and risks of food insecurity in the long run are generally overlooked by government. Liberalisation which emphasises the interests of competitive industrial and service sectors and which ignores its impact on the agricultural sector in spite of its core role in the economy is particularly worrisome. Therefore, trade liberalisation may not work as well as predicted by the standard theory.
The main research question is; what impact on the food security situation in ASEAN, such as food production, food prices and nutritional calorie intake probably will occur in the ASEAN countries after the EU-ASEAN free trade agreement is implemented. The results are expected to predict the direction and size of the impact of the FTA and to propose a set of recommendations so as to manage and avoid food insecurity.

1.2 Objective

The main objective of this research is to estimate empirically the impact of EU-ASEAN trade liberalisation on food security in ASEAN. This main objective can be further categorised into the following specific purposes:

1. To study and analyse the importance, specific features and current trends, as well as indicators, of food security.

2. To estimate the \textit{ad valorem} tariff equivalent of non-tariff barriers between the EU and ASEAN countries.

3. To assess the effects of a free trade area that aims to reduce trade barriers between the EU and ASEAN, on food security in ASEAN.

1.3 Justification of choice of the objectives

The objectives are selected to justify the empirical literature in academic and business point of view as follow:

1. Objective 1 is selected in order to present the characteristics of food security in ASEAN.

2. Objective 2 is selected in order to understand the importance and magnitude of non-tariff barriers between the EU and ASEAN countries.
3. Objective 3 is selected in order to provide policy recommendations and guidelines so as to avoid or minimise the negative effects stemming from food insecurity in the ASEAN region.

1.4 Research methodology

The impact of the EU-ASEAN trade liberalisation on food security in ASEAN countries will be analysed based on both general equilibrium and partial equilibrium approaches.

There are three main tasks to complete in this study.

First, the effects of non-tariff barrier (NTBs) elimination are also taken into account to compare with those of tariff only elimination and the ad valorem tariff equivalents of NTBs are estimated by employing a partial equilibrium model, namely Gravity equations.

Second, the tariff and non-tariff elimination is applied as a shock into a general equilibrium model; the model relies on the multi-country and multi-sectoral Computable General Equilibrium (CGE) model, namely the Global Trade Analysis Project (GTAP) model.

Third, results obtained from the GTAP model are adopted to use in the Food Security Assessment Model to investigate the estimated impact on the food security situation in the ASEAN countries.

1.5 Research structure

This research comprises six chapters. Chapter one describes the nature of the food security problem, and provides an outline of the research. Crucial issues relating to food security such as the definition of food security, the current global food situation as well as the theories of trade liberalisation are reviewed in the literature review in Chapter two. Chapter three presents the methodology used in the research. Results derived from the research methodology are shown and interpreted
in Chapter four in relation to their general impact on ASEAN countries, and in Chapter five for their particular effects on food security in each ASEAN country. Chapter six presents the research conclusions and provides some policy recommendations as well as guidelines on managing the impact of food insecurity.

1.6 Previous studies limitations and implications for the PhD research

Most previous studies aimed to evaluate the impact of free trade on the agricultural sector in broad economic terms such as the impact on imports, exports and production. On the other hand, there are few studies reviewed assessing the impact of an FTA on rural livelihoods and poverty. However, the issue of food security is not addressed directly in any previous study despite being one of the most vital problems currently occurring in many countries, particularly in developing countries.

A variety of research methodologies for assessing the impact of trade liberalisation on agriculture have been applied to previous studies. The most popular method for the study of the impact on food security is a field survey using questionnaires. However, the field survey is appropriate only for ex-post evaluation. Since this thesis aims to study the ex-ante impact, the field survey may be inappropriate. Furthermore, even though other methodologies for analysing trade liberalisation impact like cross-sectional regressions can describe the impact of tariff reduction on food security; their results are probably unclear in relation to some questions, such as the gainers and losers from the impact.

As GTAP is a type of CGE model, it accounts for economic changes in all sectors. Agricultural trade liberalisation not only affects the agricultural sector directly such as changes in production and prices, but also has some impact on other sectors including households in an indirect way that reflects on their livelihoods and food security (Plummer et al, 2010). Moreover, the GTAP model is relatively accessible compared to other CGE models. In addition, the GTAP database associated with the model is peer-reviewed and fully documented with high quality and internal consistency (Hertel, 2009).
Additionally, for the ex-ante impact assessment, most of the reviewed articles and studies mentioned in 2.5 employed the GTAP model to evaluate the effects from trade policies. However, most of the studies are interested in assessing the impact of tariff barrier only reduction, in other words, there are very few studies applying the effects of NTBs elimination into the assessment.

Therefore, the aim of the thesis is to study the impact of trade liberalisation on food security using the GTAP model with the impact assessment of both TBs and NTBs. In addition, results obtained from the GTAP model will be used to evaluate food security using food security indicators and the food security assessment model.
Chapter 2 Literature review

This chapter compiles the literature review relating to the definition of food security, food security indicators, and the current food security situation in ASEAN countries individually and in Europe overall. In addition, studies on the impact of agricultural trade liberalisation are also reviewed in this chapter. It starts with definitional issues.

2.1 Official definitions of food security

A definition of “Food security” was first provided in the 1974 World Food Summit. The catalyst for the provision of the definition came from the increasing awareness of the existence of problems associated with food insecurity at that time. The definition is as follows:

“Food security means 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” (United Nation, 1975: 6)

In 1983, the Food and Agriculture Organisation of the United Nations (FAO) expanded the concept to include “Food access” in the concept itself. In 1986, the main issue dealt with in the World Bank report entitled “Poverty and Hunger” is food insecurity, and the report shows the difference between the state of food insecurity associated with chronic problems of poverty and low income and temporary food insecurity which involves periods of food insecurity caused by natural disasters, economic failure or conflict. The concept of food security in terms of food access is defined as follows:

“ensuring that all people at all times have both physical and economic access to enough food for an active, healthy life” (FAO, 1983)

During the mid-1990s, food security was recognised as a major concern which extends from the individual to the global level. Nevertheless, in the original 1983 FAO definition, “access” is an indicator used to see problem conditions as only
The definition was again considered to extend it to include food safety issues and also nutritional balance, which could reflect concerns about food ingredients and “minor” nutrient needs. However, this issue was too complex and did not meet the objective of the FAO.

The United Nations Development Program (UNDP) Human Development Report in 1994 presented the point of human security, including some perspectives on food security. This concept correlates well with human rights attitudes that influence food security. The 1996 World Food Summit added a more complex definition of food security and was improved again in a 2002 FAO report, as follows:

“Food security is 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)

The international community has agreed with the 2002 FAO broad definition, goals and responsibilities. The operation, in fact, has been focused on narrower objectives and practices which are easier to perform both nationally and internationally. The main objective of international development policy is to reduce and eliminate poverty. The 1996 World Food Summit illustrated this policy direction through declaring that the main objective of the international operation on food security was reducing the number of food shortages or malnutrition cases by half by 2015.

Primarily, food security can be explained as relating to individual citizens; it shows the nutritional status of each household’s member. Furthermore, the risk of severe lack of food should not occur either as a temporary or a more long term situation. Food security, therefore, can be defined as follows

Food security is achieved when all people have physical, social and economic access to food at all times. The food must be nutritious, safe and adequate in order to meet nutritional requirements for an active and healthy life. Household food security is the adjustment of this concept for individuals within households for use at the family level.
This definition of food security includes four key elements which are: availability, accessibility, stability and utilisation (FAO, 2008).

(A) **Food availability** means reasonably sufficient amounts of quality food. The food may be acquired from domestic production, food assistance, or imports.

(B) **Food accessibility** means that individuals can access resources and have the right to receive food in accordance with their nutritional needs. The right consists of legal, political, economic, and social rights (including local rights, such as the right to use the resources of the community).

(C) **Food stability** means that the overall public, families, and individuals can access food at all times. These people should not encounter particular food crises (whether caused by an economic crisis or a climate change crisis), or repetitious food crises (such as food shortages in certain seasons).

(D) **Food utilisation** means the role of food contributing towards the well-being of people. Adequate food, clean water for consumption, and health care should be offered to people responding to their physical well-being needs.

### 2.2 Food Security Indicators

Food security indicators have become increasingly relevant since the topic of food security emerged in the 1970s. The initial examples of food security indicators, for example, measure food security on the basis of regional or national food supply or rainfall (Staatz, 1990: 1311-1317). Policy makers believe that this type of indicator was a measure that correlated significantly with indicators of food access. However, many researchers started to suspect the validity of these regularly used indicators; therefore, new types of indicators were introduced. Despite some indicators of food consumption such as household calorie adequacy, or more complex indicators such as income levels and food expenditure, Haddad et al. (1991) have proven that these were difficult to consolidate into progressing evaluation systems. Alternative indicators which are reliable, timely and less expensive have been investigated to determine food insecurity but a general agreement still has not been reached with regard to the methods of measurement.
Later studies describing the measurement of food security were published subsequently. Campbell (1991) and Braun et al. (1992), for example, suggested extensive and complicated food security indicators incorporating agro-physical, socioeconomic, and biological factors. Watt and Bohle (1993) and Kendall et al. (1995) introduced the concept of vulnerability of food security determined by the factors of food availability, food access, and food utilisation. Additionally, Webb et al. (1995) established a conceptual framework of food security and generic indicator categories also based on a group of food security concepts: food availability, food access, and food utilisation.

At a global level, the FAO has played a crucial role in developing and applying food security indicators. The first group of indicators recognised by The FAO Committee on Food Security concerns the global cereals market (FAO, 1999). There are six indicators in total as follows:

1. Ratio of world cereal stock to world cereal utilisation
2. Ratio of supplies to requirements in the 5 main cereal exports
3. Ratio of closing stock in the 5 main exporters to their domestic consumption plus exports
4. Cereal production in the 3 main importers (China, India and CIS)
5. Cereal production in Low Income Food Deficit Countries (LIFDC)
6. Production in LIFDC except China and India

The second group of indicators involves changes in world food markets. World food price stability and world food price levels are cited as key indicators.

At a regional level, Paarlberg (1999) suggested two beneficial indicators used to measure food security levels in some developing countries:

- A change in the ratio of cereal import requirements (derived in value terms as consumption requirements minus domestic production) to total agricultural export earnings;
- A change in the ratio of cereal import requirements (derived in value terms as consumption requirements minus domestic production) to total merchandise.

These factors and variables are involved in closely influencing the elements of food security and are related to each other. The effect of each variable on food security is quite different due to the unique production function and agricultural condition of each country.

2.3 Food security situation

Through the first twelve years of the 21st century, food prices have dramatically increased, including cereal, meat, sugar and dairy prices (see Figure 2.1). The FAO Food Price Indices illustrate a dramatic increase in food prices throughout the period, soaring from 100 to 200 approximately. Even though the 2009 Food Price Indices (except the Sugar Price Index) fell sharply after the 2008 financial crisis, the Indices have returned to trending upward since 2010. The increasing food prices can cause food unavailability and inaccessibility and instability in food markets and economists have referred to this situation as food insecurity.
Furthermore, agricultural products are the main exported goods of the countries in South-East Asia. With the establishment of the ASEAN Economic Community by 2015, free trade agreements will exist among the ASEAN members and also between ASEAN and other economic regions. Therefore, agricultural products including food will be increasingly exported to their trade partners around the globe. Researchers have recently been interested in studying the food security situation and the impact of trade liberalisation on food security. There are a number of empirical studies showing the impact as discussed below:

2.3.1 Food security situation in ASEAN

ASEAN was a leader in agricultural product exports in 2012, especially in rice and cassava. It accounted for 10.8 percent of the world total value compared to 39.65 percent from the European Union, 12.1 percent from South America and 10.65 percent from the United States (World Bank, 2013).
Table 2.1 Share of Agricultural Export Value in 2012

<table>
<thead>
<tr>
<th>Regions</th>
<th>Rice (%)</th>
<th>Cassava (%)</th>
<th>Total Agricultural Exports (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0.64</td>
<td>0.11</td>
<td>3.44</td>
</tr>
<tr>
<td>Australia &amp; New Zealand</td>
<td>1.05</td>
<td>0.01</td>
<td>3.64</td>
</tr>
<tr>
<td>China</td>
<td>1.84</td>
<td>0.27</td>
<td>3.22</td>
</tr>
<tr>
<td>European Union</td>
<td>7.82</td>
<td>1.34</td>
<td>39.65</td>
</tr>
<tr>
<td>South America</td>
<td>6.7</td>
<td>1.17</td>
<td>12.1</td>
</tr>
<tr>
<td>South-Eastern Asia (ASEAN)</td>
<td>44.97</td>
<td>93.75</td>
<td>10.8</td>
</tr>
<tr>
<td>United States of America</td>
<td>9.0</td>
<td>0.06</td>
<td>10.65</td>
</tr>
<tr>
<td>Rest of the world</td>
<td>27.97</td>
<td>3.29</td>
<td>16.5</td>
</tr>
</tbody>
</table>


However, there may be some countries suffering from food insecurity caused by the following factors. First is the declining performance of agriculture. According to the 2011 FAO report, the percentage growth in crop yield between the 1960s and 2000s has decreased significantly from 5 percent to 2 percent approximately. Another major factor that has threatened food security is a rise in food prices and food price volatility in recent years. The FAO Food Price Index shows dramatically higher prices in all food commodities in 2008 and 2011. Although most ASEAN countries are major agricultural exporters, these countries are also big importers of some agricultural commodities, for example, Indonesia for wheat and rice, Malaysia for corn and Thailand for soybean (FAO, 2012) and increasing agricultural prices could make their food situation insecure. Besides, climate change, soil degradation, and fuel prices could be other factors resulting in food insecurity in ASEAN (Desker et al, 2013).

This subsection describes the historical food situation of all ten ASEAN countries including Brunei Darussalam, Cambodia, Indonesia, Laos PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.
Brunei Darussalam

The country is a food-importing country since the share of agriculture is less than 3 percent of GDP. Brunei is almost self-sufficient in vegetables, and is attempting to produce tropical fruits. Livestock such as cattle (both beef and dairy), buffaloes, and goats are also promoted and they are self-sufficient in egg and poultry production. However, the rearing of pigs has been banned since 1993.

Brunei’s 10th National Development Plan in Agriculture (2010–2015) is focused on achieving self-sufficiency in rice production in the country, developing of a plantation quarantine facility and developing the infrastructure for its agricultural areas (Department of Agriculture and Agrifood, 2012). Brunei intends to increase domestic agricultural production for import substitution, in other words, to decrease dependence on outsources of food supply. Moreover, Brunei has modern technology for sustainable food production particularly in the fisheries sector such as aquaculture. At present, the country could be able to produce sufficient food to satisfy the minimum needs of its population. However, rice and sugar are important imported goods. Brunei imports rice from Thailand, Vietnam, Myanmar and Pakistan and sugar from Brazil.

Cambodia

Agriculture accounts for about half of GDP and employs about 80 percent of the workforce. Rice is the major commodity food. Rice production is a vital indicator in Cambodia’s agrarian society. However, severe food shortages were recorded in 1979, 1981, 1984, and 1987. Adverse weather conditions, insufficient farm implements and draft animals, security problems, and the government’s collectivisation policies have led to low productivity (Cambodia Food Security and Nutrition Information System, 2012).

Rural Cambodian people were provided with 65-69 percent of their daily caloric intake from rice and cereals supplemented by root crops in 2004. In 2008, approximately 2.8 million people had lack of access to adequate food, and meanwhile, about 40 percent of children suffered from chronic malnutrition. There
was food insecurity even in the capital, Phnom Penh (FAO, 2010). Despite being a net exporter for rice, Cambodians relied heavily on food imports, therefore, food security depended on Cambodian household’ purchasing power. In the meantime, most of the people in rural areas, accounting for 93 percent of the population, were under the poverty line (Ecker and Diao, 2010). Furthermore, vulnerability to external shock such as an economic crisis and disasters is a big factor affecting the stability of food markets.

Nevertheless, Cambodia’s Ministry of Economy and Finance has cooperated with the international private sector to implement the Food Emergency Programme in October 2008 to mitigate the effects of food price increases on poor households. They have set up projects to relieve the problems at grassroots level.

**Indonesia**

The Indonesian economy faced peak situations mainly due to petroleum and rubber and partly due to macroeconomic policies until the 1970s. Since the mid-1980s, the situation has changed with a bigger focus on agriculture, industry, international trade, and improved monetary regulations.

The country has aided agricultural protection by subsidising fertilisers, seeds, insecticides, and pesticides. An organisation called BULOG has been founded to provide a market for rice and to help farmers with floor prices. The gap between domestic and international prices for rice was 19 percent in the 1980s and 9 percent in the 1990s due to price support. However, the decreasing rate of protection of rice prices in the 1990s indicates a shift in focus to international competitiveness (FAO, 1999). The cost reduction and the decrease in the relative price of rice helped ensure better access to food (Anderson and Pangestu, 1995).

Nevertheless, rice production was very unstable from 1995 to 1999 because tariff cuts promoted imports. Moreover, since the price of imported rice was lower than its domestic counterpart, the policy led to the depression of domestic prices. Furthermore, the cut in input subsidy made the output-input price ratios worse
while the cut in credit subsidy resulted in small producers becoming weaker (Japan FAO, 2003).

The government plays a major role in the control of the marketing system for rice and sugar. The market operation is controlled so as to stabilise prices, that is, to buy when the producer’s price drops and to sell when the consumer’s price rises beyond the normal level. In addition, a farm credit called “Food Security Credit” is provided to promote domestic production of goods that are generally imported (Japan FAO, 2003).


Since 2009, Indonesia has become a lower middle income country and experienced a gradual decrease in overall poverty, from 17 percent in 2004 to 13 percent in early 2010 (IFAD 2012). However, about 12.5 percent of Indonesians currently live below the poverty line and is increasingly prevalent in rural areas, where 70 percent of the population lives. Therefore, food insecurity and under-nutrition are persistent challenges (IFPRI, 2012).

Laos PDR

Agricultural production is largely subsistence-oriented and farm technology is characterized by low inputs, low risks, and low outputs. Crops account for some 55 percent of agricultural GDP, with rice contributing about 40 percent, livestock 30 percent, fisheries 1 percent, and forestry 5 percent. Sticky rice is the predominant crop grown on over 80 percent of the cultivated land, though some one-third is produced uplands through slash-and-burn cultivation. Agricultural productivity is low. Annual rice imports range from 27,000 to 64,000 tons. Drought and flooding are frequent causes of crop failure and food shortages (FAO, 2006).
Even though Laos PDR’s economy has grown steadily since the 21st century, the country still suffers chronic malnutrition rates particularly in children who account for 31 percent of cases (WFP, 2013). More than three quarters of the population live in rural areas and have agricultural activities for sustaining their lives. In 2011, 43 percent of people in upland areas were under the poverty line, with people in lowland areas accounting for 28 percent (IFPRI, 2009). Only one third of Laos PDR’s rural population are food secure, with the rest of the people at risk of food insecurity. In addition, 40 percent of rural people are at risk of food insecurity due to either drought, floods or rapidly increasing food prices (WFP, 2007). However, LAOs PDR continues developing policies and actions to increase its regional and global integration. The country is a partner of The Greater Mekong Sub-region (GMS) Economic Cooperation Program, as well as of the Association of Southeast Asian Nations (ASEAN) and the ASEAN Free Trade Area (IFPRI, 2009).

**Malaysia**

Malaysia recorded high growth rates in the 1970s until a short period of stagnation in the mid-1980s. Its main exports (petroleum, palm oil, as well as rubber) were developed to improve productivity and to exploit favourable conditions especially in the rubber trade. Malaysia has been an open economy since the mid-1970s and its exports account for a very large share of the gross domestic product (GDP). Malaysia’s growth pattern is similar to other developing countries in the region, but at a more rapid pace. For instance, the share of agriculture as output had dropped from 22 percent to 14 percent within less than a decade due to the rising share of manufacturing and services and a significant shift from traditional exports of primary products to industrial products (FAO, 1999).

Unlike Indonesia, Malaysia did not support a cheap food policy in order to help people under the poverty line. Instead, it strove to improve yields. However, the government also provided a steady market and a price support regime by buying rice from small farmers. The effective rice protection rate was estimated to be 26 percent in the late 1980s. However, the rate was much higher in the early 1980s.
Buffer stocks were held to provide support against shortages but their main function in recent years was to stabilise prices for producers.

A policy called the Third National Agricultural Policy (NAP) sets the strategic thrusts for the development of agriculture and forestry. This includes an international halal food hub development and positioning Malaysia as an aquarium fish and tropical floriculture product distribution centre (International Trade Strategies, 2004).

After applying the policy, Malaysia has increased potential to produce sufficient food and food needs have been increasingly produced in the country. In addition, Malaysia has suitable resources and weather for staple food production. Favourable weather conditions support the Third NAP indirectly.

**Myanmar**

Myanmar has been shifting from a centrally planned economy to one that is market-oriented since 1988. Rice is the most important crop. It is both the main food and an important export crop. Therefore, the government has attempted to increase production. The government controlled production and marketing between 1962 and 1988, and also fixed the price of rice. After 1989, rice exportation was monopolised while the domestic market was partly liberalised. Indonesia, Singapore, and Malaysia are among the countries importing rice from Myanmar (Japan FAO, 2003).

In 2011, 33 percent of households in the Northern State of Myanmar were moderately food insecure while 45 percent were in a state of severe food insecurity. In the dry zone, people faced food insecurity at moderate and severe levels, at 24 and 18 percent of the population respectively. In addition, the percentage of chronically malnourished children under five years was very high at 41 percent (ACF, 2012). There have been many factors contributing to the high rates of malnutrition such as the increasing price of foods, unusual rainfall patterns, water scarcity and a lack of basic knowledge of how to take care of children (WFP, 2012).
The Philippines

The agricultural sector accounts for 20 percent of gross domestic product and more than 40 percent of employment. However, it is losing its competitive advantage, and shows slow growth. Therefore, the sector has been a net importer of foreign agricultural products. Comparative advantage and exports of all major agricultural activities have also declined (David, 1999).

Marcos’ regime was introduced on the Aquino administration to make the right policy and institutional distortions. Export taxes, and government monopoly over international trade in coconut oil, maize, and soybeans, and the marketing of sugar were removed. Price distortions had been worsened by efforts to avoid the agricultural trade policy reforms specified by the GATT-UR agreement. The Estrada government announced a program of food security attainment. But food security was often confused with self-sufficiency in rice and maize which are two highly politically sensitive commodities in nature.

The Philippines is a World Trade Organization (WTO) member and as such has been able to implement improved market access policies through a price intervention framework for Filipino agriculture. However, implementation of the policies shows that there may be no benefit realised (David C.C., 1999: 40-46). Moreover, the rice sector was exempted from tariffs until 2004 because rice is a heavily regulated, politically sensitive commodity. In addition, in April 1996, the quantitative restrictions (QRs) were lifted; meanwhile, applied tariffs that are equal to the high binding tariffs (mostly 100 percent) were applied.

In order to relieve the negative effects of price shocks on both consumers and producers, the government intervened in agricultural markets and fixed prices. Between 1970s and 1980s, the domestic price of rice was under international prices as a result of input subsidies (fertilizers, credit, and other inputs) and "stock and release" techniques. However, price protection has declined due to free trade.

In the 1970s, the exclusive right to import wheat, soy, and other food items were held by the Marcos administration. A Food Terminal Inc. was founded for processing, storing, and marketing food items. Furthermore, the Kadiwa stores took the responsibility to sell basic food at low prices in urban stores in order to provide
cheap food and increase food production (as a result of advanced rice technologies and subsidized inputs). However, in the late 1980s, the program was officially terminated because of budget constraints, inefficient operation, and a long period of poor harvests.

Export taxes on commercial crops such as sugar cane and soybean were also cancelled. In the meantime, the National Food Authority (NFA) has a monopoly on all rice imports with the government setting the total limit or QRs on the amount that may be imported. In 1995, an exemption was granted for the Philippines’ removal of QRs on rice and the exemption expired December 31, 2004.

In 2012, according to the World Food Programme survey, the Philippine’s hunger levels declined notably by 4.3 percent in the second quarter of 2012, down to 13.7 percent of the population. Moreover, severe hunger levels also decreased from 5.8 percent to 4.8 percent.

Furthermore, to efficiently handle the remaining poverty, the Food and Agriculture Organization of the United Nations (FAO) introduced the project “Establishment of the Food Security Information System in the Philippines” (PhilFSIS) under its Technical Cooperation Programme (TCP). The Bureau of Agricultural Statistics of the Department of Agriculture (DA-BAS) has moreover cooperated as the implementing partner. The project started in July 2012 and will run for two years (WFP, 2013).

**Singapore**

As a small country, Singapore has limited natural resources and depends basically on food imports as in the case of Brunei, and the share of agriculture in its GDP is less than 1 percent. In 2008, the country imported more than 2.4 million tons of unprocessed food supplies including pork, chicken and rice. Even though Singapore is an urban, high-income and importing country, food insecurity could result from food unavailability. The country imports many key products from a few countries such as Brazil, Indonesia and Australia, so that any problems would probably result from a supply lockdown in the exporting countries, such as disease and unusual
weather. Furthermore, shipping systems and strong competitors for food emerging in the global market could also be problems for food availability (Teng and Escaler, 2010).

Nevertheless, Singapore has set some strategic plans to relieve the problems. The strategy has been to provide an environment conducive to business via competitive prices, coupled with political stability, stable financial systems, and transparent legal frameworks. Singapore has concentrated on improving productivity because of the limited amount of land devoted to agriculture. Land use for farming is managed by the Primary Production Department (PDD) in the Ministry of National Development. All rice imports are subject to non-automatic licensing for food security reasons. Fish farming is also managed by the PDD (Lim, 2013).

**Thailand**

Among the Southeast Asian economies in the 1990s, Thailand had the fastest growing output at over 8 percent per year. Industry has had a large share in the rapid economic growth of national income and so has exports of primary sectors, especially rice. Economic development was characterized by government intervention except for the rice and sugar sectors (FAO, 1999).

Even though Thailand has traditionally been a rice exporter, the protection of urban consumers against excessive increases in prices due to rice exports has also been a government’s concern. A Rice Reserve Commission was established in 1960 in order to set up a buffer stock in the open market through purchases. A consumption subsidy in the range of 10 percent was provided and then increased to 25-30 percent in the next decade with the rise in the international price of rice. Moreover, the reserve requirements for exporters were also raised.

The government distributed rice at a controlled price in the late 1970s. The scheme was abandoned as the rich cornered and resold the bulk of cheap rice in the open market. The Rice Reserve Commission ended its operations in 1990 when the world price of rice fell and the number of competing rice exporters (i.e., Indonesia, India, and Pakistan) rose (Siamwalla and Setboonsarng, 1991).
Previously, Thailand had imposed an export tax on rice in order partially to increase government revenues but more so to reduce the domestic price of rice. In the process, the tax reduced the producer price and the real incomes of rice farmers who had surpluses to sell. However, according to a recent study, Thailand's rice export tax has exacerbated the income difficulties of the poor in urban areas. The tax reduces the income-earning prospects of unskilled workers to such an extent that it more than offsets the benefits received directly in terms of their lower food prices (Anderson, 2000).

The Thai government has guaranteed high prices for rice pledged under a state rice price intervention program. In the 2001-2002 season, the government planned to spend up to 10 billion baht in buying 8.7 million tons of various types of rice. The maximum price for fragrant rice was 7,000 baht a ton compared to 5,000 baht which had been recently received. In addition, a record-setting year for Thai rice exports was in 2001 with shipments amounting to 7.4 million tons. The Thai government faced two challenges: increasing rice prices and reducing its own rice stocks (Bangkok Post, 2001).

Agricultural sector reforms serve the dual purpose of maintaining agricultural growth and improving the competitiveness of exports. Thailand has also focused on improving food safety standards. This involves tasks such as crop monitoring and food processing, certification of farms and food processing plants, and establishing quarantine points along borders (International Trade Strategies, 2004).

Normally, the country seldom experiences food shortages because most of the consumption demand can be provided by domestic production with little imports. Most of the discussions on food security in Thailand thus focused on nutrition and safety issues. However, there has been legislation in this field since the early 1970s. The latest institutional development was the enactment of the National Food Commission Act in 2008 which authorises the establishment of a national committee responsible for overseeing food issues including food security (Prachason, 2009).
**Vietnam**

Agriculture is still a key sector of the Vietnamese economy. The sector employs 70 percent of the labour force and contributes roughly 30 percent to export revenues. It grew at a sustained level of some 4 percent per annum between 1990 and 2001 as a consequence of market-oriented policies, more clearly defined property rights, and an export-oriented strategy.

The sub-sectors under agriculture changed only slightly in the past decade. However, within the crop sub-sectors, a more diversified agricultural system has emerged. Agricultural diversification is being promoted for several reasons. First, the success of rice production has been accompanied by declining real prices and diminished incentives for farmers. Second, there is a large surplus of labour in rural areas. Third, there is a changed pattern of demand from staple foods to other foods. Finally, diversification is seen as a strategy to reduce risks arising from an open economy (Japan FAO, 2003). Policies are focused on the agricultural sector generally and directly target promoting agricultural production.

Despite economic growth in Vietnam, the rural population still encounters poverty. A large number of rural farmers are landless or have only smallholdings and low-quality land, and moreover, off-farm employment is becoming scarce. Furthermore, they have also faced soaring food prices as commercial and residential developments have dominated agricultural lands and rural people have migrated into urban areas (IFAD, 2012).

### 2.3.2 Food security situation in the EU

The European Union has brought food security into the core of its policy through the Common Agricultural Policy (CAP). The original objectives were defined in the Treaty establishing the European Economic Community (Treaty of Rome) in 1957 and retained in the Treaty on the Functioning of the European Union (TFEU).
The objectives of the common agricultural policy are:

(a) to increase agricultural productivity by promoting technical progress and by ensuring the rational development of agricultural production and the optimum utilisation of the factors of production, in particular labour;

(b) thus to ensure a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture;

(c) to stabilise markets;

(d) to assure the availability of supplies;

(e) to ensure that supplies reach consumers at reasonable prices.

The objectives and priorities, however, have been improved for supporting the post-2013 CAP. The current main aim of the CAP is not only providing enough food but also producing high-quality food with sustainability and environmental protection. The Commission's Communication offers three broad objectives and also several sub-objectives within each main objective for the CAP in the future. The detail can be seen as follows.

The Commission's objectives for the future CAP

Objective 1: Viable food production

- to contribute to farm incomes and limit farm income variability

- to improve the competitiveness of the agricultural sector and to enhance its value share in the food chain

- to compensate for production difficulties in areas with specific natural constraints because such regions are at increased risk of land abandonment

Objective 2: Sustainable management of natural resources and climate action

- to guarantee sustainable production practices and secure the enhanced provision of environmental public goods

- to foster green growth through innovation
- to pursue climate change mitigation and adaptation actions

Objective 3: Balanced territorial development

- to support rural employment and maintaining the social fabric of rural areas
- to improve the rural economy and promote diversification
- to allow for structural diversity in the farming systems, improve the conditions for small farmers and develop local markets

As a result of the CAP’s objectives, the probability of food insecurity occurring in the European Union is very low. The European Union members have produced sufficient food to provide for their people and to export every year since 1960s (Andreosso, 2003). Furthermore, the EU’s potential for food production is likely to grow more in the future due to technological improvement and developed farming approaches (Zahrnt, 2011). In the meantime, farmers can generate income from cultivating different crops and from off-farm work such as tourism. Also, agricultural risks can be controlled by producer cooperatives (Bielza et al., 2009).

Nevertheless, low agricultural productivity and lack of alternative employment are present in the New Member State Countries of EU (NMS) such as Poland, Bulgaria and Romania. There are rural people at risk of poverty due to central planning, EU environmental standards and expropriation of land (Bertolini et al., 2008). In addition to the above-mentioned threats, there have been some signs of economic threats to food security occurring in recent years.

The 2011 data from Eurostat (European Commission, 2012: 76) showed a 28.2 percent increase in nominal price indices of agricultural products for the EU-27 compared to 2005. In the meantime, agricultural real prices for crop output and animal output increased by 14.6 and 6.4 percent respectively, except for Spain, Malta, Portugal and Belgium which revealed a decrease in the real price index for crop output. The rise in the real crop price index ranged from 48.2 percent in the United Kingdom to 20.1 percent in Ireland, while the real price index for animal output reported the highest increase of 28.9 percent in the UK and the lowest rise of 0.2 percent in Slovenia.
In the EU-27, cereals and rice are the main crops harvested on arable land. In 2008, good weather such as an adequate rainfall, and high cereal prices in 2007 were factors resulting in a dramatic growth in cereal production. However, in 2009 and 2010, production dropped, possibly due to a fall in total arable area allocated for cereals and bad weather conditions before increasing slightly the next year. In 2011, vegetable and fruits have become more essential forage plants varying significantly in many countries. Apples, for example, are very popular among the EU-27, while aubergines, for example, are grown and consumed in certain countries or regions. The countries in the south of Europe, bordering the Mediterranean Sea, typically grow vegetables and fruits with a favourable climate for their production.

2.3.2.1 Analysis of products market

Cereal and crop plants

There has been a considerable fluctuation in cereal production since 2007. Very high cereal prices in 2007 possibly caused a significant increase in cereal production of 21 percent in 2008. However, cereal production decreased by 10 percent in 2010 probably due to climate change reasons across regions such as a lack of rainfall and unusually high temperatures. Cereal production recovered to slightly increase by 2.3 percent in 2011.

Rape production was on an upward trend until 2009 before dropping slightly in 2010-2011 while sunflower production was on a downward trend, sharply falling by 29 percent in 2007 before going up by 47 percent in 2008, remaining stable during 2009-2010 and rising by 21 percent in 2011. France is the largest producer of field peas in EU. EU field pea production dropped from 2005 to 2008 particularly during 2006-2007, when France faced a dramatic fall of 42 percent in field pea production. However, field pea production has grown significantly by 24 percent in 2011 due mainly to a recovery in French production addition; sugar beet production has been relatively stable since 2006.

Three major cereals in the EU are wheat, grain maize and barley holding shares of 46, 23 and 18 percent respectively in 2011. In 2008, the production of these three
cereals increased significantly by 26, 30 and 13 percent respectively compared to 2007, to respond high world cereal prices. The production of wheat, grain maize and barley reached a peak before decreasing by 8, 9 and 5 percent respectively in 2009. However, during 2009-2011, wheat production rose slightly, grain maize production grew considerably, whereas barley production continued dropping until 2011. Instability emerging in main cereals production between 2008 and 2011 probably resulted from not only weather conditions but also instability in global prices.

There has been a steady increase in rye and maslin production since 2006 reaching a peak in 2009 before decreasing by 21 percent in 2010 and 10 percent in 2011. Rice production faced little fluctuation as it is an essential crop before rising by 14 percent in 2009.

**Livestock**

In the EU-27, cattle claimed the biggest share of the livestock units surveyed at 48 percent while pigs and poultry followed with 27.4 and 14 percent respectively. France, Germany and the UK hold 47 percent of the total number of cattle; Denmark raises the highest percentage of pigs at 71 percent and Hungary accounts for the biggest share of total livestock at almost 40 percent of all poultry.

There were severe outbreaks of animal diseases such as Bovine spongiform encephalopathy (BSE) crises in 1996 and 2000 leading to the EU banning exports of British beef (Food Safety Research Information Office, 2007.), foot-and-mouth disease in the UK in 2001 (BBC news, 2001) and avian influenza or bird flu spreading to the EU in 2005 (Monke, 2006). These diseases had severe effects not only on EU animal production but also on worldwide society and economy.

There has been a slight fall in the numbers of cattle and sheep throughout the past decade, whereas the numbers of pigs and goats have remained stable in EU as a whole. France, Germany, Spain and the UK are the countries producing most meat in the EU. Spain, the Netherlands and France account for 66 percent of veal production in the EU, while France, Germany and the UK produce 50 percent of
beef. Germany, Spain and France produce 49 percent of pork, while 55 percent of sheep and goat meats are produced in the UK and Spain.

Between 2010 and 2011, veal, pork, poultry and sheep meat production indices showed an increase by 4, 3.5, 3.3 and 1.3 percent respectively, despite 2.5 and 2.3 percent decreases in goat meat and beef respectively. Overall the bovine meat production index rose to its highest in 2011 before dropping down in 2012 due to high prices. However, the bovine meat price index is soaring globally resulting from the high growth of consumption. From 2011 to 2012, the bovine meat price index increased significantly by 10.78 percent due to a drop in meat production.

In 2011, as a result of higher demand for milk and higher milk prices, milk production in the EU-27 increased by 1.8 percent. Yogurts, cheese and other dairy products also increased in line with demand whereas butter and skimmed milk powder production were lower. Germany, France, Poland and the UK account for 53 percent of the EU cow’s milk while Denmark, Portugal, Finland and Sweden produced efficiently with an annual average yield over 8,000 kg. Cow’s milk accounts for more than 95 percent share of all the milk produced in EU.

Dairy producers enjoyed higher than average dairy prices and this led to a much better EU dairy market. Global demand drove the EU milk price to a peak in late 2007 before the global economic and financial crisis caused a considerable fall in demand that led to a historically low level price in 2009. However, dairy prices recovered in 2011, increasing by 14.3 percent compared to the previous year. In 2011, over 70 percent of cow’s milk was provided mainly from Germany, France, the UK, the Netherlands, Italy and Poland. Milk production increased and then the price increased indicating market stress between 2008 and 2011. Eventually, arising from the increase in milk supplies until 2011, milk prices started to decrease in 2012.

**Vegetables and fruits**

Tomatoes, carrots and onions are the major vegetables produced in the EU and the important fruits are apples, oranges and peaches. Apples are grown by all Member
States while oranges and peaches are produced mainly in the southern and Mediterranean countries.

**Fisheries**

In 2010, Denmark, Spain and the UK accounted for a 43 percent share of the EU-27 total fisheries production (both wild catch and aquaculture), but overall production decreased by 33 percent compared to 1995. However, among EFTA countries, Norwegian fisheries production (both wild catch and aquaculture) recorded its highest level since 1995, and produced the equivalent of more than half of the EU-27 total production in 2010.

Aquaculture production in the EU-27 stayed relatively stable throughout the period 1995 to 2010. Spain, France, the UK and Italy are the four biggest producers of aquaculture, accounting for 20, 17, 16 and 12 percent respectively and accounting for two thirds of total aquaculture production in 2010. However, Norway (not a member of the EU-27) enjoyed a dramatic increase of 267 percent in aquaculture output during 1995-2010 while the total production of the EU-27 fell considerably by 33 percent approximately. In 2010, Norwegian aquaculture production was more than 80 percent of the EU-27 aggregate output. For the EU-27, the large producers, namely France and Italy faced a significant decrease in their production by 25 and 30 percent respectively, whereas the UK and Greece enjoyed a 115 and 270 percent increase in output respectively. Germany, Denmark and the Netherlands are medium sized producers and underwent a drop of 37, 28 and 20 percent respectively.

Wild caught fish in the EU-27 has decreased year-on-year by 39 percent between 1995 and 2010 except in 2001 and 2008. Denmark, Spain, the UK and France together accounted for 53 percent of the catch in 2010. However, the Norwegian catch was as large as the aggregate catches of those four large EU-27 producers. In 2010, Denmark, the UK and Spain saw a slight drop in their catches of 9.1, 9 and 3.8 percent respectively, whereas France encountered a considerable decrease of 25.6 percent compared to 2005.
2.3.2.2 Food availability in European households

There are four main daily items of consumption as shown by the Dose Adjustment For Normal Eating (DAFNE) food groups at the household level (The DAFNE Databank, 2007). These are namely:

**Vegetables (fresh and processed)**

In general, Europeans are still far from meeting the goal of at least three portions of vegetables per day (approximately 250 g). However, in terms of household locality, greater availability of vegetables is found in urban and semi-urban areas than in rural ones, except for Belgium and France.

**Fruits (fresh and processed)**

As the World Health Organisation (WHO) has recommended that at least two portions (approximately 150 g) of fruits should be eaten a day, the average daily consumption of fruits in Mediterranean countries and Austria went beyond the recommendation. However, the lowest fruit consumption was recorded in the United Kingdom (106 g/person/day). As for locality in all EU countries, rural areas recorded lower fruit consumption compared to semi-urban or urban households.

**Meat and meat products**

Norway recorded the lowest meat and meat products consumption, meanwhile the highest was in Austria, recording 126 and 182 g/person/day respectively. Persistently, lower meat and meat product consumption were observed in urban and semi-urban areas than in rural ones.

**Fish and seafood**

Dietary guidelines suggest at least two servings of fish a week. The highest level of fish consumption was found in Spain with 61 g/person/day, followed by Norway (50 g/person/day). However, the lowest fish and seafood consumption was encountered in Austria (9.3 g/person/day). Urban areas generally recorded higher fish consumption, excluding Norway.
2.3.2.3 Rural poverty

European people are not overall facing poverty, especially those who live in the European Union and Northern Europe. Human development indicators show that standards of living in the EU-27 member countries are among the highest in the world. However, poverty is nevertheless occurring in rural areas in Eastern Europe and parts of Southern Europe. Many countries from the ex-Soviet Union are confronting difficult economic, social and political transitions. A large proportion of rural people in, Poland, Bulgaria, Romania and the Republic of Moldova in particular, are living under the poverty line.

Nevertheless, the EU provides a substantial part of its common development budget for the poorer rural areas. Furthermore, the EU’s agricultural policy also offers development funds to help the Eastern European countries that have become members of the EU.

2.4 Impact of trade liberalisation on the agricultural sector

The agricultural sector is economically vital for people in developing countries, especially in ASEAN countries, not only as a major source of economic value accounting for almost 20 % of GDP (ADB, 2013) on average, but also providing employment to generate income. Furthermore, it plays a crucial role as a key sector for reducing poverty, improving rural people’s livelihoods and making food secure. Despite being one of the most important sectors, international trade saw agriculture as a minor priority until the Uruguay Round multilateral trade negotiation which led to the elimination of export subsidies. After the Uruguay Round, agricultural trade has been substantially encouraged among countries in the world.

Trade liberalisation has been linked to human development both directly and indirectly. Theoretically, trade contributes to economic growth, provides increasing employment and results in higher incomes (World Bank, 1986 and Edwards, 1998). As a result of trade liberalisation, most agricultural output prices are expected to grow, leading to a rise in agricultural production and income in developing countries (Samuel, 2010). If incomes are improved and widely distributed, it is
believed that there will be a decrease in poverty rate, ensuring food security, particularly in developing countries (AusAID, 2007 and Tupy, 2005).

Nevertheless, trade liberalisation in agriculture between developing and industrialised countries has not had positive effects for the whole of developing countries as per the theory. According to Thirlwall and Pacheco-Lo’pez (2008), the impact of trade liberalisation on food security has been negative as it gave rise to lower production and competitiveness, especially in Africa. Moreover, many developing countries in Latin America and Asia including particularly ASEAN countries, have been encountering a severe agrarian crisis due to the impact of trade liberalisation policies in agriculture (Sharma, 2005). The theory of effects that occur after establishing an FTA is described as follow.

**Theory of trade liberalisation**

Trade liberalisation can result in impacts on member countries’ economies. There are two types of impact likely to occur after the commencement of a free trade agreement opening, i.e. trade creation and trade diversion. They are illustrated as follows.
Van den Burg (2004) describes the theory of the impact of trade liberalisation with the two-country partial equilibrium model. The model shows how a trade bloc causes a distortion in the international trade. Suppose there are two countries (Home and Foreign) and two markets, domestic and international, for rice in the Home country as illustrated in Figure 2.2. Before the FTA commencement, $D_H$ and $S_H$ are the demand and supply curves for rice respectively in the Home country. Despite probably dealing with the world price for rice at $P_{world}$, a tariff is levied equally on all trade partners and hence the price increases to $P_{tax}$ (the equilibrium price at the quantity of rice demanded and supplied with tariffs imposed, $D_T$ and $S_T$). According to the Figure 2.2, the gains and losses are illustrated by the grey triangles as deadweight loss and the darker grey box as tariff levied, some part of which is effectively compensated for by foreign producers.

Suppose that the Home country establishes a free trade area with the Foreign country, but both countries still levy tariffs on imported products from the rest of the world (ROW). However, the Foreign country is not the world’s low-cost rice producer as the Foreign country’s international supply curve for rice, $S_F$, stretches above the world supply curve ($S_W$). This makes the free trade area price, $P_{fta}$, higher.
than $P_{world}$ but lower than $P_{tax}$. Therefore, the Home country will import rice from the Foreign country at the higher price of $P_{fta}$. Moreover, the government in the Home country will no longer earn revenue from tariffs.

Nevertheless, the trade liberalisation results in more trade than that would have occurred with a uniform tariff levied on all countries. According to Figure 2.2, the amount of rice imported is equal to $0Q_6 = Q_1Q_4$ which is greater than the quantity imported with the uniform tariff levied on rice imports from all countries ($0Q_5 = Q_2Q_3$). The expanded trade decreases the deadweight losses resulting from the tariff by the gridded grey triangles while the trade diversion removes the government’s tariff revenue and Foreign country’s rice increases in price.

The effects on the trade bloc’s net welfare are whether the grey gridded triangles, representing the gains from trade creation, are greater than the grey gridded rectangle which is loss from trade diversion. The latter area is the sum of the tariff absorbed by overseas suppliers and the price premium of the Foreign country’s rice.

In conclusion, trade liberalisation creates additional trade, but on the other hands, the free trade area also causes trade diversions by obliging importers to purchase rice at higher-cost from the Foreign country instead of from the world’s lowest-cost suppliers.

However, there are other forms of trade restrictions for protecting domestic industries generally called non-tariff barriers (NTBs). The effects of trade liberalisation with NTBs elimination can be derived from Molle (1997) whose theory is based on a one product model.
Figure 2.3 Effects of tariff and non-tariff elimination

Source: adapted from Molle (1997), page 94.

Figure 2-3 shows the Home country’s rice demand (\(D_H\)) and supply (\(S_H\)). Suppose that all overseas rice suppliers are subject to cost-increasing NTBs (\(ntb\)) and a tariff (\(tax\)) is levied on all rice imports from the ROW. Before establishing trade liberalisation, the initial domestic price of rice is at \(P_{tax+ntb}\) and domestic rice production is equal to 0Q2. However, domestic consumption exceeds 0Q2 and equals 0Q3, and rice imports of the Home country is therefore at Q2Q3 which is entirely imported from the ROW. After the FTA between the Home and the Foreign country is established with agreements on tariff and non-tariff elimination, the Home country’s domestic rice price falls to the price \(P_{fta}\). Domestic consumption and production become 0Q4 and 0Q1 respectively, and the excess demand Q1Q4 is substituted by entirely importing from the Foreign country. The FTA creates the additional trade Q1Q2, whereas it replaces all cheaper rice imports from the ROW (Q1Q2) as trade diversion. According to Figure 2.3 the gridded grey area is a net gain of consumer and producer surpluses. However, the government’s revenue
decreases by the darker grey area. The net welfare effect is the difference between the gridded grey area and the darker grey area, depending on the slopes of the curves, and also the level of tariff ($tax$) and non-tariff barriers ($ntb$).

In accordance with the positive and negative impacts from the FTA commencement, the following subsections present the effects of trade liberalisation on different economic variables in some ASEAN countries.

**2.4.1 Impact on imports**

Most of the labour force in developing countries are in the agricultural sector and are involved in small-scaled landholdings. Due to their small scale, and inefficiency levels, domestic agricultural farmers are generally protected by trading barriers such as quotas and tariffs. Prachason (2009), using Thailand’s 1997-2007 agricultural data as a descriptive analysis, shows that free trade agreements would therefore reduce import barriers on agricultural products and subsequently promote overseas products into the countries. Subsequently, Ghosh (2005) using descriptive analysis and Fabiosa (2008) employing export and import price equations and income effect state that the price levels of domestic products could be more determined by potential imports and result in problems for those farmers in the case of cheaper agricultural products. Cheaper agricultural imports not only come from developed countries but also from some developing countries. Notably, imported products such as rice, maize and soybeans cut the domestic price level and pose greater risk to small-scaled producers who are inefficient or unable to increase efficiency to compete with cheaper imports (FAO, 2003 and Madeley, 2012). Huang and Chen (1999) show that domestic grain market prices of wheat, maize and soybean in China declined gradually ranging from 10 to 20 percent after trade liberalisation. As a result, the grain self-sufficiency rate dropped significantly and significant unemployment was caused in the grain sector. This will anyhow cause structural change in those countries.

The most important ASEAN case is that of Indonesia which has high levels of trade dependence. The country changed from the status of a successful agricultural country in the late 1980s with mainly food surpluses and rice exports, to the status
of a food importer with decreasing domestic production by the end of the 1990s. In 1999, after trade liberalisation, the Indonesian government terminated support for agricultural inputs including fertiliser, seed and pesticide. As a result, input prices became higher. In the meantime, the tariff rate on all food was also reduced to almost zero, leading to a fall in rice and soybean production. Therefore, Indonesia turned into a net importer of rice in spite of the country being the 9th largest rice exporter before 1995 (Oxfam, 2001).

The liberalisation of agricultural trade led the country to experience severe international market volatility and resulted in deterioration of cultivators’ livelihoods. Consequently, Indonesian farmers left the land in search of alternative employment (Ghosh, 2005).

Like Indonesia, The Philippines also turned from being a net food export country between the 1970s and the 1990s, to a food importer by 2000 (FAOSTAT, 2003). Rice and corn are the two important staples in The Philippines. After intensive trade liberalisation, the corn sector was the sector that suffered most in the late 1990s, partly due to cheaper imports. Subsequently, a large number of corn farmers lost their land, this having been converted for agribusiness, industry and real estate. Moreover, cheap rice has been increasingly imported and competitive on the rice market in The Philippines, resulting in a negative effect on small farmers (Sharma, 2005). Other traditional exports such as coconuts, sugar and especially meat and poultry sectors have lost markets. Cheap chicken parts as well as beef imported from the US increased dramatically in the late 1990s and have led to herdsmen losing their livelihoods.

Another example, Cambodia, shows some of the drawbacks on rural people as a result of free trade. Despite being a net rice exporter, most of the exported Cambodian rice is harvested in only one province. While some farmers in that province benefit in terms of increasing rice exports, other cultivators in other provinces face cheaper imports of other products (Ghosh, 2005).

In the case of Thailand, Itharattana (1999) employed regression models to analyse the effects of free trade on the agricultural sector. The result shows that the
domestic price of soybeans at wholesale farm levels decreased after reducing tariffs and caused a loss in producers’ surpluses.

In conclusion, many studies suggest that full agricultural trade liberalisation would allow cheaper imports to flow into developing countries. Those imports would certainly benefit urban people in terms of increased food choice and lower consumer prices, while eroding rural farmers’ livelihoods and creating more poverty and food insecurity (Minot, 2007 and Paasch, 2011).

2.4.2 Impact on exports

Agricultural prices have not always fallen as a result of trade liberalisation. An international free trade theory prescribes a rise in prices after the opening of free trade areas (Van den Berg, 2004: 301). Some studies correspondingly show increasing prices in agricultural products due to agricultural trade liberalisation (Itharattana, 1999, Huang and Chen, 1999, Anderson, 2002, Joseph, 2005, Sharma, 2005, and Razzaque and Laurent, 2008). By reducing protection, and depending on the case, Minot (2007) analysing with the Social Accounting Matrix and CGE micro simulation models explains that there can be an increase in world agricultural prices for wheat, rice, sugar and dairy products between 3-20 percent. These price increases arise as follows:

Razzaque and Laurent (2008) employed the GTAP model to study the impact of trade liberalisation in South Asia. As a result of trade liberalisation, with the total abolition of tariffs, subsidies and domestic supports for agricultural commodities, domestic production would decrease significantly while there would be a rapid rise in trade volume. As a result of the elimination of export subsidies, agricultural prices are likely to increase and tempt many countries depending on different support measures to allocate more resources in the same inefficient activities, and finally causing losses of efficiency. On the other hand, if government employs export subsidies as a minor measure compared to other agricultural support measures, the rise in prices would not be as sufficiently much to offer beneficial returns to the traditional producers that face the efficiency losses.
For example, a rise in the price of rice originating from withdrawing agricultural support measures is a cause of the considerable decrease in the world production of rice, unequal income distribution and emergence of new competitors in the global rice markets.

Thailand has emerged as a global leader for rice export over decades. Trade liberalisation encouraged an increase in rice prices in Thailand and showed a positive effect on the Thai economy with a net gain and the growth in the domestic supply (Itharattana, 1999 and Sharma, 2005). However, as a result of the policy of liberalisation, the Thai government withdrew support to farmers as in Indonesia. Accordingly, the cost of rice production rose and moreover exceeded the growth rate of rice prices, and production thus declined. The farmers’ price gain was less than his increased costs and this caused a rise in rural debt.

The Cambodian example of only one province providing exported rice also shows that the gains arising from growing exports have not been benefited equally all farmers in the province, with typically large holders benefitting most (Ghosh, 2005).

In addition, a study revealed that as a result of rice trade liberalisation, China would become the biggest rice exporter in the world probably dominating the market with one third of rice exports. Subsequently, Thailand and Vietnam would experience a noticeable fall in market shares of rice exports (Razzaque and Laurent, 2008).

Agricultural exports through free trade to global markets may not be a reliable tool for rural development. Even though most ASEAN countries are net agricultural exporters and likely to benefit widely from trade liberalisation, few of benefits would go to rural communities (Perez, 2008) and there would probably be more negative than positive outcomes for the countries concerned.

2.4.3 Impact on real income and equality

Given the high proportion of agricultural exports in most of the ASEAN countries (see Table 2-1), the impact of trade liberalisation on agriculture would be significant. Trade liberalisation would possibly lead to lower food prices and
subsequently lower real income of agricultural producers despite a marginal increase in export values (Ahmad T.M.A.T. and Tawang A., 1999). European Commission (2009), a major study, assessed the likely trade sustainability impact of an EU-ASEAN FTA using the GTAP model. As a result, Indonesia, Malaysia, Philippines and Vietnam would encounter this problem whereas only Thailand is estimated to gain benefits from the free trade agreement with slightly higher real income in the agricultural sector. However, in the case of Vietnam, the real income effect may be significant due to both decreases in output and prices.

Another study reveals that after the establishment of agricultural trade liberalisation, a considerable fall in commodity prices would exceed the cost reduction benefits from cheaper imported inputs. As a result, farmers’ income earned from maize production would decrease significantly (Huang and Chen, 1999).

In line with the decline in real income in the agricultural sector, almost every ASEAN country excluding Thailand would be confronted with an expanding income gap between poor and rich people in the short run. However, the income gap may decrease in the long run due to an increasing percentage of people employed in the higher value-added sector (European Commission, 2009).

Eventually, agricultural trade liberalisation would reduce farm incomes in those developing countries, and especially real incomes in ASEAN countries would decrease significantly (Joseph, 2005). Moreover, the impact tends to be restricted to only people employed directly in the agricultural sector, and hence, food self-sufficiency would possibly fall (Anderson, 2002). Consequently, a fall in food self-sufficiency could possibly have a negative impact resulting on food security.

2.4.4 Impact on investment

Within the agricultural sector, investment would negatively be affected after the opening of free trade. Since large farms use less labour but more capital than small farms, smallholder farming is likely to be less profitable than large farming enterprises. Farm consolidation may take place with the decline in labour used in
the sector (European Commission, 2009). In the Philippines, trade liberalisation has resulted in lower agricultural investments, higher costs for food inventories that cause staple foods prices instability and lead to a drop in food production (Tauli et al, 2006).

This impact could also be a foretaste of the impact of an FTA on the agricultural sector in many ASEAN countries.

2.4.5 Impact on employment

Employment is another issue arising from the effects of trade liberalisation. According to figures for the World Bank’s worldwide employment rate in agricultural sectors, the agricultural employment rate has declined significantly from 40.43 percent on average (1980-1994) to 30.4 on average (1995-2010) after trade liberalisation established since the middle of 1990s.

The most significant employment loss was found in the wheat and maize sectors (Huang and Chen, 1999). In some developing countries, relatively high percentages of people would lose their livelihoods caused by maize prices decreases (Tauli et al, 2006). Meanwhile, the remaining developing countries would face a clear drop in rural employment after the drop in onion and potato production (FAO, 2010). Moreover, as a result of a significant drop in grain self-sufficiency due to FTAs, significant unemployment was also found in the grain sector (FAO, 2003).

Eventually, increasing unemployment would lead to a collapse in rural livelihoods in developing countries, resulting in more migration from rural to urban areas (Sharma, 2005). This would mean that the rural people in the ASEAN countries would face increasing levels of poverty, since people removed from the sector may not be able to find new jobs in urban areas. Certainly, jobless people would be more food insecure than others.
**2.5 GTAP based studies**

To study the impact of the trade liberalisation, it is crucial to analyse the impact that may occur to various variables, such as production levels, price levels, exports, imports and gross domestic product (GDP). In the meantime, it is also essential to consider linkages of the effects among different production sectors as well as linkages in trade and investment among member and non-member countries. According to the complexity of the economic systems, general equilibrium models are then essential for use as an analysing method, and the highly popular and widely used model called the Global Trade Analysis Project (GTAP) can describe the complex international relationships among countries and their economic sectors simultaneously.

GTAP is a type of CGE model developed by cooperation between University of Purdue (USA) and University of Monash (Australia). The GTAP model covers more than 100 different economic regions in the world and consists of 57 manufacturing sectors in each region/country. Each sector is linked with imports, exports and international capital mobility.

Analyses of the impact of trade liberalisation using the GTAP model have appeared intermittently over the last decade. The six main studies available for this research include Friedman (2000), Hertal et al. (2001), Joseph (2005), Razzaque and Laurent (2008), Gerard (2008) and the European Commission (2009). These studies employ the standard GTAP model.

One of the first studies to provide the effects of free trade agreements was carried out by Friedman (2000). This study’s objective was to investigate the different impacts of the FTA on rural and urban people in Indonesia. It provided simulations of the GTAP model under an Indonesian unilateral free trade agreement, and global trade liberalisation. Interestingly, under both trade scenarios, very few households face disadvantages from the FTA but most of the FTA advantages tend to be distributed toward the urban household rather than rural people.

Hertal et al. (2001) made an extension from Friedman’s previous study. Global trade liberalisation simulations were created on seven countries including Brazil, Chile, Indonesia, Philippines, Thailand, Uganda, and Zambia using the GTAP
model to find out factor and commodity price changes by region. The results show that trade liberalisation generally leads to poverty reduction in each of the seven selected countries; especially Indonesia which experiences the largest national reduction in poverty.

Joseph (2005) studied the impact of a free trade agreement between the EU and developing countries using the GTAP model. The GTAP database is aggregated into 24 sectors and 30 regions. In addition, non-tariff barriers (NTBs) are adapted into the model as a mix of import and export taxes on agriculture. The results show that the ASEAN countries would encounter a decrease in real income of 18 million of US dollars.

Razzaque and Laurent (2008) examined the economic effects of an agriculture and rice FTA on the South Asian countries. Using the standard GTAP model, different simulations were conducted reflecting six liberalisation scenarios that generate macroeconomic consequences for each of the countries. The database is aggregated into 14 sectors and 19 regions. As a result, the removal of agricultural support measures, particularly in the EU and US, not only results in a considerable decrease in the global production of rice, but also a rise in the rice price.

Another key study of the impact of agricultural trade liberalisation was undertaken by Gerard (2008). The study employs the GTAP model as a research methodology and designs four scenarios to investigate different results. The database is aggregated into eight agricultural commodities associated with other three non-agricultural sectors. The regions are categorised into seven large economies including the EU, US, China, India, Brazil, the least developed countries and the rest of the world. The results show that the least developed country group gains neither from the CAP reform nor the partial trade liberalization scenario.

An important study, Trade Sustainability Impact Assessment for the FTA between the EU and ASEAN, was conducted by the European Commission (2009). The study focuses on the impact on economic, social and environmental issues. The GTAP database is aggregated into 32 sectors and 14 regions (including individual ASEAN countries, except Cambodia, Laos PDR and Myanmar due to a lack of data). Using the GTAP model, simulations were separated into two broad
liberalisation scenarios and, in addition, non-tariff barriers (NTBs) are also adapted into the model. The results indicate that income rises and trade increases as liberalisation deepens, especially in Thailand where the capital inputs are the largest among the ASEAN members.

2.6 NTBs eliminations

One of the important issues relating to the analysis of trade liberalisation is the consequences affected from the eliminations of NTBs. The “purely free” trade agreement goes far beyond the tariff barriers between the trade partner countries; it is supposed to not only be associated with tariff reductions but also non-tariff elimination.

Nonetheless, previous studies that took the impact of NTBs elimination into account are rare. In addition, the NTBs elimination in most of the studies is based on the assumption of a reduction in iceberg trade costs only. Lee and Mensbrugghe (2004), for example, reduce the iceberg trade costs by 2.5 percent and 5 percent in their scenarios.

However, there are few studies available employing different methodologies to estimate the impact of NTBs elimination. Studies by Lejour et al. (2001), Francois and Rombout (2001), and Uprasen (2009) take NTBs elimination into account with gravity equations and estimating the tariff equivalent of NTBs. Most of data used in the gravity model in these studies come from the GTAP database that provides data on input–output, value added, final demand, bilateral trade, tax and subsidy data.

2.7 Conclusion

The United Nations Development Program (UNDP) Human Development Report in 1994 initially highlighted food security and the 1996 World Food Summit added a more comprehensive definition of food security. The definition of food security has been improved again in a 2002 FAO report, as follows:
“Food security is 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”

In 2008, the beneficial definition of food security was additionally provided by the FAO as follows:

“Food security will be achieved when all people have physical, social and economic access to food at all times. The food must be nutritious, safe and adequate in order to meet nutritional requirements and consumption for an active and healthy life. Household food security is the adjustment of this concept for individuals within households to use in the family level.”

This definition of food security includes four key elements which comprise availability, accessibility, stability and utilisation.

For food security indicators, at a global level, the FAO has played a crucial role in developing and applying food security indicators. There are two broad groups of indicators; the first group concerns the global cereals market and the second group involves changes in world food markets. In addition, at a regional level, Paarlberg (1999) suggested changes in the ratio of cereal import requirements to total agricultural export earnings and to total merchandise as two beneficial indicators used to measure food security levels.

Since the beginning of 21st century, food prices have dramatically increased including cereal, meat, sugar and dairy prices. The FAO Food Price Indices indicates a dramatic increase in food prices throughout the latest decade, soaring from 100 to 200 approximately. Therefore, the rise in food prices can cause food unavailability, inaccessibility and instability in food markets and economists have referred to this situation as food insecurity.

For ASEAN countries, despite being leaders in agricultural exports in 2012, some countries have suffered from food insecurity due to, for example, the declining performance of agriculture, a rise in food prices and food price volatility, increased fuel prices and political issues. By contrast, in the EU-27, human development indicators show that the standard of living in the EU-27 member countries is among
the highest in the world. However, poverty is arising in rural areas in Eastern Europe and parts of Southern Europe.

Apart from the above-mentioned factors likely threatening food security in ASEAN, trade liberalisation is also a significant factor affecting food security. The impact of trade liberalisation can be categorised onto five main economic variables including imports, exports, real income and equality, investment and employment. Focusing on the impact on the ASEAN countries after the opening an FTA, for example, the Indonesian government terminated support for agricultural inputs and input prices therefore became higher. In the meantime, tariffs on all food was also reduced to almost zero, leading to a fall in rice and soybean production and turning Indonesia into a net importer of rice. In addition, as a result of rice trade liberalisation, China would become the biggest rice exporter in the world probably accounting for one third of the rice exports. Subsequently, Thailand and Vietnam would experience a noticeable fall in market shares of rice exports. Besides, almost every ASEAN country would be confronted with an expanding income gap between poor and rich in the short run, lower agricultural investment, higher costs for food inventories, and significant agricultural unemployment.
Chapter 3 Research methodology

This chapter shows the research methodology employed in this study. The characteristics of Computable General Equilibrium models (CGE models) and the Global Trade Analysis Project (GTAP) model are explained as well as the estimation and implications of non-tariff barriers in the GTAP model. The last section explains the food security assessment model used in this study.

3.1 Computable General Equilibrium

Computable General Equilibrium models (CGE models) operate under the assumptions based on the Walras' Law (Walras, 1895), which states that in general; an economic system is always in equilibrium. If any part of the system is not in equilibrium, changes will lead the economic system to continuously adapt its behaviour in line with the change until it returns to a new general equilibrium. Besides, when the economy is already in equilibrium, if exogenous economic factors change, these will link to the internal economic sectors and then those sectors will adjust themselves into a new equilibrium. The size of the impact on the economic system depends on the structure of the economy and the elasticity of the factors. The relationship between different economic sectors can therefore be written in the form of equations in order to calculate and assess the overall impact arising from changes in any variable in the model.

An economic system consists of production sectors, households, government and the rest of the world (international trade). The main structure of CGE models describes the production and consumption relationship among economic sectors. The relationship in the models is mainly based on resource allocation concepts that various economic sectors in the economy can decide to do economic activities for the highest utility. Consumers, for example, decide on suitable consumption volumes in order to gain the highest utility under certain budget limitations or consumer’s income. Manufacturers decide to use inputs that minimise costs to produce goods in order to gain maximum profit. Policy makers or government,
furthermore, cannot directly determine the volume of consumption or production. They can only implement a number of possible policies that could affect the decisions of economic sectors through the market mechanism.

The principles, theories and assumptions of CGE models comprise six main economic activities (Dixon PB et al, 1992) as follows:

**The structure of production**: consists of the different steps of using input factors i.e. primary, intermediate and other input factors.

**Consumption and saving**: shows income and expenditure of households and government which are in return received from owners of input factors. In other words, household incomes are partly spent for consumption and the remainder is preserved as savings.

**Investment**: refers to the capital accumulation of households and government. The investment size of each economic sector depends on the returns on investment.

**Exports and imports**: depend on different factors such as world market prices, prices of substitute products and other factors including elasticity of demand for each production sector.

**Price determination**: there are several price categories such as real price, producer’s price and other prices, etc., depending on the model.

**Market clearing**: makes demand equal to supply in both domestic production and imports in every market such as product markets and input factor markets.

Therefore, the CGE models, which describe the relationships linking these variables in the economic system, allow studying and evaluating the impacts arising from changes in focused variables on other variables.

**3.2 GTAP Model**

The Global Trade Analysis Project (GTAP) is a multi-region and multi-sector Applied General Equilibrium (AGE) model (Hertel, 1997). It is built on a neoclassical economic basis.
The GTAP model is widely used by various trade policy researchers. The European Commission (2009), for example, used such a model to estimate the likely impact of an EU-ASEAN Free Trade Agreement on the economy, society and the environment. Their models predicted small negative impacts on output, real income and poverty in the ASEAN countries. Andreosso and Uprasen (2008) studied the impact of the fifth EU enlargement extending to ten countries in East and Central Europe on the EU, and on ASEAN countries. A GTAP model was applied with technology spillovers via imports. Andreosso and Uprasen’s results derived from the adjusted GTAP models assessed some positive effects on several sectors such as leather, textile and clothing; however, the overall effects tend to be negative, particularly in the agricultural sector for ASEAN countries. Another study by Razzaque and Laurent (2008) analysed agriculture and rice trade liberalisation affecting South Asian countries. Different GTAP model simulations were conducted following a number of liberalisation scenarios.

This study focuses on economic variable changes in real terms and the GTAP model has an advantage of interpreting outcomes as changes in the variables in real terms. Therefore, it is suitable and is employed in this study.

Structure of the GTAP Model

The structure of the GTAP model, e.g. its theoretical structure, its assumptions and situations in analysing the impact of trade liberalisation, and the limitations in the GTAP Model analysis are all explained as follows.

The structure of the GTAP model is divided into three major sections:

(1) Economic activities of each country: there are four main economic activities in each country i.e. current production activities, production activities for capital creation, consumption and government expenditure.

(2) International capital movement: each country has one type of labour and capital which can transfer internationally by assuming that all countries will save a part of their income (at constant rates) as their savings. The savings will be integrated into the global saving funds, and allocated to invest in each country. The
proportion of investment will vary according to the rate of return on investment in each country. International capital movements will take place to eventually equalize the rates of return on investment for each country in the long run.

(3) **International trade:** products of each country are assumed to be imperfect substitutes. The substitutions comprise of the substitution between imported and domestic products and the substitution between imported products from different sources.

The overall illustration of the model is shown in Figure 3.2 and will be further explained below. To describe the relationship in the model thoroughly, the three major sections are decomposed into seven main economic agents who play crucial roles in the model. In each region or country, there are four agents including regional households, private households, producers and government while the rest of the world (ROW) plays a role as a foreign country. Another two global organisations which create a linkage between the home country and the foreign countries are the global banking sector and the global transportation sector (not shown in figure 3.2).

The theory behind the GTAP model is obtained from other multi-region and multi-sector CGE models such as the AGE model. The equation system in the GTAP model can be separated into three main groups. The first group consists of the equations explaining accounting relationships which endorse the balance of income and expenditure. The second group comprises behavioural equations which manage the behaviour of each economic agent based on microeconomic theory such as utility maximisation and budget constraint. The third group comprises the auxiliary variables which indicate changes in related economic variables resulting from shocks of exogenous variables into the model.

The accounting relationships and each agent’s behaviour are explained in subsection 3.2.1, while the auxiliary variables are presented in subsection 3.2.2.
3.2.1 The accounting relationships and each agent’s behaviour in the GTAP model

The sets and subsets of related accounting variables in the GTAP model are classified into various categories as shown in Figure 3.1 and Table 3.1.

**Figure 3.1** Sets and subsets of variables in the GTAP

```
NSAV_COMM
  /  \
PROD_COMM  DEMD_COMM  ENDWC_COMM
  |    |    |
CGDS_COMM TRAD_COMM ENDW_COMM
  |          |    |
ENDWS_COMM ENDWM_COMM
```

Table 3.1 Description and example of each set in the GTAP

<table>
<thead>
<tr>
<th>Set</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>REG</td>
<td>Regions</td>
<td>ASEAN, EU, ROW</td>
</tr>
<tr>
<td>NSAV_COMM</td>
<td>Non-saving commodities</td>
<td>land, labour, capital, agricultural products, manufacturing products, services, capital goods</td>
</tr>
<tr>
<td>PROD_COMM</td>
<td>Produced commodities</td>
<td>agricultural products, manufacturing products, services, capital goods</td>
</tr>
<tr>
<td>DEMD_COMM</td>
<td>Demanded commodities</td>
<td>land, labour, capital, agricultural products, manufacturing products, services</td>
</tr>
<tr>
<td>ENDWC_COMM</td>
<td>Capital endowment commodities</td>
<td>Capital</td>
</tr>
<tr>
<td>CGDS_COMM</td>
<td>Capital goods commodities</td>
<td>capital goods</td>
</tr>
<tr>
<td>TRAD_COMM</td>
<td>Tradable commodities</td>
<td>agricultural products, manufacturing products, services</td>
</tr>
<tr>
<td>ENDW_COMM</td>
<td>Endowment commodities</td>
<td>land, labour, capital</td>
</tr>
<tr>
<td>ENDWS_COMM</td>
<td>Sluggish endowment commodities</td>
<td>Land</td>
</tr>
<tr>
<td>ENDWM_COMM</td>
<td>Mobile endowment commodities</td>
<td>labour, capital</td>
</tr>
</tbody>
</table>


According to Figure 3.1 and Table 3.1, the model assumes that there are two types of primary factor endowment. The first type is perfectly mobile factors (ENDWM_COMM) which can be moved among industries such as labour and capital while the other type is sluggish factors (ENDWS_COMM) which cannot be freely moved across industries, such as land. Both types of primary factor endowment are defined as subsets of endowments (ENDW_COMM). Since the endowments play a role as inputs for firms’ demand for production, the ENDW_COMM is a subset of demanded commodities (DEMD_COMM). In addition, the set of DEMD_COMM encompasses the other subset, TRAD_COMM, which consists of tradable commodities such as agricultural products, manufactured
products and services. The commodities are consumed by households and governments to maximise their consumption utility and used as intermediate inputs by firms for production. The TRAD_COMM is not only a subset in the set of DEMD_COMM but also possessed by the produced commodities (PROD_COMM) which is a set of all the commodities in TRAD_COMM including capital goods (CGDS_COMM). The capital goods are produced on the basis of the savings spent by regional households. In addition, the capital stock in the GTAP model is defined as a commodity named capital endowment commodities (ENDWC_COMM) which are accumulated from the capital formation process. All the sets of commodities are defined as subsets of non-saving commodities (NSAV_COMM).

The accounting relationships in the GTAP model can be described as value flows among the economic agents. The value flows are shown in Figure 3.2.
The relationships among these economic agents and each agent’s behaviour are explained in the following subsections.

### 3.2.1.1 Regional household

Since the regional household possesses a primary factor, its income is therefore generated from the sale of its endowment to firms represented by Value of Output at Agents’ prices of ‘endowment commodities’ (VOA (endw)). The other source of regional income is in the form of taxes. All taxes levied domestically are obtained from consumption taxes (TAXES) paid by producers, private households and government while taxes levied from trades are obtained from commodities exported.
from the region to the rest of the world as import taxes (MTAX) and export taxes (XTAX). On the expenditure side, there are three forms of final demand that all the regional income is expended on, comprising private household expenditures (PRIVEXP), government expenditures (GOVEXP) and savings (SAVE).

In relation to savings, the demand for investment in the GTAP model is formulated on the basis of a savings-driven demand pattern. Even though current investment is assumed not to affect production in the region, the demand for investment goods affects the industries’ productive capability in the model.

Regional household’s behaviour

According to Figure 3.3, regional income is exhausted on three main expenditures: private expenditure, government expenditure, and savings. The three main components are managed under the Cobb-Douglas utility function which is modified as per capita terms. The Cobb-Douglas utility function is applied into the model for easy calibration of parameters; however, with the property of homothetic function, it offers income elasticity of demand for all goods with a constant unit that makes expenditure shares not vary with income.

To solve the problem, a non-homothetic function (a Constant Difference of Elasticity (CDE) function), is adopted to form private consumption while the Cobb-Douglas utility function is used to express government consumption.
3.2.1.2 Private household

According to Figure 3.2, one part of regional income is distributed as private household expenditure which spends its income to maximise its consumption utility through two channels. One involves expenditure on products from the producer denoted as Value of Domestic purchases by Private households at Agents’ prices (VDPA) while the other channel involves import payment for consumption goods paid to the rest of the world denoted as Value of Import Private household purchases at Agent’s price (VIPA). Also, private household income is used to pay taxes to the regional household.

Private household’s behaviour

Private consumption is a part of the regional household’s expenditure. Income distributed from the regional household is allocated to purchase composite goods, determined on the basis of the Constant Difference of Elasticity (CDE) function.

According to figure 3.4, the tradable goods $P_1$ to $P_n$ are consumed by the private household. Each commodity $P$ comes from two sources (shown as $P_{1d}$ and $P_{1m}$ in figure 3.4), namely domestic markets and imports. The combination of the commodity $P$ from these two markets is calculated under the CES function.
3.2.1.3 Government

Another part of regional income is allocated to government as government expenditure. According to Figure 3.2, government revenue is also spent on the same agents as in the case of the private household, i.e. the producer and the rest of the world. The revenue spent on purchases of domestic goods is denoted as Value of Domestic Government purchases at Agent’s price (VDGA), while the revenue spent on purchases of imports is denoted as Value of Import expenditures by the Government at Agent’s price (VIGA). Like the private household, a part of government income is also spent as taxes to the regional household.

Government’s behaviour

Government consumption is a part of the regional household’s expenditure. When the government earns income from the regional household, the income is allocated to pay for composite goods under the Cobb-Douglas utility function modified as per capita term.

According to figure 3.5, the tradable goods $G_1$ to $G_n$ are consumed by the government. Each commodity $G$ is chosen to be consumed from the combination

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Figure 3.4 Private household’s behaviour in the GTAP model

![Diagram](image-url)

between domestic markets and imports (shown as $G_{1d}$ and $G_{1m}$ in figure 3.5) determined by the elasticity of substitution calculated on the basis of CES function.

**Figure 3.5 Government’s behaviour in the GTAP model**

![Diagram](diagram.png)

Source: derived from Hertel (1997), page 48-49.

### 3.2.1.4 Producers

For producers, it is assumed that they produce and supply both tradable commodities for consumption and saving commodities. According to Figure 3.2, producers generate income from their sales of goods to both domestic and international markets. In the domestic markets, the revenue is obtained from selling consumption goods to the private household (VDPA) and to the government (VDGA). Furthermore, tradable goods are also distributed among firms as intermediate inputs for production, denoted as Value of Domestic Firm purchases at Agent’s prices (VDFA). In the international markets, revenue is obtained from exporting consumption goods to the rest of the world and to the global transport sector, denoted as Value of exports of tradable commodity at Domestic market prices (VXMD). However, producers’ income generated from selling artificial investment commodities to the global bank sector (REGINV) is not accounted for in the relationships of the firms. The equations are ignored due to the Walras’ law adopted into the model which states that if there are n markets, then if n-1 markets
are in equilibrium, the remaining n-th market is also in equilibrium. Producers’ expenditure is separated into three parts. The first part is spent on the rent of primary factor endowment such as land, labour, and capital to the regional household (VOA). Another part is paid for buying tradable commodities used as intermediate inputs from other producers (VDFA). The other part is spent on imported tradable goods from the rest of the world, denoted as Value of Import of tradable commodity by Firms at Agent’s price (VIFA). The extra payment is the taxes levied to the regional household.

**Producers’ behaviour**

In the GTAP model, firms are assumed to produce goods on the basis of the Constant Elasticity of Substitution (CES) production function (Hertel, 1997). According to figure 3.6, the production tree presents the structure of production used in the model. The degrees of substitution are different among inputs; in other words, the elasticity of substitution among primary inputs ($\sigma_{ESP}$) is different from that among intermediate inputs ($\sigma_{ESI}$). On the top of the tree, the final goods are produced with an input selection based on the elasticity of substitution between the primary inputs and the intermediate inputs ($\sigma_{ESF}$).

**Figure 3.6** Production tree in the GTAP model

![Production tree in the GTAP model](image)

3.2.1.5 Global bank

The global bank behaves as a middleman to create linkages between global savings and global and regional investment. The investment commodity (REGINV) from each region is collected into the bank and the bank thereupon creates composite investment goods, according to Figure 3.2. The investment goods are offered to the regional household and exchanged with the savings (SAVE) in each region.

The global banking system and the savings-investment linkage

The GTAP model generally has no explicit intertemporal optimisation mechanism due to the static characteristics of the model. However, Howe (1975) showed that the intertemporal extended linear expenditure system (ELES) could be derived from an equivalent atemporal maximization problem in which savings enters the utility function. Therefore, the standard GTAP model allows savings as a part of the aggregate utility function of the regional household.

According to figure 3.2, the global banking sector is the linkage agent between savings and investment. After the savings are collected from the regional household and transformed into homogeneous investment goods by the global bank, the global banking system distributes the investment goods into each region by two methods. The first method fixes the global capital stock to be unchanged after establishing the investment and allows the rate of return to adjust itself. This means that the rates of return can be different in each region. The second method determines all regional rates of return to be changed by the same percentage after establishing the investment and consequently allows the shares of regional composition of global capital stock to adjust. However, selection method depends on the objectives and assumptions of the study.

3.2.1.6 Global transportation

The global transportation sector (not shown in Figure 3.2) is an agent which produces a composite good used to transport commodities from an exporting country to another trading partner country. Its income is generated from the value of the international transport margin which is equal to the difference between the
value of imports at world price (Cost, Insurance and Freight: cif) and the value of
exports at world price (Free on Board: fob). In the meantime, the global
transportation sector’s income is spent on the margin commodities from each
region.

**International transport services**

This agent offers an international transportation service to move tradable
commodities between an exporting country (Home Country) and an importing
country (Foreign Country) as shown in figure 3.7

**Figure 3.7** Global transportation service sector in the GTAP model

Source: derived from Hertel (1997), page 60-61.

According to Figure 3.7, the global transportation services are provided based
on the Cobb-Douglas production function that demands the shipping service from each
country. The global transport sector’s margin is equal to the difference between the
value of imports (cif price) and the value of exports (fob price). In the meantime,
the global transport sector also plays the other role as a buyer for tradable
commodities T distributed from each region. The commodities T are inputs for
producing the global transportation commodity.
3.2.1.7 Rest of the world

According to Figure 3.2, the rest of the world (ROW) represents the foreign trading partner of the home country. The income of the rest of the world is generated from distributing tradable goods to the agents in the home country including the private household (VIPA), government (VIGA), and producers (VIFA). However, the income of the rest of the world is paid for imported commodities transported from the producers in the home country (VXMD). In addition, export taxes (XTAX) and import taxes (MTAX) are imposed from the rest of the world to the regional household in the home country.

3.2.2 Auxiliary variables

The auxiliary variables in this study are described by the international trade relationships and the equilibrium conditions.

3.2.2.1 The international trade relationships

Besides explaining the economic agents’ behaviour, the GTAP model also describes relationships among economic variables related to international trade. Effects from a reduction in the bilateral tariff on imports, for example, can be considered appropriately using equations relating to the change in the tariff rate, change in supply of exports, and change in demand for imports. In addition, a change in the terms of trade, a change in gross domestic products (GDP), and a change in the regional trade balance can be also investigated from the model.

Even though the GTAP model is constructed on the basis of neoclassical economics assuming perfect competition and homogeneous products, one commodity can be both exported and imported due to adopting the Armington (1969) assumption into the model. It assumes that commodities are distinguished by the country of origin and are therefore imperfectly substituted for each other. The difference between domestic and imported goods, and the difference among commodities imported from different sources can be explained using the Armington assumption applied to all economic agents in the model.
3.2.2.2 Equilibrium conditions

The equilibrium condition is generally known as the market clearing condition. In the GTAP model, Walras’ law is adopted to describe the equilibrium conditions as used in general CGE models. However, the equilibrium condition between savings and investment cannot be managed by the ordinary market clearing condition; it is achieved through the virtue of Walras’ law.

3.3 Model implementation

This section aims to present the relevant information for the model implementation. Estimation of the tariff equivalent of NTBs is adopted in this study in order to estimate the size of the shock arising from NTBs elimination in the simulation process. Therefore, subsection 3.3.1 illustrates the related information for using the procedure of the estimation of NTBs, and the calculations for tariffs equivalent of NTBs as well as how to implement NTBs in the GTAP model. Section 3.3.2 portrays the data aggregation of regions and commodities in the GTAP model and shows trade liberalisation scenarios applied in this study.

3.3.1 Estimation of NTBs

Despite tariffs reduction on imports to low levels or tariff elimination, there have been increasing non-tariff barriers (NTBs) which may distort and restrict trade liberalisation. Even though the NTBs are difficult to measure due to different policy instruments and a lack of data, there are a number of studies using NTBs’ measurements that can be grouped into three main approaches (Deardorff and Stern, 1997 and UNCTAD, 2012). Frequency-type measures and price-comparison measures are two of the three main NTBs measures; however, this study ignores these two approaches because of unavailable data of products and countries of interest. The approach adopted in this study uses quantity-impact measures, namely the gravity equations (Baier and Bergstrand, 2009).
3.3.1.1 Theoretical foundations of the Gravity equation

Gravity equations are widely used in the field of international economics. This concept of model is adopted from the Newtonian theory of gravitation. The model can predict bilateral trade flows between trade partners by explaining the relationship between the size of economies, their distance from each other and the amount of their trade (Tinbergen, 1962). Moreover, Tinbergen found that the gravity equations work well when bilateral trade is regressed on GDP. Even though there was a lack of strong economic theory describing the gravity model, Anderson (1979) and Bergstrann (1985) show a direct implication of the model on a theoretical basis of product differentiation and monopolistic competition.

A gravity equation based on the log-linear model is derived by specifying the clearing condition and the symmetry in trade costs between bilateral trade partners (Anderson and Wincoop, 2003) as shown below.

The gravity equation is generally in the multiplicative form as shown by equation 1:

\[ X_{ij} = G S_i M_j \varphi_{ij} \] (1)

where 
- \( X_{ij} \) = the monetary value of exports from country i to country j
- \( G \) = a variable that does not depend on i or j such as the level of world liberalisation
- \( S_i \) = exporter-specific factors
- \( M_j \) = all importer-specific factors
- \( \varphi_{ij} \) = the inverse of bilateral trade costs

In particular, Anderson and Wincoop (2003) develop a context of N countries based on the importance of relative trade costs between two countries, and also develop a context of goods differentiation by the country of origin. A specified gravity equation takes the following form.

\[ X_{ij} = \frac{Y_i Y_j}{Y} \left( \frac{\tau_{ij}}{P_i P_j} \right)^{1-\sigma} \] (2)

where 
- \( Y \) = the world gross domestic product (GDP)

\( Y_i \) and \( Y_j \) = the GDP of countries i and j respectively
\[ \tau_{ij} \] = the cost in country j of importing a good from country i (iceberg trade cost)

\[ P_i \text{ and } P_j \] = composite price indices in country i and j respectively

\[ \sigma \] = the constant elasticity of substitution (\( \sigma > 1 \))

According to equation 2, the log-linear form of the gravity equation is derived as follow.

\[ \ln X_{ij} = \alpha + \ln Y_i + \ln Y_j + (1 - \sigma) \ln \tau_{ij} + (\sigma - 1) \ln P_i + (\sigma - 1) \ln P_j \] (3)

Equation 3 shows that the size of two economies indicated by their GDP, the iceberg trade costs, price levels, and the elasticity of substitution among all goods are independent variables that determine the volume of trade flows. The iceberg trade costs in the log form are shown as equation 4:

\[ \ln \tau_{ij} = \beta \ln D_{ij} + \ln T_{ij} \] (4)

where \( \beta \) = estimated parameter

\[ D_{ij} \] = transportation costs (proxied by distance)

\[ T_{ij} \] = unobserved trade costs

In general, there are a number of econometric methods for estimating the parameters in the developed gravity equation to calculate the tariff equivalents of NTBs (Staiger, 2012). This study employs a residual based approach to estimate all parameters of the gravity equation. The approach compares actual trade flows to potential trade flows estimated from the gravity model and the resulting difference between two trade flows is defined as the trade barriers. However, the difference includes both TBs and NTBs; the equation is therefore adjusted to control for import tariffs and export subsidies as independent variables. The following equation is the adjusted gravity equation.
\[ \ln X_{ij} = \alpha + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln D_{ij} + \beta_4 \ln P_i + \beta_5 \ln P_j + \beta_6 \ln IM_j \] (5)

\[ + \beta_7 \ln EX_i + \theta_i \sum dum_i + \varepsilon_{ij} \]

where \( IM_j \) = import tariff rate imposed by importing country \( j \)

\( EX_i \) = export subsidy rate by exporting country \( i \)

\( dum_i \) = dummy variables

\( \varepsilon_{ij} \) = error term

Nevertheless, equation 5 is developed again with Linder’s hypothesis. According to Linder (1961), countries with similar per capita GDP also tend to trade more with each other. The difference in per capita income is therefore added into the equation to evaluate the trade pattern following Linder’s hypothesis. The augmented equation is shown below.

\[ \ln X_{ij} = \alpha + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln D_{ij} + \beta_4 \ln P_i + \beta_5 \ln P_j + \beta_6 \ln IM_j + \beta_7 \ln EX_i + \beta_8 \ln |dinp_{ij}| + \beta_9 \ln EU + \beta_{10} \ln ASEAN + \varepsilon_{ij} \] (6)

where \( X_{ij} \) = imports from country \( i \) to country \( j \) or exports from \( j \) to \( i \)

\( GDP_i, GDP_j \) = GDP of country \( i \) and \( j \) respectively

\( D_{ij} \) = distance between the capital cities of the importing and exporting country

\( P_i, P_j \) = composite price indices in country \( i \) and \( j \)

\( IM_j \) = import tariffs imposed by importing country \( j \)

\( EX_i \) = export subsidies imposed by exporting country \( i \)

\( |dinp_{ij}| \) = absolute value of the difference between GDP per capita between country \( i \) and \( j \)
\[ EU \] = binary dummy variable for European Union membership
\( \text{ (= 1 if the importing and exporting country are members of the EU simultaneously, and 0 if otherwise)} \)

\[ ASEAN \] = binary dummy variable for ASEAN membership
\( \text{ (= 1 if the importing and exporting country are members of the ASEAN simultaneously, and 0 if otherwise)} \)

\[ \varepsilon_{ij} \] = error term

Economic data of 37 countries (individual member countries of the EU27 and ASEAN countries) with four agricultural sectors (as indicated in table 3.2) is used to estimate the parameters. All the data is cross-sectional and available in 2007 (base year of database in the GTAP version 8). Coefficient values in equation 6 are estimated using the technique of ordinary least square (OLS). In addition, the problem of heteroscedasticity is checked and fixed with White’s covariance matrix estimator to make the regression model unbiased.

### 3.3.1.2 Transformation of NTBs to *ad valorem* tariff equivalents (AVEs)

As noted in 3.3.1.1, a trade barrier is implied as the difference between actual and potential trade flows among countries. When the potential trade flow is estimated from the augmented gravity model (equation 6), the next step is the transformation of NTBs to AVEs. According to equation 6, the residual \( \varepsilon_{ij} \) is defined as the difference between the log form of actual imports and of potential imports shipped from country i to country j (Anderson and Wincoop, 2003). The equation is illustrated below.

\[
\ln X_{ij}^q - \ln X_{ij}^P = (1 - \sigma)\ln T_{ij}
\]  
(7)

where,  
\[ X_{ij}^q \] = actual imports from country i to country j  
\[ X_{ij}^P \] = potential imports from country i to country j  
\[ T_{ij} \] = unobservable trade cost  
\[ \sigma \] = constant elasticity of substitution between all commodities
In relation to this general definition, there are two modifications introduced by Philippidis and Sancjuan (2006). First, a tariff-equivalent of NTBs for each country $j$ is calculated over all trade partners by aggregating actual and potential imports over all trade partners.

Given $S_j^a = \sum_i X_{ij}^a$ and $S_j^p = \sum_i X_{ij}^p$, where $i \neq j$

Equation 7 can be rewritten as:

$$\ln S_j^a - \ln S_j^p = (1 - \sigma) \ln T_j$$

Rearranged as:

$$\ln \left( \frac{S_j^a}{S_j^p} \right) - \ln T_j = -\sigma \ln T_j$$

Subsequently, the relationship between actual and potential imports is normalised by calculating a ratio which is related to a free trade benchmark import ratio. In the meantime, the free trade benchmark ratio is selected from country $j$ with the greatest positive difference between actual and predicted trade. Equation 7 is rewritten as follows.

$$\ln \left( \frac{S_j^a}{S_j^p} \right) - \ln \left( \frac{S_b^a}{S_b^p} \right) = -\sigma \ln T_j$$

Equation 10 can be solved for the tariff-equivalent ($T_j$) of the trade barriers imposed by country $j$ as below.

$$T_j = \exp \left\{ \ln \left( \frac{S_j^a}{S_j^p} \right) - \ln \left( \frac{S_b^a}{S_b^p} \right) \right\}^{-\frac{1}{\sigma}}$$

$$T_j = \left( \frac{S_j^a / S_j^p}{S_b^a / S_b^p} \right)^{-\frac{1}{\sigma}}$$

Since $T_j$ is the power of the AVEs, it needs to minus by 1 in order to obtain the AVEs. Equation 11 can therefore be solved for the AVEs ($T_j - 1$) as follows:
3.3.1.3 Application of NTBs in the GTAP model

Non-tariff barriers typically generate different economic effects such as an increase in costs and trade restrictions. They can be categorised broadly into two main types: the effects arising from the shifts in supply and in demand (Roberts et al., 1999). Supply shifting effects can be identified as technical regulations such as creating standards for products while demand shifting effects are related to any sort of technical regulation (Fugazza and Maur, 2008).

There are a number of studies applying the tariff equivalent of NTBs into CGE models such as Philippidis and Carrington (2005), Philippidis and Sanjuán (2007a, 2007b), Winchester (2009) as well as Chang and Hayakawa (2010). Andriamananjara et al. (2003) state that the tariff equivalent of NTBs can be calculated as a tariff barrier in CGE models when the analysed policies directly affect the domestic prices of imported goods. This implies that economic rents stemming from higher import prices can be computed by the importing country. Otherwise, if the policies result in efficiency reduction and import discouragement, such as in the case of technical regulations, instead of economic rents, the tariff equivalent of NTBs should be treated as an effective import price.

According to Hertel et al. (2001a), the removal of NTBs is introduced in the GTAP model as an additional effective import price, that is, a difference between the observed import price and an exogenous unobserved technical coefficient as follow.

\[
(T_j - 1) = \left( \frac{S_j^a}{S_j^p} \right)^{-1} \sigma - 1
\]  

(12)

where

\[
pms_{irs}^* = pms_{irs} - ams_{irs}
\]

(13)

where \( pms_{irs}^* \) = effective market price by source of commodity \( i \) imported from country \( r \) to country \( s \)

\( pms_{irs} \) = observed market price by source of commodity \( i \) imported from country \( r \) to country \( s \)
\[ ams_{irs} = \text{unobserved technical change in region s due to imports of commodity i from region r} \]

Trade costs that are removed from an exporter result in a rise of \( ams_{irs} \) based on the assumption stating that \( ams_{irs} \) is equal to one in the initial equilibrium. The effective domestic price of product i exported from country r to s (\( pms_{irs}^* \)) decreases and therefore results in a reduction of real resource costs. Furthermore, the increase in \( ams_{irs} \) and the corresponding efficiency improvement reflects that the effective quantity of imported product i from country r to s associated with the price is increased, leading to the import demand and composite import price equation as follows (Hertel et al., 2001a).

\[ qxs_{irs}^* = qxs_{irs} + ams_{irs} \]  

(14)

where \( qxs_{irs}^* \) = effective quantity of exports of commodity i from country r to country s

\[ qxs_{irs} \] = observed quantity of exports of commodity i from country r to country s

Equations 13 and 14 are developed and included into the latest version of the GTAP model.

### 3.3.2 Data aggregation and scenario design

This study applies the GTAP database version 8 where the data is collected on the base year 2007. The database consists of 129 regions and 57 sectors. However, since only the EU and ASEAN as well as the agricultural sectors are the main focus for this study, data aggregation is therefore necessary. The regions are aggregated into 13 regions and the commodities are aggregated into 6 sectors. The detail is shown in table 3.2 below.
### Table 3.2 Region and sector aggregation

<table>
<thead>
<tr>
<th>Regions</th>
<th>Sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU-27</td>
<td>Paddy rice</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Vegetable oil</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Meat</td>
</tr>
<tr>
<td>Philippines</td>
<td>Sugar</td>
</tr>
<tr>
<td>Singapore</td>
<td>Other agricultural commodities</td>
</tr>
<tr>
<td>Thailand</td>
<td>Manufacturing and Service commodities</td>
</tr>
<tr>
<td>Vietnam</td>
<td></td>
</tr>
<tr>
<td>Other ASEAN (including Brunei Darussalam, Cambodia, Lao PDR and Myanmar)</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td></td>
</tr>
<tr>
<td>South Korea</td>
<td></td>
</tr>
<tr>
<td>Rest of the World</td>
<td></td>
</tr>
</tbody>
</table>

Furthermore, to compare the impact of tariff elimination without an NTB effect elimination to that of tariff elimination including an NTB effect elimination, two scenarios are designed in this study. Scenario 1 assumes that the free trade agreement between the EU and ASEAN implies a 100 percent tariff barrier elimination in the agricultural sector without eliminating NTBs. For scenario 2, it is similar to scenario 1 but the elimination of NTBs in the agricultural sector between the EU and ASEAN is also taken into account.

The simulations are conducted in the GEMPACK (General Equilibrium Modelling Package) computer programme.

### 3.4 Food security assessment model

The International Food Security Assessment model is developed by USDA’s Economic Research Service for projections of food consumption. In the model, the food security of a country is assessed as the gap between projected domestic food
consumption and a consumption target. The results of projections provide a baseline for the food security situation in the countries concerned.

Partial equilibrium recursive equations are employed to evaluate food security in the ASEAN countries. For this study, each country’s model comprises four commodity groups: rice, vegetable oil, meat, and sugar. The model is described as follows.

Food consumption is defined as the difference between domestic supply and non-food use, where subscripts f, n and t stand for food commodity, country and time respectively. The equation for food consumption is shown as follow.

\[ CON_{fct} = DQ_{fct} - NF_{fct} \]  \hspace{1cm} (15)

where \( CON_{fct} \) = Food consumption
\( DQ_{fct} \) = Domestic supply
\( NF_{fct} \) = Non-food use

In addition, the non-food use can be explained as a summation of every use of the commodity including exports. The non-food use is therefore described as the following equation.

\[ NF_{fct} = SU_{fct} + FU_{fct} + EX_{fct} + OU_{fct} \]  \hspace{1cm} (16)

where \( SU_{fct} \) = Seed use
\( FU_{fct} \) = Feed use
\( EX_{fct} \) = Exports
\( OU_{fct} \) = Other uses
Meanwhile, the domestic supply of a commodity in equation 15 is defined in equation 17.

\[ DQ_{fct} = PR_{fct} + IM_{fct} + CS_{fct} + FA_{fct} \]  \hspace{1cm} (17)

where  
- \( PR_{fct} \) = Domestic production  
- \( IM_{fct} \) = Commercial imports  
- \( CS_{fct} \) = Change in stocks  
- \( FA_{fct} \) = Food aid

For the domestic production side, in the food security assessment model, production is determined by the real domestic price, the real domestic price of substitute goods, and the domestic supply of substitute goods. The production equation is shown as follows.

\[ PR_{fct} = f(DRP_{fct}, SDRP_{fct}, SDQ_{fct}) \]  \hspace{1cm} (18)

where  
- \( DRP_{fct} \) = Real domestic price  
- \( SDRP_{fct} \) = Real domestic substitute price  
- \( SDQ_{fct} \) = Domestic substitute supply

The real domestic price is defined in equation 19.

\[ DRP_{fct} = f(DRP_{fct-1}, DQ_{fct}, SDQ_{fct}, RY_{fct}, REX_{fct}) \]  \hspace{1cm} (19)

where  
- \( RY_{fct} \) = Real income  
- \( REX_{fct} \) = Real exchange rate

Commercial imports are assumed as a function of the domestic price, world commodity price, and foreign exchange availability. Foreign exchange availability is a key determinant of commercial food imports and is the sum of the value of export earnings and the net flow of credit. The commercial import demand function is therefore defined as follows.
\[ IM_{fct} = f(WRP_{fct}, SWRP_{fct}, FEX_{fct}, DRP_{fct}) \] (20)

where

\[ WRP_{fct} \quad = \text{Real world food price} \]
\[ SWRP_{fct} \quad = \text{Real world substitute price} \]
\[ FEX_{fct} \quad = \text{Real foreign exchange availability} \]

### 3.5 Conclusion

This chapter has shed light on the models which are adopted in the PhD thesis. Since the study is conducted under the CGE framework, the basic concept of the CGE model is described in section 3.1 while the particular CGE model, GTAP, is structurally described in section 3.2. In addition, because a number of previous studies ignored considering the NTBs effects when analysing the impact of trade liberalisation, this study aims to take the effects of NTBs elimination into account and section 3.3 thus explains how to implement the NTBs effects into the GTAP model. Finally, as the main objective of this study, a food security assessment model is applied to evaluate the food security situation in each ASEAN country and is thoroughly illustrated in the final section.
Chapter 4 Macroeconomic results

This chapter aims to show the simulation results estimated from the models described in chapter 3, including the augmented Gravity equation and the GTAP model. The analysis framework is illustrated in subsection 4.1 to understand the overall process of analysis. Subsection 4.2 describes the empirical results from the augmented Gravity Equation while the results of ad valorem tariff equivalent calculations are shown in subsection 4.3. The results derived from the GTAP model are explained in subsection 4.4-4.6. A summary of macroeconomic results is illustrated in subsection 4.4 while the results by commodities are described in subsection 4.5 and subsection 4.6 is created to explain changes in the pattern of trade. Finally, the conclusions of this chapter are shown in subsection 4.7.

4.1 Analysis framework

As clearly illustrated in Figure 4.1, two scenarios are conducted in this study: scenario 1 assumes that trade liberalisation between the EU-27 and ASEAN is established involving the elimination of tariff barriers only, while scenario 2 takes the elimination of both tariff and non-tariff barriers into account. The next step is to introduce a shock (elimination of trade barriers) into the GTAP model for both scenarios. The results are obtained in the form of macroeconomic variables such as changes in imports, exports and production overall and in the individual selected commodity. All the results mentioned above are described in this chapter. To analyse the impact on ASEAN food security, the results obtained from the GTAP model are used as shock variables in the Food Security Assessment Model to evaluate and project the food security situation in the ASEAN countries and this is elaborated in chapter 5. Eventually, the results of the food security analysis lead to a number of policy implications in chapter 6.
Figure 4.1 Analysis framework of the study

Scenario 1
Tariff elimination without NTBs elimination

Scenario 2
Tariff elimination with NTBs elimination

Shock

GTAP

Results from scenario 1
- Macroeconomic results
- Results by commodities
- Pattern of trade

Shock

Food Security Assessment Model

Results of food security projection in ASEAN from scenario 1

Results of food security projection in ASEAN from scenario 2

Policy implications
4.2 Empirical results of the augmented Gravity Equation

This subsection presents the empirical findings estimated from the augmented Gravity Equation including the data used in the model.

4.2.1 Data used in the augmented Gravity Equation

The data used in the Gravity Equation is collected from different sources as shown in table 4.1.

Table 4.1 Data used in the augmented Gravity Equation

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_{ij}$</td>
<td>GTAP database version 8</td>
<td>imports from country i to country j (million USD)</td>
</tr>
<tr>
<td>$GDP_i, GDP_j$</td>
<td></td>
<td>GDP of country i and j (million USD)</td>
</tr>
<tr>
<td>$D_{ij}$</td>
<td>distance between the capital cities of the importing and exporting country (kilometre)</td>
<td></td>
</tr>
<tr>
<td>$IM_j$</td>
<td>import tariffs imposed by importer j (percent)</td>
<td></td>
</tr>
<tr>
<td>$EX_i$</td>
<td>export subsidies imposed by exporter i (percent)</td>
<td></td>
</tr>
<tr>
<td>$P_i, P_j$</td>
<td>IMF</td>
<td>composite price indices in country i and j proxied by consumer price indices (2000=100)</td>
</tr>
<tr>
<td>$</td>
<td>dinp_{ij}</td>
<td>$</td>
</tr>
<tr>
<td>$EU$</td>
<td>European Commission</td>
<td>binary dummy variable for EU-27 membership (EU=1, otherwise=0)</td>
</tr>
<tr>
<td>$ASEAN$</td>
<td>ASEAN Secretariat</td>
<td>binary dummy variable for ASEAN membership (ASEAN=1, otherwise=0)</td>
</tr>
</tbody>
</table>

The data is drawn from economic data of 37 countries (individual member countries of the EU27 and ASEAN countries) with four agricultural sectors (as indicated in table 3.2). All the data is cross-sectional and available in 2007 (base year of the database in the GTAP version 8). The GTAP database version 8 provides data for import values, GDP, distance between importing and exporting countries, import tariffs, and export subsidies. The composite price indices are proxied by the consumer price indices with the base year 2000. The absolute value
of the difference between GDP per capita in country i and j is calculated from the GDP data in the GTAP database version 8 while the binary dummy variables are defined depending on the regions in which the countries are located. Coefficient values in equation 6 are estimated using the technique of ordinary least square (OLS) and the problem of heteroscedasticity is checked and fixed by White’s covariance matrix estimator to make the regression model unbiased.

4.2.2 Findings

The empirical results of equation 6 shown in table 4.2 invite a necessary explanation of bilateral trade patterns among trade partners in the EU-27 and ASEAN by the gravity equation across countries in staple food sectors. Rice, vegetable oils, meats and sugar mainly provide nutritional energy for people living in ASEAN countries (WHO, 2012), therefore, these foods are selected for the food security analysis of ASEAN countries in this study.

Table 4.2 Estimated coefficients from the augmented Gravity Equation

<table>
<thead>
<tr>
<th></th>
<th>Rice</th>
<th>Vegetable oil</th>
<th>Meat</th>
<th>Sugar</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant term</td>
<td>-23.06*</td>
<td></td>
<td></td>
<td>-15.46*</td>
</tr>
<tr>
<td>$GDP_i$</td>
<td>0.91**</td>
<td>0.86**</td>
<td>0.82**</td>
<td>0.76**</td>
</tr>
<tr>
<td>$GDP_j$</td>
<td>0.52**</td>
<td>0.68**</td>
<td>0.79**</td>
<td>0.70**</td>
</tr>
<tr>
<td>$D_{ij}$</td>
<td>-0.35**</td>
<td>-0.90**</td>
<td>-0.84**</td>
<td>-0.91**</td>
</tr>
<tr>
<td>$P_i$</td>
<td>-12.69*</td>
<td>-9.75**</td>
<td>-13.38**</td>
<td></td>
</tr>
<tr>
<td>$P_j$</td>
<td>6.32*</td>
<td>-5.53*</td>
<td>8.56**</td>
<td>3.48*</td>
</tr>
<tr>
<td>$IM_j$</td>
<td>-0.01**</td>
<td>-0.01**</td>
<td>-0.01**</td>
<td>-0.01**</td>
</tr>
<tr>
<td>$EX_i$</td>
<td>0.01*</td>
<td></td>
<td>0.09*</td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>dinp_{ij}</td>
<td>$</td>
<td></td>
<td>-0.09*</td>
</tr>
<tr>
<td>$EU$</td>
<td>2.13**</td>
<td>0.48**</td>
<td>1.95**</td>
<td>0.51**</td>
</tr>
<tr>
<td>ASEAN</td>
<td>4.29**</td>
<td>3.89**</td>
<td>2.11**</td>
<td>2.65**</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.48</td>
<td>0.51</td>
<td>0.64</td>
<td>0.52</td>
</tr>
</tbody>
</table>

Note: *, ** represent 95 percent and 99 percent levels of confidence respectively.

Source: Calculations by the technique of OLS.
For all the staple food sectors, the parameters estimated for GDP of both importing and exporting countries have positive values and statistical significance at the 99 percent level of confidence, implying that a country with higher income tends to possess more commodities for export and also to generate a higher propensity to consume, leading to increasing imports.

The transportation cost in the Gravity Equation is theoretically represented by the distance between two trade partners. The coefficients estimated for the distance are negative and statistically significant at the 99 percent level for all sectors, particularly the rice sector with a distance coefficient showing a low value. This may be because rice is the most vital commodity compared to the others; therefore, longer distance can negatively affect a small change in rice imports.

The impact of relative price indicators (proxied by consumer price indices) is mixed across the food sectors, depending on whether it is the price of the exporter or importer. The price of importing countries is statistically significant in the cases of rice, meat products and sugar, and shows positive effects while the price of exporting countries is also statistically significant in rice, vegetable oils and meat, but shows negative effects.

For import tariffs and export subsidies, the coefficients illustrate negative relationships between tariffs and import values, but show positive relationships between subsidies and import values. The interpretation of the relationships is clear: a high level of food import tariffs imposed in importing countries leads to a decrease in food import quantity. However, the effect is relatively small for all food products. This can be explained that tariff barriers alone can only insignificantly determine the pattern of trade. Therefore, this study also estimates the effects of the reduction of tariff barriers and non-tariff barriers. Nevertheless, the Linder effect (differences in per capita income) is observed in vegetable oils and meat sectors; it is negative and statistically significant at the 95 percent of confidence, implying that trade of these foods declines when larger differences occur in factor endowments. In addition, the coefficients estimated for the dummy variables describe that the volume of intra-trade for these food commodities among ASEAN countries is higher than that among the EU-27.
The $R^2$ coefficients for these vital foods are relatively low with the exception of meat accounting for 64 percent. The remaining three agricultural sectors, including rice, vegetable oil and sugar, show a value of $R^2$ ranging between 0.48 and 0.52, meaning that about only 50 percent of the variation in the imports of these commodities can be explained by all the variables in the Gravity Equation. This implies that these economic variables specified in the model may not fully be able to provide an appropriate explanation of the trading pattern for these agricultural products. The rest of explanatory variables may be a relatively strong interference in the staple food markets in the trade partner countries.

### 4.3 Results of the ad valorem tariff equivalent calculation

This subsection shows the empirical results derived from the calculation of the ad valorem tariff equivalent (equation 12) including the data used for the calculation.

#### 4.3.1 Data used for the ad valorem tariff equivalent calculation

An importance of the ad valorem tariff equivalent (AVEs) calculation is the elasticity of substitution ($\sigma$) since the value is sensitive to the level of industry (Hummels, 1999). There are a number of studies adopting different values of elasticity of substitution. Francois et al. (2003), for example, employed values of substitution elasticity ranging from 1.26 to 1.68 while Hummels (1999) and Park (2002) adopted 4.80, 5.60 and 6.90 for different industries. Particularly for agriculture and food, Fragiadakis et al. (2012) used values between 0.36 and 0.73 for various agricultural sectors while Merel et al. (2011) employed 0.48 for rice. However, Francois et al. (2003) and Walsh (2006) adopted elasticity values from GTAP database version 5.2 to use for the AVEs calculation in their works. Since GTAP database also provides different values of elasticity of substitution for different industries, this study therefore employs the values from the GTAP database version 8 to calculate the tariff equivalent for consistency of the data used in this work. In addition, values of tariff barriers are also collected from GTAP database version 8 to use for comparison with the tariff equivalent of NTBs.
4.3.2 Findings

The results of the ad valorem tariff equivalent calculated from equation 12 are shown below. Table 4.3 presents the import tariffs and AVEs of each ASEAN country levied on imports from the EU-27 while table 4.4 reports the import tariffs and AVEs imposed by the EU-27 against imports from each country in ASEAN.

**Table 4.3** ASEAN ad valorem tariffs and tariff equivalents of NTBs against EU-27 imports

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Indonesia</th>
<th>Malaysia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TBs</td>
<td>NTBs</td>
<td>TBs</td>
</tr>
<tr>
<td>Rice</td>
<td>0</td>
<td>145.5</td>
<td>0</td>
</tr>
<tr>
<td>Vegetable oils</td>
<td>5.7</td>
<td>78.3</td>
<td>1.9</td>
</tr>
<tr>
<td>Meat</td>
<td>2.0</td>
<td>64.9</td>
<td>3.2</td>
</tr>
<tr>
<td>Sugar</td>
<td>11.9</td>
<td>161.2</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Calculations by the augmented Gravity Equations.

**Table 4.3** ASEAN ad valorem tariffs and tariff equivalents of NTBs against EU-27 imports (cont.)

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Vietnam</th>
<th>Other ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TBs</td>
<td>NTBs</td>
<td>TBs</td>
<td>NTBs</td>
</tr>
<tr>
<td>Rice</td>
<td>0</td>
<td>75.4</td>
<td>52.0</td>
<td>194.6</td>
</tr>
<tr>
<td>Vegetable oils</td>
<td>0</td>
<td>32.1</td>
<td>26.4</td>
<td>84.3</td>
</tr>
<tr>
<td>Meat</td>
<td>0</td>
<td>114.2</td>
<td>38.2</td>
<td>175.3</td>
</tr>
<tr>
<td>Sugar</td>
<td>0</td>
<td>39.7</td>
<td>29.8</td>
<td>121.7</td>
</tr>
</tbody>
</table>

Source: Calculations by the augmented Gravity Equations.
Table 4.4 EU-27 ad valorem tariffs and tariff equivalents of NTBs against ASEAN imports (cont.)

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Vietnam</th>
<th>Other ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TBs</td>
<td>NTBs</td>
<td>TBs</td>
<td>NTBs</td>
</tr>
<tr>
<td>Rice</td>
<td>62.0</td>
<td>138.4</td>
<td>81.5</td>
<td>258.5</td>
</tr>
<tr>
<td>Vegetable oils</td>
<td>7.1</td>
<td>81.2</td>
<td>3.6</td>
<td>94.3</td>
</tr>
<tr>
<td>Meat</td>
<td>2.4</td>
<td>101.2</td>
<td>22.4</td>
<td>87.8</td>
</tr>
<tr>
<td>Sugar</td>
<td>28.8</td>
<td>135.4</td>
<td>47.0</td>
<td>142.5</td>
</tr>
</tbody>
</table>

Source: Calculations by the augmented Gravity Equations.

According to table 4.3, tariffs imposed in ASEAN countries vary, ranging from zero percent to 52 percent. Zero tariffs are imposed in Singapore on all the focused foods while Thailand still imposes relatively high tariff levels, especially on rice. Rice imports from the EU-27 are imposed on at the highest level in Thailand, accounting for 52 percent whereas other ASEAN countries levy no tariff on rice. In addition, Thailand’s import tariff level is highest for other foods such as meat and vegetable oils, accounting for more than 20 percent. However, the group of other ASEAN countries (including Brunei, Cambodia, Laos PDR and Myanmar) imposes the lowest tariff level levied on every group of imports.
Nevertheless, the EU-27’s protection against ASEAN imports is higher. Rice exported from ASEAN countries to the EU-27 experience high tariff rates ranging from 62 percent for Singapore’s rice export to 100 percent for rice exports from Indonesia. In addition, the tariffs levied on sugar imports from the Philippines and the group of other ASEAN countries are substantially high, accounting for 165 and 170 percent respectively. However, the tariff rates levied on other food imports, especially on vegetable oils, are relatively low.

However, the tariff equivalent of non-tariff barriers is clearly much higher than the tariff barriers in both regions. Even though foods are imported with zero tariffs in Singapore, the country applies non-tariff barriers as protection instead. The non-tariff barrier in Singapore against food imported from the EU-27 is calculated as between 32 and 114 percent; however, Singapore’s tariff equivalent is lowest for vegetable oils and also for other foods on average, but still higher than the tariff rates. By contrast, Thailand’s NTBs for rice and meat are equivalent to 195 and 175 percent respectively, imposing the highest AVEs for rice and meat imports in ASEAN; while the AVEs levied on sugar is highest in the Philippines and Indonesia.

Similarly, the EU-27’s non-tariff protection against ASEAN imports is higher than its tariff rates. The NTBs on rice exported from ASEAN countries to the EU-27 is equivalent to 323 percent for Indonesia’s rice exports and 138 percent for rice exports from Singapore. In addition, the AVEs levied on sugar imports from the group of other ASEAN countries and the Philippines are also higher than the tariff rates, accounting for 181 and 178 percent respectively. However, the non-tariff protection on meat and vegetable oil imports is relatively low compared to those levied on other food imports.

The results are reliable since not only the explicit trade restrictions between the EU-27 and ASEAN are shown in the figures but the implicit effects from all related factors that may affect trade costs are also revealed. In addition, the high level of non-tariff barriers shown in this result is in line with those of other studies, such as the study of Ando and Obashi (2010).
4.4 Summary of macroeconomic results

Overall trade liberalisation is expected to result in significant positive impacts (including GDP, real income, trade and employment) for ASEAN under both scenarios. Throughout the study, almost every country gains benefits from the FTA for each indicator; however, some negative effects are noticeable for Indonesia, Malaysia, the Philippines, and the group of other ASEAN countries including Brunei, Cambodia, Laos PDR, and Myanmar. These findings are consistent with the results of previous studies involving experiments on the impact of trade liberalisation on members of ASEAN (Asian Development Bank, 2010). A summary of macro-economic effects calibrated from the GTAP model for the EU and each of the ASEAN countries is shown in table 4.5.
Table 4.5 Summary of macroeconomic results

**Scenario 1: 100% tariff reduction without NTBs elimination**

<table>
<thead>
<tr>
<th></th>
<th>EU-27</th>
<th>IDN</th>
<th>MYS</th>
<th>PHL</th>
<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other</th>
<th>ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP value index</td>
<td>0.000</td>
<td>0.062</td>
<td>0.042</td>
<td>0.023</td>
<td>0.010</td>
<td>0.134</td>
<td>0.002</td>
<td>0.016</td>
<td></td>
</tr>
<tr>
<td>Real income</td>
<td>0.000</td>
<td>0.065</td>
<td>0.046</td>
<td>0.025</td>
<td>0.012</td>
<td>0.172</td>
<td>0.002</td>
<td>0.016</td>
<td></td>
</tr>
<tr>
<td>Term of trade</td>
<td>-0.002</td>
<td>0.038</td>
<td>0.020</td>
<td>0.009</td>
<td>0.007</td>
<td>0.097</td>
<td>-0.002</td>
<td>-0.003</td>
<td></td>
</tr>
<tr>
<td>Value of exports</td>
<td>0.001</td>
<td>0.087</td>
<td>-0.002</td>
<td>0.047</td>
<td>0.001</td>
<td>0.077</td>
<td>0.013</td>
<td>0.009</td>
<td></td>
</tr>
<tr>
<td>Value of imports</td>
<td>0.004</td>
<td>0.069</td>
<td>0.003</td>
<td>0.053</td>
<td>0.001</td>
<td>-0.052</td>
<td>0.003</td>
<td>-0.017</td>
<td></td>
</tr>
<tr>
<td>Trade balance (million USD)</td>
<td>-139.16</td>
<td>22.93</td>
<td>-5.62</td>
<td>-1.56</td>
<td>1.84</td>
<td>146.44</td>
<td>3.10</td>
<td>2.64</td>
<td></td>
</tr>
<tr>
<td>Price index of exports</td>
<td>-0.003</td>
<td>0.044</td>
<td>0.028</td>
<td>0.015</td>
<td>0.001</td>
<td>0.101</td>
<td>0.004</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>Price index of imports</td>
<td>-0.001</td>
<td>0.006</td>
<td>0.009</td>
<td>0.006</td>
<td>0.007</td>
<td>0.003</td>
<td>0.006</td>
<td>0.018</td>
<td></td>
</tr>
<tr>
<td>Private consumption expenditure</td>
<td>-0.000</td>
<td>0.067</td>
<td>0.045</td>
<td>0.027</td>
<td>0.011</td>
<td>0.181</td>
<td>0.003</td>
<td>0.018</td>
<td></td>
</tr>
<tr>
<td>Price index of private consumption</td>
<td>-0.003</td>
<td>0.059</td>
<td>0.021</td>
<td>0.012</td>
<td>0.002</td>
<td>0.121</td>
<td>0.003</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>Demand for net saving</td>
<td>0.001</td>
<td>0.029</td>
<td>0.030</td>
<td>0.012</td>
<td>0.014</td>
<td>0.121</td>
<td>0.002</td>
<td>0.003</td>
<td></td>
</tr>
</tbody>
</table>

**Scenario 2: 100% tariff reduction with NTBs effects elimination**

<table>
<thead>
<tr>
<th></th>
<th>EU-27</th>
<th>IDN</th>
<th>MYS</th>
<th>PHL</th>
<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other</th>
<th>ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP value index</td>
<td>0.027</td>
<td>0.805</td>
<td>0.677</td>
<td>0.445</td>
<td>0.045</td>
<td>-0.050</td>
<td>0.713</td>
<td>0.045</td>
<td>0.183</td>
</tr>
<tr>
<td>Real income</td>
<td>0.035</td>
<td>0.240</td>
<td>0.111</td>
<td>0.027</td>
<td>-0.000</td>
<td>-0.011</td>
<td>-0.057</td>
<td>-0.239</td>
<td></td>
</tr>
<tr>
<td>Term of trade</td>
<td>-0.008</td>
<td>0.512</td>
<td>0.294</td>
<td>0.181</td>
<td>-0.063</td>
<td>0.490</td>
<td>-0.009</td>
<td>0.023</td>
<td></td>
</tr>
<tr>
<td>Value of exports</td>
<td>-0.026</td>
<td>1.121</td>
<td>0.053</td>
<td>0.317</td>
<td>0.012</td>
<td>0.477</td>
<td>0.056</td>
<td>0.220</td>
<td></td>
</tr>
<tr>
<td>Value of imports</td>
<td>0.007</td>
<td>0.905</td>
<td>0.085</td>
<td>0.367</td>
<td>0.002</td>
<td>-0.298</td>
<td>0.002</td>
<td>-0.060</td>
<td></td>
</tr>
<tr>
<td>Trade balance (million USD)</td>
<td>-460.03</td>
<td>95.65</td>
<td>-6.30</td>
<td>-9.52</td>
<td>9.01</td>
<td>295.41</td>
<td>9.56</td>
<td>16.05</td>
<td></td>
</tr>
<tr>
<td>Price index of exports</td>
<td>-0.018</td>
<td>0.550</td>
<td>0.356</td>
<td>0.223</td>
<td>0.011</td>
<td>0.524</td>
<td>0.038</td>
<td>0.137</td>
<td></td>
</tr>
<tr>
<td>Price index of imports</td>
<td>-0.009</td>
<td>0.037</td>
<td>0.062</td>
<td>0.042</td>
<td>0.074</td>
<td>0.034</td>
<td>0.047</td>
<td>0.114</td>
<td></td>
</tr>
<tr>
<td>Private consumption expenditure</td>
<td>0.032</td>
<td>0.196</td>
<td>0.441</td>
<td>0.215</td>
<td>-0.033</td>
<td>0.421</td>
<td>0.019</td>
<td>0.009</td>
<td></td>
</tr>
<tr>
<td>Price index of private consumption</td>
<td>-0.013</td>
<td>0.722</td>
<td>0.258</td>
<td>0.265</td>
<td>-0.051</td>
<td>0.630</td>
<td>0.039</td>
<td>0.274</td>
<td></td>
</tr>
<tr>
<td>Demand for net saving</td>
<td>0.028</td>
<td>0.391</td>
<td>0.495</td>
<td>0.279</td>
<td>-0.083</td>
<td>0.663</td>
<td>0.038</td>
<td>0.078</td>
<td></td>
</tr>
</tbody>
</table>

Source: Simulation results from the GTAP model
Table 4.5 shows the macro-economic impact of trade liberalisation on various economic variables such as change in GDP, trade value and consumption for the EU-27 and individual ASEAN country. According to scenario 1, the ASEAN countries experience overall an economic expansion after eliminating all tariff barriers in line with international trade theory. The 100 percent reduction of tariff barriers due to the EU-ASEAN FTA results in all the ASEAN countries increasing their GDP value. In the meantime, Thailand gains the largest increase in real income of 0.172 percent while Vietnam experiences the least growth of real income of 0.046 percent. In addition, the value of exports of Indonesia and Thailand grow by 0.087 and 0.077 percent respectively, leading to a rise in the trade balance of 22.93 million USD for Indonesia and 146.44 million USD for Thailand. However, Malaysia’s and The Philippines’ trade balances fall by 5.62 and 1.56 million USD respectively after the establishment of the EU-ASEAN FTA. The price indices of merchandise exports in Thailand, Indonesia and Malaysia increase the most by 0.101, 0.044 and 0.028 percent respectively while the price indices of merchandise imports also rise by 0.003, 0.006 and 0.009 percent respectively. For the group of other ASEAN countries, the price index of imports rises over that of exports, resulting in a 0.003 percent decline in the terms of trade. Meanwhile, even though Thailand gains the most advantages from the FTA, Thai people face the highest inflation rate, measured by private consumption prices, accounting for 0.181 percent.

For the EU-27, GDP value and real income remain unchanged after implementing the free trade agreement. Private EU consumption is also constant since real income stays unaffected. However, free trade contributes to 0.004 percent growth of import value while the value of exports rises only by 0.001 percent. This decreases the trade balance of the EU-27 by 139.16 million USD. Furthermore, the price index of exports falls under that of imports, leading to a 0.002 percent drop in the terms of trade.

In scenario 2, the simultaneous elimination of both tariff and non-tariff protection is taken into account, and the overall impact is greater than that in scenario 1. The ASEAN countries experience economic growth after eradicating all tariff and non-tariff barriers. Almost every ASEAN country, with the exception of Singapore,
benefits from an increase in GDP value resulting from the 100 percent reduction of tariff barriers including non-tariff barrier elimination simulated in scenario 2. Indonesia instead of Thailand becomes the country which experiences the largest increase in real income, accounting for 0.240 percent whereas the group of other ASEAN countries Vietnam and Thailand, which enjoy a rise in real income in scenario 1, encounter a drop of 0.239, 0.057 and 0.011 respectively in scenario 2. This could be because the growth rate of inflation surpasses that of income in these countries. In addition, Indonesia and Thailand are still at the top of ASEAN countries which gain the largest increase in export values, reporting 1.121 and 0.477 percent respectively, and resulting in trade balance growth of 95.65 million USD for Indonesia and 295.41 million USD for Thailand. By contrast, the trade balances for the Philippines and Malaysia drop by 15.25 and 7.30 million USD respectively, more than those estimated in scenario 1. Indonesia and Thailand experience an increasing export-import price gap compared to that in scenario 1, leading to the greatest increase in the terms of trade, recording 0.512 and 0.490 respectively, while the terms of trade in Singapore and Vietnam become negative. Despite the highest estimated benefits that Indonesia and Thailand gain from the EU-ASEAN FTA with non-tariff barrier elimination, people in these two countries also encounter the highest inflation in the private consumption price, accounting for 0.722 and 0.630 percent respectively.

For the impact on the EU-27, the GDP value and real income increase by 0.027 and 0.033 percent respectively after implementing the free trade agreement. Conversely, all the price indices face a drop ranging from 0.009 to 0.018 percent, implying theoretically that people living in member states of the EU-27 should experience lower retail prices, should these price decreases be passed through to the final consumer. However, since the 100 percent reduction of both tariff and non-tariff barriers is applied, the import value increases while the export value declines, leading to an increasing drop in the trade balance of 460.03 million USD.
4.5 Analysis by individual commodities

This subsection describes the results estimated from the GTAP model as individual selected commodities including rice, meat, vegetable oils and sugar. The results are shown as follows.

4.5.1 Impact on the rice sector

Table 4.6 Impact on the rice sector

<table>
<thead>
<tr>
<th>Scenario 1: 100% tariff reduction without NTBs elimination</th>
<th>EU-27</th>
<th>IDN</th>
<th>MYS</th>
<th>PHL</th>
<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade balance (million USD)</td>
<td>-50.46</td>
<td>0.42</td>
<td>-1.85</td>
<td>0.02</td>
<td>0.01</td>
<td>109.56</td>
<td>4.55</td>
<td>1.04</td>
</tr>
<tr>
<td>Import price</td>
<td>-0.31</td>
<td>0.57</td>
<td>1.02</td>
<td>-0.09</td>
<td>0.37</td>
<td>-0.18</td>
<td>0.01</td>
<td>-0.02</td>
</tr>
<tr>
<td>Domestic price</td>
<td>-1.01</td>
<td>0.29</td>
<td>-0.19</td>
<td>-0.06</td>
<td>0.48</td>
<td>2.26</td>
<td>0.10</td>
<td>0.18</td>
</tr>
<tr>
<td>Production</td>
<td>-10.05</td>
<td>0.07</td>
<td>-0.39</td>
<td>-0.02</td>
<td>2.97</td>
<td>2.10</td>
<td>0.15</td>
<td>0.11</td>
</tr>
<tr>
<td>Exports</td>
<td>-22.03</td>
<td>2.02</td>
<td>-15.93</td>
<td>4.67</td>
<td>3.83</td>
<td>32.20</td>
<td>9.43</td>
<td>13.55</td>
</tr>
<tr>
<td>Imports</td>
<td>1.12</td>
<td>-0.99</td>
<td>-5.64</td>
<td>0.76</td>
<td>0.04</td>
<td>15.15</td>
<td>0.46</td>
<td>1.02</td>
</tr>
<tr>
<td>Value of exports</td>
<td>-23.04</td>
<td>2.31</td>
<td>-16.13</td>
<td>4.73</td>
<td>4.32</td>
<td>33.46</td>
<td>9.54</td>
<td>13.71</td>
</tr>
<tr>
<td>Value of imports</td>
<td>0.81</td>
<td>-0.47</td>
<td>-4.70</td>
<td>0.67</td>
<td>0.38</td>
<td>15.98</td>
<td>0.46</td>
<td>1.01</td>
</tr>
<tr>
<td>Real wage</td>
<td>-0.01</td>
<td>0.07</td>
<td>-0.03</td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.12</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 2: 100% tariff reduction with NTBs effects elimination</th>
<th>EU-27</th>
<th>IDN</th>
<th>MYS</th>
<th>PHL</th>
<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade balance (million USD)</td>
<td>-162.63</td>
<td>1.95</td>
<td>10.37</td>
<td>0.12</td>
<td>0.01</td>
<td>337.91</td>
<td>30.23</td>
<td>30.75</td>
</tr>
<tr>
<td>Import price</td>
<td>-2.33</td>
<td>3.13</td>
<td>5.36</td>
<td>3.43</td>
<td>2.63</td>
<td>2.09</td>
<td>0.04</td>
<td>-0.03</td>
</tr>
<tr>
<td>Domestic price</td>
<td>-7.57</td>
<td>3.49</td>
<td>6.09</td>
<td>1.08</td>
<td>2.22</td>
<td>6.87</td>
<td>0.67</td>
<td>2.96</td>
</tr>
<tr>
<td>Production</td>
<td>-21.30</td>
<td>0.77</td>
<td>7.50</td>
<td>0.39</td>
<td>5.89</td>
<td>6.66</td>
<td>0.95</td>
<td>2.75</td>
</tr>
<tr>
<td>Imports</td>
<td>8.74</td>
<td>2.96</td>
<td>6.93</td>
<td>-4.78</td>
<td>-0.00</td>
<td>22.76</td>
<td>3.00</td>
<td>5.22</td>
</tr>
<tr>
<td>Value of exports</td>
<td>-37.89</td>
<td>13.24</td>
<td>6.80</td>
<td>9.91</td>
<td>4.31</td>
<td>49.82</td>
<td>22.25</td>
<td>33.64</td>
</tr>
<tr>
<td>Value of imports</td>
<td>9.07</td>
<td>3.77</td>
<td>7.21</td>
<td>-4.06</td>
<td>1.63</td>
<td>23.83</td>
<td>3.04</td>
<td>5.21</td>
</tr>
<tr>
<td>Real wage</td>
<td>-0.02</td>
<td>0.36</td>
<td>0.37</td>
<td>0.29</td>
<td>-0.05</td>
<td>0.62</td>
<td>0.02</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Source: Simulation results from the GTAP model
In general, the outcomes from the GTAP model show a significant impact on the rice sector in both the EU and ASEAN due to the relatively high tariff levels on both sides (in particular the EU tariffs for Thailand and Vietnam on rice are currently rather high). Despite inelastic demand for the product, since the relatively high tariffs are completely eliminated, the considerable size of the effects on both regions occurs as a result, particularly in the EU-27.

4.5.1.1 Impact on the EU-27’s rice sector

For scenario 1, the biggest impact of the EU-ASEAN trade liberalisation for the rice sector in the EU-27 is on trade. Exports of rice from the EU-27 are estimated to drop by 27.03 percent as the region has lower competitiveness in the rice sector compared to production in ASEAN. On the other hand, a forecasted 0.31 percent fall in import price results in an estimated increase in rice imports of 1.12 percent, particularly imports of rice from Thailand due to a very high comparative advantage in rice production compared to the EU-27 (Asian Development Bank, 2009). It is noted that even though the percentage changes of import indicators are small for the EU-27 due to the size of the EU sector, they are large in absolute terms. However, the estimated growth in imports would not occur if the ASEAN countries decide to apply export restrictions as they have done in the past and which in some cases are still used. Since imports of rice are expected to increase in the EU, European rice producers could encounter production cuts. A significant decrease in output is expected in the EU-27 members after eliminating tariff barriers, accounting for 12.05 percent. Moreover, real incomes of EU rice farmers fall slightly by 0.01 percent as the expected output decreases and is coupled with a drop in domestic rice prices.

For scenario 2, the relatively high level of non-tariff barriers is eliminated (see table 4.4 for the ad valorem tariff equivalent of NTBs) and this increases the magnitude of the effects. An example of the NTBs related to the rice sector is the exports and imports restrictions and even bans in some ASEAN countries which restrict trade flows. According to scenario 2, the elimination of both tariff and non-tariff barriers results in further decreases in the domestic price, output and exports of rice in the
EU-27, accounting for 7.57, 21.30 and 35.32 percent respectively. On the other hand, imports are estimated to increase by 8.74 percent for the EU-27 in this sector while the import price is forecasted to fall by 2.33 percent. As a result, the producers of rice in the EU-27 face a 0.02 percent drop in real income due to the decline in production while consumers enjoy marginally lower prices for rice.

4.5.1.2 Impact on ASEAN’s rice sector

A study of the agricultural trade pattern in ASEAN (Mangabat and Natividad, 2007) has shown that the outside-the-region agricultural trade of ASEAN has been more substantial compared to intra-ASEAN trade, which shows the reliance of the ASEAN economies on the rest of the world. After establishing the FTA, the country which appears to experience the highest impact in the rice sector is Malaysia, which has the largest negative change of 0.39 percent in output, and 1.85 million USD decrease in its trade balance.

According to scenario 1, the effect on rice imports is estimated as negligibly increasing for most of the ASEAN countries except Malaysia, where the import value is expected to drop by 4.70 percent under the tariff elimination scenario while the export value also decreases by 15.93 percent. In addition, Thailand experiences a rise of 15.15 percent in imports. However, it is noted that despite the relatively high percentage change in imports, it is small in absolute terms. In most ASEAN countries, a positive export effect can be expected for rice, especially in Thailand which experiences the biggest increase in export value of 33.46 percent. As a result, Thailand experiences a significant rise of 337.91 million USD in its trade balance. However, the estimated impact on trade depends heavily on the possible reaction policies of the individual country governments and any further trade restrictions/bans could reverse the expected impacts.

For production, the changes in rice production are relatively small in percentage terms in most ASEAN countries, with the exception of Thailand and Singapore. It is also noted that although the percentage change in the production indicator is relatively high for Singapore due to the size of its domestic rice sector, it is very small in absolute terms. Most ASEAN countries including the group of other
ASEAN countries experience relatively small increases in production after establishing the EU-ASEAN free trade agreement, ranging between 0.02 and 0.15 percent, with the exception in Thailand where output goes up by 2.10 percent. However, because of the importance of the rice sector in many countries in ASEAN, these slight changes in rice production may trickle down into substantial absolute effects. In the meantime, Malaysia and the Philippines are countries which encounter a drop in rice production.

Because of the high proportion of agricultural employment in the majority of the ASEAN countries, the impact of the FTA as shown by the GTAP model results may be quite significant. Lower domestic prices and lower production generally translate into lower real incomes for ASEAN producers even if export values increase marginally. This is the case for Malaysia and the Philippines. In the case of Malaysia, both output and prices are shown to notably drop, accounting for 0.39 and 0.19 percent respectively, and therefore real income decreases by 0.03 percent. However, the negative real income effects are restricted to the people directly employed in the rice sector while consumers benefit from rice price cuts. By contrast, the FTA impact in Thailand is estimated to be positive, resulting in an increase of 0.12 percent in real income.

According to scenario 2, the effects on member countries of ASEAN are estimated to be greater than that estimated from scenario 1. Overall, Malaysia benefits from the elimination of tariff and non-tariff barriers while Thailand, Vietnam and the group of other ASEAN countries gain the most. For most of the ASEAN countries, except for the Philippines, the import value is estimated to increase by between 1.63 in Singapore and 23.83 percent in Thailand under the tariff and non-tariff elimination scenario while the Philippines suffers a decline in import value of 4.06 percent. On the other hand, growth in rice exports can be forecasted for most of the ASEAN countries, especially for Thailand which enjoys an additional increase in the export value of 16 percent approximately compared to the effect from eliminating only tariff barriers.

In the case of rice production, the percentage changes in scenario 2 are relatively higher than those in scenario 1. Thailand still gains the largest growth in rice production of 6.66 percent while most of the ASEAN countries including the group
of other ASEAN countries enjoy between 0.39 and 5.89 percent increases in production after eliminating both tariff and non-tariff barriers.

Unlike the impact simulated from scenario 1, since the domestic price and the production of rice increase, and real income is consequently higher for ASEAN rice producers. Malaysia and the Philippines enjoy increases in both rice output and price accounting for, on average, 7 percent in Malaysia and 0.7 percent in the Philippines. Particularly in Malaysia, rice production and its domestic price increase significantly, leading to a 0.37 percent growth in real income. Other ASEAN countries that gain significantly increasing real income from eliminating both tariff and non-tariff barriers are Thailand, Indonesia and the Philippines, reporting 0.62, 0.36 and 0.29 percent increases respectively. The overall effect on real income is approximately 0.20 percent above that derived from scenario 1, i.e. without taking the NTBs elimination into account.
### 4.5.2 Impact on the meat sector

#### Table 4.7 Impact on the meat sector

**Scenario 1: 100% tariff reduction without NTBs elimination**

<table>
<thead>
<tr>
<th></th>
<th>EU-27</th>
<th>IDN</th>
<th>MYS</th>
<th>PHL</th>
<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade balance (million USD)</td>
<td>-327.86</td>
<td>5.13</td>
<td>0.42</td>
<td>-13.53</td>
<td>0.20</td>
<td>412.91</td>
<td>-2.25</td>
<td>1.35</td>
</tr>
<tr>
<td>Import price</td>
<td>-0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Domestic price</td>
<td>-0.01</td>
<td>0.06</td>
<td>0.01</td>
<td>0.02</td>
<td>0.01</td>
<td>0.29</td>
<td>-0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>Production</td>
<td>-0.12</td>
<td>0.07</td>
<td>0.09</td>
<td>-0.25</td>
<td>0.11</td>
<td>4.54</td>
<td>-0.60</td>
<td>0.11</td>
</tr>
<tr>
<td>Exports</td>
<td>-0.26</td>
<td>9.27</td>
<td>1.62</td>
<td>16.01</td>
<td>0.48</td>
<td>27.09</td>
<td>0.50</td>
<td>4.32</td>
</tr>
<tr>
<td>Imports</td>
<td>0.23</td>
<td>0.40</td>
<td>0.28</td>
<td>4.08</td>
<td>0.00</td>
<td>14.82</td>
<td>2.41</td>
<td>0.39</td>
</tr>
<tr>
<td>Value of exports</td>
<td>-0.27</td>
<td>9.33</td>
<td>1.62</td>
<td>16.03</td>
<td>0.49</td>
<td>27.37</td>
<td>0.48</td>
<td>4.36</td>
</tr>
<tr>
<td>Value of imports</td>
<td>0.22</td>
<td>0.40</td>
<td>0.28</td>
<td>4.08</td>
<td>0.02</td>
<td>14.82</td>
<td>2.41</td>
<td>0.40</td>
</tr>
<tr>
<td>Real wage</td>
<td>0.00</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.04</td>
<td>-0.02</td>
<td>0.01</td>
</tr>
</tbody>
</table>

**Scenario 2: 100% tariff reduction with NTBs effects elimination**

<table>
<thead>
<tr>
<th></th>
<th>EU-27</th>
<th>IDN</th>
<th>MYS</th>
<th>PHL</th>
<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade balance (million USD)</td>
<td>-586.06</td>
<td>-2.54</td>
<td>2.95</td>
<td>-31.90</td>
<td>20.92</td>
<td>961.44</td>
<td>-4.18</td>
<td>14.34</td>
</tr>
<tr>
<td>Import price</td>
<td>-0.05</td>
<td>-0.06</td>
<td>-0.02</td>
<td>-0.02</td>
<td>0.03</td>
<td>-0.04</td>
<td>-0.01</td>
<td>-0.03</td>
</tr>
<tr>
<td>Domestic price</td>
<td>-0.07</td>
<td>0.48</td>
<td>0.02</td>
<td>0.24</td>
<td>-1.38</td>
<td>0.99</td>
<td>-0.05</td>
<td>0.31</td>
</tr>
<tr>
<td>Production</td>
<td>-0.30</td>
<td>-0.24</td>
<td>-4.25</td>
<td>-1.14</td>
<td>-0.20</td>
<td>15.26</td>
<td>-2.23</td>
<td>1.57</td>
</tr>
<tr>
<td>Exports</td>
<td>-0.30</td>
<td>15.72</td>
<td>7.03</td>
<td>46.09</td>
<td>34.65</td>
<td>53.14</td>
<td>1.82</td>
<td>8.10</td>
</tr>
<tr>
<td>Imports</td>
<td>0.63</td>
<td>2.06</td>
<td>1.97</td>
<td>7.96</td>
<td>-0.59</td>
<td>24.75</td>
<td>4.42</td>
<td>1.23</td>
</tr>
<tr>
<td>Value of exports</td>
<td>-0.37</td>
<td>16.19</td>
<td>7.05</td>
<td>46.33</td>
<td>33.27</td>
<td>54.13</td>
<td>1.77</td>
<td>8.40</td>
</tr>
<tr>
<td>Value of imports</td>
<td>0.58</td>
<td>2.99</td>
<td>1.94</td>
<td>7.93</td>
<td>-0.56</td>
<td>24.70</td>
<td>4.42</td>
<td>1.20</td>
</tr>
<tr>
<td>Real wage</td>
<td>-0.01</td>
<td>0.00</td>
<td>-0.02</td>
<td>0.01</td>
<td>-0.01</td>
<td>0.15</td>
<td>-0.04</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Source: Simulation results from the GTAP model

The estimated results from the GTAP model show a significant impact on the meat sector only in ASEAN due to the relatively high tariff levels, particularly both tariffs levied on meat imported into the EU-27 and into Thailand. However, since the relatively high tariff rates are completely eliminated, considerable effects on some of the ASEAN countries occur as a result.
4.5.2.1 Impact on the EU-27’s meat sector

For scenario 1, the greatest effect of the EU-ASEAN FTA for the meat sector in the EU-27 is on exports and imports. Exports of meat from the EU-27 are estimated to decrease slightly by 0.26 percent. By contrast, an estimated 0.01 percent decrease in the import price results in a marginal rise in meat imports of 0.23 percent. Since imports of meat are estimated to increase, European meat producers could encounter a drop in production. A slight drop in output is expected in member countries of the EU-27 after eliminating tariff barriers, accounting for 0.12 percent. In addition, real incomes of meat producers remain unchanged although the estimated production decreases and are coupled with a decline in domestic meat prices. This is because the level of meat trade between the EU-27 and ASEAN depends only slightly on TBs; tariff only elimination therefore has very limited effects on meat producer’s real incomes.

For scenario 2, the 100 percent reduction of relatively high rates of non-tariff barriers is taken into account (see table 4.3 and 4.4 for the ad valorem tariff equivalent of NTBs). After NTBs related to exports and imports restrictions of the meat sector are eliminated, the size of the effects is greater than that in scenario 1. According to scenario 2, the 100 percent reduction of both tariff and non-tariff barriers leads to a higher drop in domestic price, output and exports of meat in the EU-27, accounting for 0.07, 0.30 and 0.30 percent respectively. By contrast, imports are expected to increase by 0.63 percent for the EU-27 in this sector while the import price is forecasted to decline by 0.05 percent, which is more than that in scenario 1. This creates a trade deficit valued at 586.06 million USD for meat in the EU-27. In addition, since the meat trade intensity between the EU-27 and ASEAN depends relatively heavily on NTBs, meat producers in the member states encounter a marginal drop of 0.01 percent in real income due to the decrease in the domestic price and production while consumers should enjoy lower prices for meat.

4.5.2.2 Impact on ASEAN’s meat sector

After implementing the free trade agreement between the EU-27 and ASEAN, the ASEAN member country which is expected to experience the greatest effects in the
meat sector is Thailand. The country has the highest positive change of 4.54 percent in production, and a 412.91 million USD increase in its trade balance.

According to scenario 1, the effect on meat imports is estimated to slightly increase for most of the ASEAN countries except Thailand and the Philippines, where meat import values are expected to increase considerably by 14.82 and 4.08 percent respectively under the 100 percent tariff reduction scenario while the export values increase by 27.37 and 16.03 percent respectively. As a result, Thailand experiences a significant growth in its trade balance of 412.91 million USD whereas the Philippines face a trade deficit of 13.53 million USD despite enjoying a notable increase in meat exports. This is because even though the percentage growth in imports for the Philippines is lower than that in exports, the absolute value of imports is higher than that of exports.

For production, the changes in meat outputs are relatively slight and positive in percentage terms in most ASEAN countries, with the exception of Vietnam and the Philippines. Most of the ASEAN countries including the group of other ASEAN countries encounter relatively marginal increases in meat production after the opening of EU-ASEAN trade liberalisation ranging between 0.07 and 0.11 percent, except in Thailand where production rises by 4.54 percent while Vietnam’s and the Philippines’ meat outputs drop by 0.60 and 0.25 percent respectively.

In relation to employment in the meat sector in Vietnam and the Philippines, the impact of the free trade agreement as shown by the GTAP model outcomes may be considerable. Lower domestic price in Vietnam and lower production in both Vietnam and the Philippines generally translate into lower real income for producers even if export values increase. In the case of Vietnam, the domestic price shows a slight drop, accounting for 0.02 percent and the effect is coupled by a fall in production. Therefore, real income decreases by 0.02 percent. However, the negative real income effects spread to the people employed in the meat sector while consumers enjoy a lower price.

According to scenario 2, the effects on the ASEAN member countries are estimated to be greater than that estimated from scenario 1. Overall, some of the ASEAN countries still benefit from the elimination of tariff and non-tariff barriers such as
Thailand and the group of other ASEAN countries, while the impact for other countries is negative such as Indonesia. For most of the ASEAN countries, except Singapore, the meat import value is estimated to increase by between 1.20 percent for the group of other ASEAN countries and 24.70 percent for Thailand under the tariff and non-tariff elimination scenario while the import value for Singapore decreases slightly. In addition, growth in meat exports can be expected for all the ASEAN countries, particularly for Thailand which has an additional increase in export value of 27 percent approximately compared to the effect from eliminating only tariff barriers. This enables Thailand to enjoy a greater than double increase in its trade balance, accounting for 961.44 million USD while the Philippines face a 31.90 million USD deficit in its meat trade.

For meat production, the percentage changes in scenario 2 are relatively higher than those in scenario 1. Overall, most of the ASEAN countries, with the exception of Thailand and the group of other ASEAN countries, face a decline in meat production, particularly Malaysia, Indonesia and Singapore which change from countries with increasing to countries with decreasing meat production. While Thailand and the group of other ASEAN countries still gain increases in meat production of 15.26 and 1.57 percent respectively, the other ASEAN countries encounter a fall in outputs ranging between 0.20 and 4.25 percent after eliminating both tariff and non-tariff barriers.

For Vietnam, similar to the impact simulated from scenario 1, since the domestic price and production of meat decrease, meat producers consequently face a lower real income. Vietnamese meat producers encounter decreases in domestic prices and production, accounting for 0.05 and 2.23 percent respectively, leading to a 0.04 percent fall in real income. However, the overall impact on real income in the group of other ASEAN countries is approximately 0.01 percent less than under the free trade agreement without taking the NTBs elimination into account.
### 4.5.3 Impact on the vegetable oil sector

**Table 4.8 Impact on the vegetable oil sector**

<table>
<thead>
<tr>
<th>Scenario 1: 100% tariff reduction without NTBs elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EU-27</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Trade balance (million USD)</td>
</tr>
<tr>
<td>Import price</td>
</tr>
<tr>
<td>Domestic price</td>
</tr>
<tr>
<td>Production</td>
</tr>
<tr>
<td>Exports</td>
</tr>
<tr>
<td>Imports</td>
</tr>
<tr>
<td>Value of exports</td>
</tr>
<tr>
<td>Value of imports</td>
</tr>
<tr>
<td>Real wage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 2: 100% tariff reduction with NTBs effects elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EU-27</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Trade balance (million USD)</td>
</tr>
<tr>
<td>Import price</td>
</tr>
<tr>
<td>Domestic price</td>
</tr>
<tr>
<td>Production</td>
</tr>
<tr>
<td>Exports</td>
</tr>
<tr>
<td>Imports</td>
</tr>
<tr>
<td>Value of exports</td>
</tr>
<tr>
<td>Value of imports</td>
</tr>
<tr>
<td>Real wage</td>
</tr>
</tbody>
</table>

Source: Simulation results from the GTAP model

Overall, the GTAP model estimates outcomes showing a considerable impact on the vegetable oil sector in both the EU and ASEAN due to the relatively high tariff levels on both sides, particularly the EU tariffs levied on vegetable oil imports from the Philippines. However, when the relatively high tariff rates are completely eliminated, notable effects on both regions occur as a result.
4.5.3.1 Impact on the EU-27’s vegetable oil sector

For scenario 1, the greatest effects of the EU-ASEAN trade liberalisation for the vegetable oil sector in the EU-27 are on trade. Exports of vegetable oils from the EU-27 are forecasted to decrease by 2.03 percent. By contrast, an estimated 0.01 percent drop in the import price results in a slight increase in vegetable oil imports of 0.88 percent, particularly exports from the Philippines due to a very high comparative advantage in vegetable oil production compared to the EU-27 (Asian Development Bank, 2009). Even though the percentage changes of vegetable oil imports are small for the EU-27 due to the size of the sector, they are large in absolute terms. Since imports of vegetable oils are expected to rise, European vegetable oil producers could face production cuts. A moderate drop in production is expected by the EU-27 members after reducing tariff barriers by 100 percent, accounting for 1.50 percent. However, real incomes of vegetable oil producers remain unchanged although expected output drops and are coupled with a decline in domestic vegetable oil prices. This is because vegetable oil trade between the EU-27 and ASEAN depends only slightly on TBs; tariff only elimination therefore has very limited effects on vegetable oil producers’ real incomes.

For scenario 2, the elimination of relatively high levels of non-tariff barriers is taken into account (see table 4.3 and 4.4 for the ad valorem tariff equivalent of NTBs). After NTBs related to the export and import restrictions of the vegetable oil sector is reduced by 100 percent, the effect is greater than that in scenario 1. According to scenario 2, the elimination of both tariff and non-tariff barriers leads to higher decreases in domestic price, output and exports for vegetable oils in the EU-27, accounting for 0.06, 4.84 and 6.69 percent respectively. By contrast, imports are forecasted to rise marginally by 0.91 percent for the EU-27 in this sector while the import price is estimated to drop by the same percentage as that in scenario 1, accounting for 0.01 percent. This creates a 762.63 million USD trade deficit for vegetable oils in the EU-27. In addition, since the vegetable oil trade between the EU-27 and ASEAN depends relatively heavily on NTBs, the vegetable oil producers in the member states encounter a 0.02 percent decrease in real income due to the decline in production while consumers should enjoy marginally lower prices for vegetable oil.
4.5.3.2 Impact on ASEAN’s vegetable oil sector

After establishing trade liberalisation between the EU-27 and ASEAN, the ASEAN countries which are expected to experience the greatest effects in the vegetable oil sector are the Philippines, Malaysia and Indonesia which have the largest positive changes of 4.74, 3.03 and 2.87 percent in production, and 48.63, 194.90 and 219.20 million USD increases in trade balances respectively.

According to scenario 1, the effect on vegetable oil imports is considered marginal for most of the ASEAN countries except Malaysia and Indonesia, where import values are expected to rise by 2.08 and 1.95 percent respectively under the only tariff elimination scenario while export values increase by 3.31 and 5.18 percent respectively. In addition, in most ASEAN countries, positive effects for vegetable oil exports can be expected especially in the Philippines which experience the largest increase of 10.41 percent in export values. However, the estimated impact on the vegetable oil trade also depends on the possible counter actions of the governments in trade partner countries and any further trade restrictions/bans could also reverse the estimated positive effects.

For production, the changes in vegetable oil outputs are relatively slight in percentage terms in most ASEAN countries, with the exception of the Philippines, Malaysia and Indonesia. Most of the ASEAN countries including the group of other ASEAN countries experience relatively small growth in vegetable oil production after establishing the EU-ASEAN free trade agreement ranging between 0.01 and 1.12 percent, except in the Philippines, Malaysia and Indonesia where production increases by 4.74, 3.03 and 2.87 percent respectively. However, given the importance of the vegetable oil sector in these three ASEAN countries, these seemingly insignificant changes in vegetable oil production may translate into substantial absolute effects.

Because of the high proportion of employment in the vegetable oil sector in the Philippines, Malaysia and Indonesia, the impact of trade liberalisation as shown by the GTAP model results may be significant. Higher domestic prices and higher production generally translate into higher real incomes of producers even if import values increase slightly. In the case of Indonesia, the domestic price is shown to be
rise notably, accounting for 0.10 percent and therefore real income increases by 0.08 percent. However, the positive real income effects are distributed to the people employed in the vegetable oil sector while consumers face higher prices.

According to scenario 2, the impact on the ASEAN member countries is estimated to exceed that estimated from scenario 1. Overall, all the ASEAN countries still benefit from the elimination of tariff and non-tariff barriers while the group of major vegetable oil producers in ASEAN, namely the Philippines, Malaysia and Indonesia, gain the most. For most of the ASEAN countries, except Thailand, the import value is forecasted to grow by between 0.23 in the group of other ASEAN countries and 5.38 percent in Malaysia under the tariff and non-tariff elimination scenario while the import value for Vietnam remains unchanged but that for Thailand decreases slightly due to a considerable growth in production. In addition, growth in vegetable oil exports can be expected in all the ASEAN countries, particularly in the Philippines which enjoys an additional increase in export value of 17 percent approximately compared to the effect from eliminating only tariff barriers.

In the case of production, the percentage changes in scenario 2 are relatively higher than those in scenario 1. The Philippines, Indonesia and Malaysia still gain the greatest increase in vegetable oil production of 12.50, 7.72 and 7.68 percent respectively while the other ASEAN countries including the group of other ASEAN countries enjoy between 1.91 and 3.99 percent growth in production after eliminating both tariff and non-tariff barriers.

Similar to the impact simulated from scenario 1, since the domestic price and production of vegetable oil increase, vegetable oil producers consequently enjoy higher real incomes. The group of major vegetable oil producers enjoy increases in domestic prices, accounting for 0.25 percent in Indonesia, 0.10 percent in Malaysia and 0.07 percent in the Philippines. Particularly in Indonesia, vegetable oil production and its domestic price increase significantly, leading to a 0.17 percent rise in real income. The overall impact on real income is approximately 0.02 percent above that in the free trade agreement without taking the NTBs elimination into account.
4.5.4 Impact on the sugar sector

Table 4.9 Impact on the sugar sector

<table>
<thead>
<tr>
<th>Scenario 1: 100% tariff reduction without NTBs elimination</th>
<th>EU-27</th>
<th>IDN</th>
<th>MYS</th>
<th>PHL</th>
<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade balance (million USD)</td>
<td>-11.19</td>
<td>0.52</td>
<td>-0.02</td>
<td>4.01</td>
<td>0.16</td>
<td>5.29</td>
<td>0.01</td>
<td>4.29</td>
</tr>
<tr>
<td>Import price</td>
<td>-0.01</td>
<td>0.31</td>
<td>0.15</td>
<td>0.23</td>
<td>0.12</td>
<td>0.01</td>
<td>0.25</td>
<td>0.36</td>
</tr>
<tr>
<td>Domestic price</td>
<td>-0.02</td>
<td>0.15</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
<td>0.41</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Production</td>
<td>-0.10</td>
<td>0.23</td>
<td>0.08</td>
<td>0.60</td>
<td>0.37</td>
<td>0.32</td>
<td>0.01</td>
<td>6.47</td>
</tr>
<tr>
<td>Exports</td>
<td>-0.07</td>
<td>9.44</td>
<td>-0.08</td>
<td>4.21</td>
<td>2.52</td>
<td>0.23</td>
<td>-0.23</td>
<td>22.62</td>
</tr>
<tr>
<td>Imports</td>
<td>0.19</td>
<td>1.20</td>
<td>-0.14</td>
<td>0.92</td>
<td>0.13</td>
<td>13.44</td>
<td>-0.30</td>
<td>0.00</td>
</tr>
<tr>
<td>Value of exports</td>
<td>-0.09</td>
<td>9.59</td>
<td>-0.04</td>
<td>4.25</td>
<td>2.56</td>
<td>0.65</td>
<td>-0.23</td>
<td>22.66</td>
</tr>
<tr>
<td>Value of imports</td>
<td>0.18</td>
<td>1.45</td>
<td>0.00</td>
<td>1.11</td>
<td>0.22</td>
<td>13.45</td>
<td>-0.10</td>
<td>0.29</td>
</tr>
<tr>
<td>Real wage</td>
<td>0.00</td>
<td>0.03</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
<td>0.02</td>
<td>0.00</td>
<td>0.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 2: 100% tariff reduction with NTBs effects elimination</th>
<th>EU-27</th>
<th>IDN</th>
<th>MYS</th>
<th>PHL</th>
<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other ASEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade balance (million USD)</td>
<td>50.47</td>
<td>-21.73</td>
<td>9.60</td>
<td>11.18</td>
<td>3.55</td>
<td>-40.81</td>
<td>7.22</td>
<td>13.35</td>
</tr>
<tr>
<td>Import price</td>
<td>-0.09</td>
<td>1.34</td>
<td>0.74</td>
<td>0.82</td>
<td>0.54</td>
<td>0.05</td>
<td>1.17</td>
<td>1.51</td>
</tr>
<tr>
<td>Domestic price</td>
<td>-0.16</td>
<td>1.81</td>
<td>0.53</td>
<td>0.58</td>
<td>-1.70</td>
<td>2.21</td>
<td>0.08</td>
<td>0.38</td>
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<tr>
<td>Production</td>
<td>0.35</td>
<td>-3.76</td>
<td>3.01</td>
<td>1.22</td>
<td>1.71</td>
<td>-2.23</td>
<td>1.88</td>
<td>15.20</td>
</tr>
<tr>
<td>Exports</td>
<td>2.45</td>
<td>16.16</td>
<td>11.36</td>
<td>7.07</td>
<td>8.76</td>
<td>-3.75</td>
<td>17.10</td>
<td>31.89</td>
</tr>
<tr>
<td>Imports</td>
<td>0.74</td>
<td>9.36</td>
<td>-0.83</td>
<td>3.13</td>
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<td>7.66</td>
<td>8.06</td>
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<td>-0.15</td>
<td>0.02</td>
<td>0.25</td>
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</table>

Source: Simulation results from the GTAP model

The outcomes calculated from the GTAP model generally show relatively small effects on the sugar sector in both the EU and ASEAN due to the relatively low tariff levels on both sides, except the EU tariffs levied on sugar exported from the Philippines and Thailand which are currently relatively high.
4.5.4.1 Impact on the EU-27’s sugar sector

For scenario 1, the greatest effect of the EU-ASEAN trade liberalisation for the sugar sector in the EU-27 is on imports. A forecasted 0.01 percent fall in import prices leads to estimated growth in sugar imports of 0.19 percent. On the other hand, the volume of sugar exported from the EU-27 is estimated to fall by 0.08 percent, especially sugar exported to the Philippines and Indonesia due to the elimination of very high tariff rates imposed on sugar in these two countries. Since imports of sugar are estimated to rise, European sugar producers could face production cuts. A marginal decrease in sugar output is expected in the EU-27 members after reducing tariff barriers by 100 percent, accounting for 0.01 percent. However, real incomes of sugar producers remain unchanged despite the marginal drops in both output and domestic prices.

For scenario 2, the relatively high level of non-tariff barriers is eliminated (see table 4.3 and 4.4 for the ad valorem tariff equivalent of NTBs) and this has positive effects on the EU-27’s sugar production and trade. According to scenario 2, even though the elimination of both tariff and non-tariff barriers for sugar in the EU-27 leads to a slight increase in imports, accounting for 0.74 percent, sugar exports increase considerably by 2.45 percent, resulting in a 50.47 million USD trade surplus. Similarly, after establishing the FTA with non-tariff barrier cuts, even though the domestic price drops slightly by 0.16 percent, sugar production rises notably by 0.35 percent. As a result, producers of sugar in the EU-27 enjoy a 0.02 percent rise in real income and consumers enjoy marginally lower prices for sugar.

4.5.4.2 Impact on ASEAN’s sugar sector

After trade liberalisation between the EU-27 and ASEAN comes into effect, the ASEAN countries which are expected to experience the greatest effects in the sugar sector are the group of other ASEAN countries, the Philippines and Thailand which encounter the greatest positive change in production of 6.47, 0.60 and 0.32 percent, and 4.29, 4.01 and 5.29 million USD increases in the balance of trade respectively.
According to scenario 1, the effect on sugar exports is estimated to be moderately positive for most of the ASEAN countries except Vietnam and Malaysia, where the export values are expected to decrease marginally by 0.23 and 0.04 percent respectively under the only tariff elimination scenario while the import value remains unchanged in Malaysia but decreases slightly by 0.10 percent in Vietnam. In addition, Thailand experiences the largest increase of 13.45 percent in import values. However, even though the percentage change in the sugar import value in Thailand is much higher than that of export value, it is smaller in absolute terms. As a result, Thailand enjoys a moderate increase of 5.29 million USD in the balance of trade.

For production, the changes in sugar outputs are relatively small in percentage terms in most ASEAN countries, with the exception of the group of other ASEAN countries including Brunei, Cambodia, Laos PDR and Myanmar. Most of the ASEAN countries experience relatively small increases in production after trade liberalisation between the EU-27 and ASEAN ranging from 0.01 to 0.60 percent, with the exception for the group of other ASEAN countries whose output increases significantly by 6.47 percent. In the meantime, Vietnam and Malaysia are countries that encounter the smallest growth in sugar production, accounting for less than one percent.

In relation to employment in the sugar sector in the ASEAN countries, the impact of the free trade agreement as shown by the GTAP model results may be significant. Similar to the case of vegetable oils, higher domestic prices and higher production generally result in higher real income of the sugar producers even if the import value increase in some countries. In the case of the group of other ASEAN countries, both output and domestic price show considerable increases, accounting for 6.47 and 0.04 percent respectively and therefore real income increases by 0.04 percent. However, the positive real income effects are distributed to the people employed in the sugar sector while consumers encounter higher prices.

According to scenario 2, the impact on the ASEAN countries is estimated to exceed that estimated from scenario 1. Overall, Thailand suffers losses in the sugar sector from the elimination of tariff and non-tariff barriers while Malaysia’s balance of trade becomes positive and the group of other ASEAN countries gains the most.
For Thailand and Indonesia, sugar import values are estimated to rise significantly by 22.74 and 9.70 respectively under the tariff and non-tariff elimination scenario while the Philippines and the group of other ASEAN countries encounter a slight growth in import values of 3.95 and 2.62 percent. Similarly, growth in sugar exports is estimated for most of the ASEAN countries, with the exception of Thailand which encounters a notable decrease in export value of 2.54 percent compared to the positive effect from eliminating only tariff barriers.

In case of sugar production, the percentage changes in scenario 2 are also relatively higher than those in scenario 1. The group of other ASEAN countries still gains the highest increase in sugar production of 15.20 percent while most of the ASEAN countries enjoy between 1.22 and 3.01 percent growth in the production after eliminating both tariff and non-tariff barriers. However, Indonesia and Thailand face a fall in sugar production of 3.76 and 2.23 percent respectively.

In the case of Indonesia and Thailand, despite encountering a small positive change in the domestic price, production of sugar decreases significantly. These two countries enjoy an increase in the domestic price of 2 percent on average but suffer from a drop in production of 3 percent approximately, leading to, on average, a 0.10 percent fall in real income. The overall effect on real incomes in all ASEAN countries is 0.04 percent on average above that in an FTA without taking the NTBs elimination into account.

4.6 Impact on patterns of trade

Even though the EU-27 is one of the biggest trade partners for ASEAN countries, other large Asian economies such as China and India also play an important role as food traders for both the EU-27 and ASEAN countries. Therefore, changes in the pattern of trade between these two blocs (the EU-27 and ASEAN countries) can affect the patterns of trade of those other countries.

The impact on the patterns of trade of the EU-27 and the individual countries in ASEAN is analysed in this subsection including comparisons with changes in trade patterns of other major Asian trade partners. These are China (CHN), Japan (JPN),
South Korea (KOR), India (IND) and the Rest of the World. The analysis is shown as follows.

### 4.6.1 Changes in the pattern of rice trade

According to table 4.10, the effect from a 100 percent tariff reduction due to the EU-ASEAN FTA generates a decrease of 28.70 percent in the rice trade among the EU-27 member states. In addition, these European countries also tend to decrease rice imports from India and the Rest of the World by 21.03 and 23.21 percent respectively while increasing imports of rice from Thailand by 50.51 percent due to lower comparative import prices. As a result, rice exported from Thailand to other countries declines (except to the EU), particularly exports to the Rest of the World, accounting for 11.94 percent. The trade patterns of other countries change marginally or remain unchanged for rice.

For scenario 2, the impact of tariff and non-tariff barrier elimination generates a fall of 59.7% in intra-regional trade of rice among the EU-27 countries (see table 4.11). Rice exported from India and the Rest of the World to the EU-27 drop considerably by 40.16 and 41.47 percent respectively. China is also a rice exports-affected country and encounters a slight drop in rice exports of 1.43 percent. This is because the EU-27 tends to increase rice imports from other countries that offer cheaper import prices and have more comparative competitiveness. Thailand is the country which gains the most benefits from the elimination of tariff and non-tariff barriers between the EU-27 and ASEAN. Rice exports from Thailand to the EU-27 grow dramatically by 94.83 percent; however, this country faces a significant drop of 18.16 percent in rice exports to the Rest of the World while South Korea increasingly imports rice from China and the Rest of the World instead of Thailand. Malaysia, Vietnam and the group of other ASEAN countries experience a significant increase in rice exports to the EU-27, accounting for 13.99, 7.41 and 7.13 percent respectively. In addition, countries in the Rest of the World have more rice trade among themselves, accounting for 9.33 percent.
### Table 4.10 Changes in the patterns of rice trade from tariff elimination only

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<th>MYS</th>
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<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other ASEAN</th>
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<th>JPN</th>
<th>KOR</th>
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<th>Rest of the World</th>
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Source: Simulation results from the GTAP model
## Table 4.11
Changes in the patterns of rice trade from both tariff and non-tariff elimination

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Source: Simulation results from the GTAP model
4.6.2 Changes in the patterns of the meat trade

According to table 4.12, the effect from tariff elimination due to trade liberalisation between the EU-27 and ASEAN results in a significant decrease of 33.53 percent in intra-regional trade of meat among the EU-27 members. In addition, these European countries are also expected to decrease meat imports from the Rest of the World by 7.18 percent whereas meat exports from the EU-27 to The Philippines increase notably by 4.93 percent. However, imports of meat from Thailand by the European countries are expected to increase significantly by 56.14 percent due to lower comparative import prices. Subsequently, meat exports from Thailand to other countries decrease, particularly those exported to Japan, accounting for 2.07 percent. Countries in the Rest of the World face a considerable fall of meat exports to the EU-27, to the Philippines and to Thailand, accounting for 7.18, 1.45 and 1.16 percent respectively, while the trade patterns of other countries change marginally or remain unchanged.

For scenario 2, the impact of tariff and non-tariff barrier elimination leads to a further drop in intra-regional trade of meat among the EU-27 countries, amounting to 106.59 percent while meat exported from the rest of the world to the EU-27 falls considerably by 23.49 percent (see table 4.13). However, the EU-27 member countries tend to increase meat exports to all the ASEAN countries, especially to Singapore, Malaysia, the Philippines and Thailand accounting for 27.19, 20.04, 15.98 and 12.34 percent respectively. Thailand enjoys a dramatic rise of 156.30 percent in meat exported to the EU-27 while encountering a significant drop in meat exports to other countries, particularly to Japan and Singapore, accounting for 5.81 and 1.98 percent respectively. China faces a further decrease in meat exports to ASEAN members such as Singapore and Malaysia because these countries tend to increase their meat imports from the EU-27 due to lower import prices. In addition, the group of the Rest of the World counties are forecasted to face the largest negative impact on meat exports to the ASEAN countries, falling by 20.42, 7.92 and 5.12 percent for meat exports to Singapore, Malaysia and the Philippines respectively.
Table 4.12 Changes in the patterns of the meat trade from tariff elimination only

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Source: Simulation results from the GTAP model
Table 4.13 Changes in the patterns of the meat trade from both tariff and non-tariff elimination

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Source: Simulation results from the GTAP model
4.6.3 Changes in the patterns of the vegetable oil trade

According to table 4.14, the effect from a 100 percent tariff reduction due to the free trade agreement between the EU-27 and ASEAN is limited to the group of major ASEAN vegetable oil exporters comprising of Indonesia, Malaysia and the Philippines, and also to the group of the Rest of the World countries. For the EU-27, even though vegetable oil exports from the region to other countries increase, especially to Thailand showing a 2.21 percent increase, the EU-27 member states face a considerable drop in intra-regional trade of vegetable oils, accounting for 44.48 percent. In addition, the EU-27’s vegetable oil imports rise significantly from Indonesia, Malaysia and the Philippines, accounting for 46.84, 43.88 and 10.29 percent respectively. The Rest of the World countries encounter a significant decline of 39.26 percent in vegetable oil exports to the EU-27.

For scenario 2, the impact of tariff and non-tariff barrier elimination generates the largest decrease in intra-regional trade of vegetable oils among the EU-27 countries, accounting for 139.87 percent (see table 4.15). In addition, vegetable oil exported from the group of major ASEAN vegetable oil exporters to the EU-27 rises dramatically by 126.07 percent from Indonesia, 111.29 percent from Malaysia and 27.54 percent from the Philippines resulting from cheaper import prices. Countries in the Rest of the World encounter a huge negative effect on vegetable oil exports to the EU-27, accounting for 120.24 percent. The trade patterns of other countries change slightly or remain unchanged for vegetable oil.
Table 4.14 Changes in the patterns of the vegetable oil trade from tariff elimination only

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Source: Simulation results from the GTAP model
Table 4.15 Changes in the patterns of the vegetable oil trade from both tariff and non-tariff elimination

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</table>

Source: Simulation results from the GTAP model
4.6.4 Changes in the patterns of the sugar trade

According to table 4.16, the impact of a 100 percent tariff reduction from trade liberalisation between the EU-27 and ASEAN results in a notable drop of 15.25 percent in intra-regional trade of sugar among the EU-27 member states. In addition, these European countries are also expected to decrease sugar imports from the Rest of the World by 11.52 percent but increase sugar exported from the group of other ASEAN countries by 17.92 percent instead. However, exports of sugar from the EU-27 to Thailand are expected to increase notably by 13.64 percent. Indonesia and the Philippines are estimated to enjoy an increase in sugar exports to the EU-27, accounting for 6.02 and 4.22 percent respectively. In the meantime, even though the group of other ASEAN countries gains the highest percentage increase in sugar exports to the EU-27, other countries including the Rest of the world countries decrease sugar imports from the group of other ASEAN countries by 1.32 percent on average. The trade patterns of other countries change marginally or remain unchanged for sugar.

For scenario 2, the effect of tariff and non-tariff barrier elimination leads to a further decrease in intra-regional trade of sugar among the EU-27 countries, accounting for 39.24 percent while sugar exported from the Rest of the World countries to the EU-27 drops significantly by 30.94 percent (see table 4.17). However, the EU-27 member countries are expected to increase sugar exports to all the ASEAN countries, especially to Thailand, whose sugar imports from the EU-27 increase significantly, accounting for 69.38 percent. The group of other ASEAN countries, including Brunei, Cambodia, Laos PDR and Myanmar, still enjoys a significant rise of 41.38 percent in sugar exported to the EU-27 while facing a significant decline in sugar exports to other countries, particularly to Thailand and the Rest of the World countries, accounting for 31.56 and 12.25 percent respectively. Countries in the Rest of the World group have a rising intra-regional trade of 6.28 percent and also export more sugar to Japan and South Korea, accounting for 4.17 and 2.21 percent respectively. The trade patterns of other countries change slightly or remain unchanged for sugar.
### Table 4.16 Changes in the patterns of the sugar trade from tariff elimination only

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<tr>
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<th>SGP</th>
<th>THA</th>
<th>VNM</th>
<th>Other ASEAN</th>
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<th>KOR</th>
<th>IND</th>
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Source: Simulation results from the GTAP model
Table 4.17 Changes in the patterns of the sugar trade from both tariff and non-tariff elimination

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Source: Simulation results from the GTAP model
4.7 Conclusion

This chapter shows the estimated results, including those derived from the potential effects of non-tariff barriers on selected food commodities derived from the Gravity equation, the ad-valorem tariff equivalent of NTBs, and the impact of the FTA between the EU-27 and ASEAN on selected food products estimated from the GTAP model.

The Gravity equation explains that the levels of non-tariff barriers are high on all the selected foods indicated by a low $R^2$ value in each model accounting for 50 percent on average, meaning that about only 50 percent of the variation in the imports of these commodities can be explained by all the variables in the Gravity Equation. It can be inferred that the economic variables specified in the model may not be able to provide an appropriate explanation of the trading pattern for these foods. The other explanatory variables may likely be a relatively strong interference in the staple food markets in the trade partner countries.

When taking the residual $\varepsilon$ derived from the Gravity equation into the ad valorem tariff equivalent calculation following Anderson and Wincoop (2003)’s methodology, the tariff equivalent of non-tariff barriers is clearly much higher than the tariff barriers in both the EU-27 and ASEAN. Thailand’s NTBs for rice and meat are equivalent to 195 and 175 percent respectively, showing the highest AVEs for rice and meat imports in ASEAN; while the AVEs levied on sugar is highest in the Philippines and Indonesia. In addition, non-tariff barriers in Singapore against food imported from the EU-27 are also high despite zero tariffs for food imports. Similarly, the EU-27’s non-tariff protection against ASEAN imports is higher than its tariff rates. The AVEs on rice products exported from ASEAN countries to the EU-27 is in excess of 250 percent on average while the AVEs levied on meat and vegetable oil imports is relatively low compared to those levied on other food imports. The results are reliable since not only the explicit trade restrictions between the EU-27 and ASEAN are shown in the figures but the implicit effects from all related factors that may affect trade costs are also revealed. In addition, the high level of non-tariff barriers shown in this result is in line with those of other studies, such as the study by Ando and Obashi (2010).
After designing and simulating two scenarios, namely a FTA with only a 100 percent tariff reduction and a FTA with tariffs and non-tariffs elimination, the concluding results can be presented as follows.

Overall, the ASEAN countries experience economic expansion after eliminating all tariff barriers in line with international trade theory, leading to an increase in GDP values for all the ASEAN countries. Thailand gains the largest increase in real income while Vietnam experiences the least growth. In addition, Thailand and Indonesia enjoy the highest rise in export values, resulting in the largest trade surpluses compared to other ASEAN countries. However, Malaysia and the Philippines encounter a trade deficit after implementing the FTA. All the price indices (of exports, imports and consumption) are higher in all the ASEAN members, particularly in the group of other ASEAN countries including Brunei, Cambodia, Laos PDR and Myanmar where the price index of imports increases over that of exports leading to a decline in the terms of trade.

For the EU-27, GDP value and real income remain unchanged after implementing the free trade agreement. Private consumption is also constant since real income stays unaffected. However, since the free trade results in a greater increase in the import value than that in the export value, the EU-27 faces a trade deficit. Furthermore, the price index of exports falls under that of imports, leading to a drop in the terms of trade.

In scenario 2, the simultaneous elimination of both tariff and non-tariff protection is taken into account, and the overall impact is greater than that in scenario 1. Almost every ASEAN country, with the exception of Singapore, benefits from an increase in GDP value. Indonesia experiences the largest increase in real income instead of Thailand which experienced the biggest rise under scenario 1. The group of other ASEAN countries, Vietnam and Thailand, which enjoy a rise in real income in scenario 1, encounter a drop instead. This could be because the growth rate of inflation rises over that of income in these countries. In addition, Indonesia and Thailand are still at the top of the ASEAN countries which gain the largest increase in trade balances while the trade balances for the Philippines and Malaysia drop more than that estimated in scenario 1. Indonesia and Thailand experience an increasing export-import price gap compared to that in scenario 1, leading to the
biggest increase in the terms of trade; by contrast, the terms of trade in Singapore and Vietnam becomes negative.

For the EU-27, GDP value and real income increase after the opening of the free trade agreement with tariff and non-tariff elimination. Conversely, all the price indices face a drop, implying that people living in member states of the EU-27 experience cheaper prices. However, since the 100 percent reduction of both tariff and non-tariff barriers is applied, the import value increases while the export value declines, leading to an increasing drop in the trade balance.

According to the results by commodities, in general, the impact estimated from scenario 2 is greater than that estimated from scenario 1 and the EU-27 faces negative effects; however, there is an exception in some cases. Thailand is the country which enjoys the greatest benefits in the rice sector while Malaysia encounters the worst situation including a decrease in rice production, exports and real wages after eliminating tariffs only. However, Malaysia enjoys positive economic variables after the opening of the FTA without non-tariff barriers levied on rice. This is because the elimination of very high rates of NTBs leads to higher comparative competitiveness in the rice sector in Malaysia and the country can therefore increase rice production and exports. By contrast, after eliminating the NTBs, the Philippines faces a drop in rice imports due to a higher import price while the domestic price increases and its rice production rises slightly. This could possibly lead to food insecurity in the Philippines.

For the meat sector, Thailand is still the country which gains the most; by contrast, the Philippines face the biggest trade deficit after eliminating tariffs only. However, Indonesia encounters a trade deficit and a decline in production after implementing the EU-ASEAN trade liberalisation with taking non-tariff barriers into account. This is because the elimination of NTBs results in lower comparative competitiveness in meat production in Indonesia compared to other countries. In addition, Vietnam encounters a drop in real wages in both scenarios.

In the vegetable oil sector, major ASEAN vegetable oil exporters, Indonesia, Malaysia and the Philippines, are the group which gains the most in the vegetable oil trade, production and real wages while the economic variables in the other
ASEAN countries either change slightly or remain unchanged. The results are similar under both scenarios.

For the sugar sector, the group of other ASEAN countries gains the most on all economic variables such as the trade balance, production and real wages while other countries experience little change. However, after opening the FTA without non-tariff barriers levied on sugar, Thailand and Indonesia face a trade deficit as well as a decrease in sugar production while the trade balance of sugar in the EU-27 changes from a trade deficit to a trade surplus; in addition, production and exports also rise. This leads to a decline in real wages in the sugar sector in Thailand and Indonesia while the EU-27 enjoys a rise in real wages in that sector.

Importantly, some countries encountering decreases in production and real income as well as an increase in domestic food prices are likely to suffer from food insecurity. When food production is replaced by imports, there will be a decline in employment and people (particularly those living below the poverty line) will therefore face increasing levels of poverty as people are pushed out of the sector and may not be able to find new jobs. In addition, increasing food prices can lead to worse food situations as people have to pay more for expensive foods or decrease their consumption. As a result, food insecurity may occur in some countries and this is analysed in chapter 5.
Chapter 5 ASEAN food security results

This chapter aims to provide the simulation results estimated from the food security assessment model described in chapter 3. The data used for the estimation is illustrated in subsection 5.1 Subsection 5.2 describes the specific assumptions made and methodology used for this study. The results derived from the food security assessment model are explained in subsection 5.3. Finally, the conclusions of this chapter are shown in subsection 5.4.

5.1 Data used for the estimation of the Food Security Assessment Model

The data used in the Food Security Assessment Model is collected from different sources as shown in table 5.1

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<th>Variables</th>
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</tbody>
</table>

Most of the data are collected from the United States Department of Agriculture (USDA) and the Statistics Division of the FAO (FAOSTAT). Data relating to types of food use such as seed use and feed use is from FAOSTAT. Food aid data is provided from the UN’s World Food Programme (WFP) while all the financial data such as real income and real exchange rate are obtained from the International Monetary Fund (IMF) and World Bank. Macroeconomic data such as production, prices, exports and imports are provided from the USDA. All the data are collected for the period of 1989 – 2013.

5.2 Assumptions and methodology

This study aims to analyse ASEAN food security focusing on people who live below the international poverty line in each ASEAN country. To analyse this, a core assumption is made and the calculation techniques used are spelled out as follows:

1. A core assumption for this analysis is that the free trade agreement between the EU-27 and ASEAN is implemented in 2014. Therefore, the empirical results for this study are projected from 2015 to 2020 and shown as indices with base year 2013 (before implementing the FTA) except for nutritional energy and total energy which are shown as kilocalories (kcal).

2. This study analyses food consumption only for people who live below the poverty line in each ASEAN country and the Lorenz curve (Lorenz, 1905) and income/consumption model is introduced for the calculation of income distribution and consumption proportions for those people.
3. The Lorenz curve for each ASEAN country is constructed from 2013 income distribution data collected from World Bank and the income distribution is assumed constant during the projection period. The Lorenz curve equation is employed to estimate the income level of those people who live below the poverty line. For example, the Lorenz curve equation for Thailand is \( y = 0.0001x^3 - 0.0092x^2 + 0.5808x - 0.5885 \), where \( x \) is the percentage of population and \( y \) is the percentage of income distribution.

4. The income/consumption relationship is specified as shown below.

\[
\ln C = a + b \ln Y \\
C = C_0/P \\
P = P_1 + \ldots + P_i \quad i = 1 \text{ to } 10 \\
Y = Y_0/P
\]

where \( C \) = average per capita food consumption

\( Y \) = per capita income

\( C_0 \) = total food consumption

\( P \) = the total population

\( i \) = income deciles

The parameter \( b \) is the consumption income propensity estimate based on cross-country data for per capita calorie consumption and income.

5. The percentage of food consumption derived from the model for each ASEAN country is used to calculate the per capita consumption quantity of rice, meats, vegetable oils and sugar for the ASEAN population living below the poverty line.

6. The per capita consumption for each food is calculated in terms of nutritional energy. According to the World Health Organisation (WHO), 100 g of rice, meat, vegetable oil and sugar provide on average 257, 190, 884 and 385 kcal respectively.
5.3 Projected food security situation in ASEAN

Empirical results of food security in each ASEAN country derived from the food security assessment model are shown in this subsection. The results start with showing trend lines in food production, domestic price and imports which are important variables to determine food consumption in the food security assessment model. Trend lines of food consumption, per capita food consumption and nutritional energy obtained from each food are subsequently described and total energy obtained from all the selected food is finally explained. The total nutritional energy is the food security indicator showing whether people who live below the poverty line can have enough nutrition for their daily lives or not.

The empirical results for each ASEAN country are shown as follows, starting with Indonesia (Figure 5.1 and 5.2)
Figure 5.1 Indonesia’s projected food production, domestic prices and imports

Source: Projection results from the Food Security Assessment Model.
Figure 5.2 Indonesia’s projected food consumption, per capita consumption and nutritional energy intake

Source: Projection results from the Food Security Assessment Model.
5.3.1 Results for Indonesia

After the free trade agreement between the EU-27 and ASEAN countries is implemented, according to Figure 5.1, almost all results derived from both scenario 1 (FTA with TBs elimination only) and scenario 2 (FTA with TBs and NTBs elimination) show increasing trends in production, domestic price and imports in Indonesia between 2015 and 2020 for all foods including rice, meats, vegetable oils and sugar. In addition, almost every index estimated from scenario 2 exceeds that from scenario 1 throughout the period since NTBs elimination is taken into account.

Food production is estimated to rise by 1.5 percent approximately throughout the period except for vegetable oils where production increases over 5 percent for scenario 1. In comparison, results derived from scenario 2 show higher growth in rice and vegetable oil production, accounting for about 5 and 11 percent respectively while meat and sugar production experience a decreasing trend of approximately 2 and 8 percent respectively during 2015 – 2020.

Domestic food prices in Indonesia are projected to grow slightly by between 1-3 percent throughout the period after only tariffs are eliminated. For scenario 2, domestic prices of all foods are estimated to rise at a higher rate than those derived from scenario 1, ranging between 2 and 7 percent.

In addition, according to scenario 1 (FTA with tariff elimination only), Indonesia is also expected to experience an increase in food imports at about 3 percent projected growth by 2020 for meat and sugar while vegetable oil imports is projected to increase by 7 percent throughout the period. However, rice imported to Indonesia is estimated to drop by more than 5 percent. Similar to most of the indices shown in Figure 5.1, results estimated in scenario 2 are higher than those in scenario 1. Indonesia encounters a bigger increase in food imports in scenario 2; sugar imports experience the highest growth at over 12 percent by 2020 while rice, meat and vegetable oil imports face a rise of 7, 5 and 10 percent approximately.

As a result, changes in food production, domestic prices and imports mainly lead to changes in consumption for Indonesian people. According to Figure 5.3, 11.70 percent of the Indonesian population live below the poverty line, and the Lorenz curve for Indonesia constructed from the 2013 World Bank data indicates that those
people possess only 5.39 percent of national income and the income/consumption model provides the result that they possess only 9.95 percent of food for consumption.

**Figure 5.3** Lorenz curve for Indonesia (year 2013)

![Lorenz curve](image)

Source: Constructed by the 2013 World Bank income distribution database.

In scenario 1, according to Figure 5.2, food consumption for Indonesian people who live below the poverty line is improved throughout the period; rice, meat and sugar consumption experience small growth of 1-2 percent while vegetable oil consumption is projected to rise by approximately 7 percent by 2020. In comparison, the food consumption trend estimated from scenario 2 exceeds that of scenario 1. Indonesian people experience a much higher increase in rice consumption, accounting for more than 5 percent by 2020 while meat and sugar are increasingly consumed at 2-3 percent growth rate and vegetable oil consumption rises over 10 percent during 2015-2020. In the meantime, per capita consumption
growth pattern is similar to total consumption but increases at a slightly lower rate because it is pushed by Indonesian population growth.

Nutritional energy obtained from food consumption, in scenario 1, is expected to improve due to per capita food consumption increases over the period. There is a slight growth in nutritional energy obtained from rice consumption while increases in meat, vegetable oil and sugar consumption provide higher growth of nutritional energy intake. However, in scenario 2 (FTA with both tariff and non-tariff elimination), Indonesian people are provided with significantly increasing nutritional energy intake from higher growth of per capita rice consumption while other foods provide moderately increasing energy intake, compared to those in scenario 1.

**Figure 5.4** Total energy obtained by people below the poverty line in Indonesia

![Figure 5.4](image)

Source: Projection results from the Food Security Assessment Model.

According to Figure 5.4, after the EU-27 and ASEAN free trade agreement is implemented with tariff elimination only, Indonesian people who live below the poverty line are provided with nutritional energy of 1,760 kcal in 2015 and 1,774 kcal in 2020. However, the amount of nutritional energy is still below the minimum dietary energy requirement (FAO’s MDER for Indonesia = 1,810 kcal). By

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contrast, these Indonesian people can reach the MDER when the FTA is implemented with elimination of both TBs and NTBs. Even though the target MDER for Indonesia is not reached during 2015-2017, Indonesian people below the poverty line are expected to reach it in 2018 with nutritional energy intake of 1,820 kcal and projected to reach almost 1,850 kcal in 2020.

In conclusion, full trade liberalisation between the EU-27 and ASEAN can improve impoverished people’s lives in Indonesia; however, FTA with elimination of both TBs and NTBs is expected to improve their lives substantially more than with tariff elimination only.
Figure 5.5 Malaysia’s projected food production, domestic prices and imports

Source: Projection results from the Food Security Assessment Model.
Figure 5.6 Malaysia’s projected food consumption, per capita consumption and nutritional energy intake

Source: Projection results from the Food Security Assessment Model.
5.3.2 Results for Malaysia

Malaysia is estimated to experience rising trends in production, domestic price and imports for almost all foods including meats, vegetable oils and sugar when the free trade agreement between the EU-27 and ASEAN countries is implemented in 2014. In addition, almost every index estimated from scenario 2 exceeds that from scenario 1 throughout the period since NTBs elimination is taken into account.

Malaysia’s food production is projected to increase by 1-6 percent approximately throughout the period except rice whose production decreases about 2 percent for scenario 1. In comparison, results derived from scenario 2 show higher growth in vegetable oil and sugar production, accounting for about 12 and 5 percent respectively while rice production increases by 10 percent and meat production encounter a decreasing trend of approximately 8 percent between 2015 and 2020. For domestic food prices, the country is estimated to encounter a less than 1 percent rise throughout the period after eliminating tariffs only; however, the domestic rice price is estimated to drop by 1 percent by 2020. In the meantime, domestic prices of all foods derived from scenario 2 are estimated to rise at a slightly higher rate than those derived from scenario 1, accounting for about 1 percent except the domestic rice price which is projected to experience a significant growth of almost 10 percent by 2020.

In the case of food imports in scenario 1, Malaysia is also expected to experience a rise in food imports at about 2-3 percent projected growth by 2020 for meat and vegetable oils. Rice imports are estimated to face a significant decrease of 9 percent throughout the period while there is a slight drop in sugar imports during 2015-2020. In addition, most food imports estimated in scenario 2 are higher than those of scenario 1 except sugar imports. Malaysia experiences a bigger increase in food imports in scenario 2; rice imports experience the highest growth of over 10 percent by 2020 while meat and vegetable oil imports are projected to grow by 8 and 4 percent approximately. However, there is a 2 percent drop in sugar imports throughout the period.

Changes in the economic variables mentioned above (food production, domestic prices and imports) mainly lead to changes in food consumption for Malaysian
people. The Lorenz curve constructed by the 2013 World Bank data, shown in Figure 5.7, indicates that 3.80 percent of the Malaysian population lives below the poverty line and those people possess only 1.12 percent of national income. As a result derived from the income/consumption model shows, they possess only 3.06 percent of food for consumption.

**Figure 5.7** Lorenz curve for Malaysia (year 2013)

Source: Constructed by the 2013 World Bank income distribution database.

According to Malaysia’s projected food consumption (Figure 5.6), under scenario 1 meat, vegetable oil and sugar consumption for those Malaysian people who live below the poverty line is slightly improved throughout the period with small growth of 1-2 percent approximately, whereas rice consumption is estimated to encounter a considerable decline of approximately 8 percent by 2020. In comparison, the food consumption trend estimated after eliminating both TBs and NTBs (scenario 2) exceeds that of scenario 1 with the exception of meat consumption. Malaysian people experience a higher rise in vegetable oil and sugar consumption, accounting for 9 and 1 percent respectively by 2020 while meat is decreasingly consumed by 2
percent. Moreover, rice consumption increases by 10 percent by 2020. In the meantime, per capita consumption growth pattern is similar to total consumption but increases at a slightly lower rate because it is pushed by Malaysian population growth.

In the case of nutritional energy obtained from food consumption, according to scenario 1, it is estimated to improve for meat and vegetable oils due to increases in per capita consumption over the period; however, nutritional energy from rice and sugar is projected to drop, as a result of the decline in per capita consumption. However, in scenario 2, Malaysian people are provided with significantly increasing nutritional energy from the higher growth of per capita rice and vegetable oil consumption while meat provides lesser energy compared to scenario 1.

**Figure 5.8** Total energy obtained by people below the poverty line in Malaysia

![Graph showing total energy obtained by people below the poverty line in Malaysia](image)

Source: Projection results from the Food Security Assessment Model.

As a result of the nutritional situation, Malaysian people who live below the poverty line face a worse nutritional energy intake after the EU-27 and ASEAN free trade agreement is implemented with tariff elimination only, decreasing from 1,718 kcal in 2015 to 1,687 kcal in 2020. The amount of nutritional energy is below the minimum dietary energy requirement (FAO’s MDER for Malaysia = 1,820 kcal). By contrast, these Malaysian people can reach the MDER when the FTA is
implemented with the elimination of both TBs and NTBs. The target MDER for Malaysia is reached in 2015 with nutritional energy intake of 1,858 kcal and improved throughout the period to reach 1,916 kcal in 2020.

In conclusion, trade liberalisation between the EU-27 and ASEAN can improve impoverished people’s lives in Malaysia; however, FTA with elimination of both TBs and NTBs is expected to improve their lives rather than tariff elimination only which is estimated to disimprove their lives.
Figure 5.9 The Philippines’ projected food production, domestic prices and imports

Source: Projection results from the Food Security Assessment Model.
Figure 5.10 The Philippines’ projected food consumption, per capita consumption and nutritional energy intake

Source: Projection results from the Food Security Assessment Model.
5.3.3 Results for the Philippines

According to Figure 5.9, after the free trade agreement between the EU-27 and ASEAN countries is implemented, and as in the cases of Indonesia and Malaysia, almost all results derived from both scenario 1 (FTA with TBs elimination only) and scenario 2 (FTA with TBs and NTBs elimination) show increasing trends in food production, domestic price and imports in the Philippines between 2015 and 2020. In addition, almost every index estimated from scenario 2 exceeds that from scenario 1 throughout the period, when NTBs elimination is taken into account.

Sugar production in the Philippines is estimated to increase by 1.5 percent approximately throughout the period while vegetable oil production rises over 9 percent for scenario 1. However, rice and meat face a decrease of about 1 percent in production. In comparison, results derived from scenario 2 show higher growth in rice and sugar production, accounting for about 3 percent while vegetable oil production experiences almost 10 percent growth. However, meat production encounters a decreasing trend of approximately 1 percent during 2015-2020. Meanwhile, domestic food prices in the Philippines are projected to grow less than 1 percent approximately throughout the period after only tariffs are eliminated. For scenario 2, domestic prices of all foods are estimated to increase at a higher rate than those derived from scenario 1, ranging between 1 and 4 percent.

In addition, according to scenario 1, the Philippines is also projected to experience an increase in food imports at about 2 percent projected growth by 2020 for vegetable oils and sugar while rice and meat imports are estimated to rise by 5 percent throughout the period. In addition, the Philippines experiences a bigger increase in food imports in scenario 2 (after both tariffs and non-tariffs are reduced to zero); meat imports experience the highest growth at over 12 percent by 2020 while vegetable oil and sugar imports face a rise of 2 percent approximately. However, rice imports face a significant decrease of 9 percent during 2015-2020.

Changes in food production, domestic prices and imports mainly result in changes in consumption for people in the Philippines. According to Figure 5.11, 26.50 percent of the population in the country lives below the poverty line, and the 2013 Lorenz curve for the Philippines indicates that those people possess only 10.68
percent of national income. In addition, a result derived from the income/consumption model shows that they possess only 20.53 percent of food for consumption.

Figure 5.11 Lorenz curve for The Philippines (year 2013)

Source: Constructed by the 2013 World Bank income distribution database.

In scenario 1, according to The Philippines’ projected food consumption (Figure 5.10), food consumption for people who live below the poverty line in The Philippines is improved throughout the period; rice, meat and sugar consumption experience growth of 2 percent while vegetable oil consumption is projected to increase by approximately 6 percent by 2020. In comparison, the food consumption trend estimated from scenario 2 exceeds that of scenario 1. People in the Philippines experience a higher increase in meat, vegetable oil and sugar consumption, accounting for more than 4 percent by 2020 while rice is decreasingly consumed by 4 percent during 2015-2020. In the meantime, per capita consumption growth patterns are similar to total consumption but increases at a slightly lower rate because it is pushed by its population growth.
In the case of nutritional energy intake obtained from food consumption (scenario 1), the Filipinos are projected to experience an improvement due to per capita food consumption increases over the projection period. There is growth of nutritional energy obtained from all types of food consumption. However, in scenario 2, people in the Philippines are provided with significantly increasing nutritional energy from the higher growth of per capita meat, vegetable oil and sugar consumption while decreasing rice consumption provides decreasing energy intake.

**Figure 5.12** Total energy obtained by people below the poverty line in the Philippines

Source: Projection results from the Food Security Assessment Model.

According to Figure 5.12, after the EU-27 and ASEAN free trade agreement is implemented with tariff elimination only, people who live below the poverty line in the Philippines are provided nutritional energy of 1,745 kcal in 2015 and 1,777 kcal in 2020. Even though the target MDER for the Philippines is not reached in 2015 (FAO’s MDER for the Philippines = 1,750 kcal), these people are expected to reach it in 2016 with nutritional energy of 1,751 kcal. By contrast, nutritional energy for people in the Philippines who live below the poverty line deteriorates when the FTA is implemented with the elimination of both TBs and NTBs. They are
provided less nutritional energy, accounting for 1,716 kcal in 2015 and 1,708 kcal in 2020.

In conclusion, trade liberalisation between the EU-27 and ASEAN can improve impoverished people’s lives in The Philippines, if and only if, trade liberalisation is agreed with the elimination of TBs only.
Figure 5.13 Thailand’s projected food production, domestic prices and imports

Source: Projection results from the Food Security Assessment Model.
Figure 5.14 Thailand’s projected food consumption, per capita consumption and nutritional energy intake

Source: Projection results from the Food Security Assessment Model.
5.3.4 Results for Thailand

According to Figure 5.13, almost all variables in terms of food production, domestic price and imports derived from both scenario 1 (EU-ASEAN FTA with TBs elimination only) and scenario 2 (EU-ASEAN FTA with TBs and NTBs elimination) indicate growth for Thailand between 2015 and 2020 for all foods including rice, meats, vegetable oils and sugar. In the meantime, the results show that almost every index estimated from scenario 2 exceeds that from scenario 1 throughout the period when NTBs elimination is taken into account.

In the case of scenario 1, rice and meat production are estimated to grow by 5 percent approximately during 2015-2020 while vegetable oil and sugar production increase less than 1 percent. In comparison, results derived from scenario 2 illustrate higher growth for rice, meat and vegetable oil production, ranging between 4 and 10 while sugar production decreases by approximately 3 percent by 2020. In addition, domestic food prices in Thailand are projected to grow slightly by between 1-3 percent throughout the period after only tariffs are eliminated. For scenario 2, domestic prices of all foods are estimated to rise at a higher rate than those derived from scenario 1. Meat, vegetable oil and sugar prices experience increases, ranging between 1 and 5 percent while the rice price grow significantly by over 10 percent by 2020.

As a result of tariff elimination only (scenario 1), Thailand is also expected to experience an increase in vegetable oil imports of 1 percent by 2020 while rice and sugar imports are projected to increase by 9 and 11 percent respectively throughout the period. However, meat imported in Thailand is estimated to face a decreasing trend, declining by more than 5 percent by 2020 but it is still higher than meat imports before implementing the FTA (with an index > 100). In line with most of the indices, results estimated for both zero TBs and NTBs (scenario 2) are higher than those of scenario 1. Thailand encounters a bigger increase in sugar imports in scenario 2 while meat imports increase throughout the period. However, rice and vegetable oil imports face a lower increasing rate, compared to those estimated from scenario 1.
Food consumption for Thai people changes mainly due to changes in food production, domestic prices and imports. According to Figure 5.15, from the 2013 World Bank income distribution data, 7.80 percent of Thai population live below the poverty line. The 2013 Lorenz curve for Thailand illustrates that those people have a 3.43 percent share of national income and the income/consumption model shows that they possess only 7.11 percent of food for consumption.

Figure 5.15 Lorenz curve for Thailand (year 2013)

Source: Constructed by the 2013 World Bank income distribution database.

In scenario 1, according to Thailand’s projected food consumption (Figure 5.14), food consumption for Thai people who live below the poverty line is improved throughout the period; rice, vegetable oil and sugar consumption experience growth of 1-6 percent while meat consumption is projected to drop by approximately 2 percent by 2020 but it is still higher than meat consumption before implementing the free trade agreement (index > 100). In comparison, the food consumption trend estimated from scenario 2 exceeds that of scenario 1. Thai people experience a much higher increase in rice and meat consumption, accounting for 10 and 13
percent respectively by 2020 while vegetable oils and sugar consumption are projected to increase by 2 and 7 percent respectively during 2015-2020. In the meantime, per capita consumption growth pattern is similar to total consumption but increases at a slightly lower rate because it is pushed by Thai population growth.

Nutritional energy obtained from food consumption, according to scenario 1, is expected to improve due to per capita food consumption increases over the period. There is slight growth of nutritional energy obtained from vegetable oil and sugar consumption while increases in rice consumption provide higher growth of nutritional energy intake. However, in the case of both TBs and NTBs elimination (scenario 2), Thai people are provided with significantly increasing nutritional energy from higher growth of per capita rice, meat and vegetable oil consumption while energy from sugar increases at a slower rate compared to that in scenario 1 due to the slower growth rate of per capita sugar consumption.

**Figure 5.16** Total energy obtained by people below the poverty line in Thailand

![Graph showing total energy obtained by people below the poverty line in Thailand with different scenarios.](chart.png)

Source: Projection results from the Food Security Assessment Model.

According to Figure 5.16, Thai people who live below the poverty line are provided with nutritional energy of 1,983 and 2,023 kcal in 2015 and 2020 respectively in the case of tariff elimination only (scenario 1). The amount of nutritional energy is higher than the minimum dietary energy requirement (FAO’s MDER for Thailand
Furthermore, these Thai people can reach the average dietary energy requirement (ADER = 2,100 kcal) when the FTA is implemented with elimination of both TBs and NTBs (scenario 2). Thai people below the poverty line are expected to reach the ADER in 2020 with nutritional energy intake of 2,100 kcal.

In conclusion, trade liberalisation between the EU-27 and ASEAN can improve impoverished people’s lives in Thailand; however, FTA with elimination of both TBs and NTBs is expected to improve their lives considerably more than with tariff elimination only.
Figure 5.17 Vietnam’s projected food production, domestic prices and imports

Source: Projection results from the Food Security Assessment Model.
Figure 5.18 Vietnam’s projected food consumption, per capita consumption and nutritional energy intake

Source: Projection results from the Food Security Assessment Model.
5.3.5 Results for Vietnam

According to Figure 5.17, after the free trade agreement between the EU-27 and ASEAN countries is implemented, almost all results derived from both scenario 1 (FTA with TBs elimination only) and scenario 2 (FTA with TBs and NTBs elimination) illustrate small growth in production, domestic price and imports in Vietnam during 2015-2020 for all foods. In addition, almost every index estimated from scenario 2 exceeds that from scenario 1 throughout the period since NTBs elimination is taken into account.

Food production is projected to rise below 1 percent throughout the period except meat whose production decreases approximately 1 percent for scenario 1. In comparison, results derived from scenario 2 show higher growth in rice, vegetable oil and sugar production, ranging between 1 and 5 percent while meat production faces a decreasing trend of approximately 3 percent between 2015 and 2020.

Domestic food prices in Vietnam are estimated to rise slightly by less than 1 percent throughout the period after only tariffs are eliminated. For scenario 2, domestic prices of all foods are estimated to rise at a higher rate than those derived from scenario 1, ranging between less than 1 percent and 3 percent.

In addition, according to scenario 1 (EU-ASEAN FTA with tariff elimination only), Vietnam is also expected to experience an increase in rice and meat imports of 3 and 5 percent approximately by 2020 while vegetable oil imports is projected to face a less than 1 percent increase throughout the period. However, sugar imported into Vietnam is estimated to decrease by 2 percent. Similar to most of the indices shown in Figure 5.17, results estimated after both tariff and non-tariff elimination (scenario 2) are higher than those of scenario 1. Vietnam experiences a higher increase in rice and meat imports in scenario 2, accounting for 5 and 7 percent respectively. In the meantime, sugar imports encounter a decline of 4 percent by 2020.

In consequence, changes in the variables (food production, domestic prices and imports) mainly lead to changes in food consumption for the Vietnamese people. According to Figure 5.19, 11.30 percent of the Vietnamese population live below the poverty line, and the Lorenz curve for Vietnam constructed with the 2013
World Bank income distribution data illustrates that those people possess only 5.05 percent of national income. In addition, a result derived from the income/consumption model shows that they possess only 9.58 percent of food for consumption.

**Figure 5.19** Lorenz curve for Vietnam (year 2013)

Source: Constructed by the 2013 World Bank income distribution database.

As a result of changes in food production, domestic prices and imports, according to Figure 5.18, food consumption for Vietnamese people who live below the poverty line is improved throughout the period; rice, meat and vegetable oil consumption experience small growth of 1-2 percent while sugar consumption is projected to drop by approximately 1 percent throughout the period. In comparison, the food consumption trend estimated from scenario 2 exceeds that of scenario 1. Vietnamese people experience a higher increase in rice consumption, accounting for about 5 percent by 2020 while meat, vegetable oils and sugar are increasingly consumed at 1.5 percent growth during 2015-2020. In the meantime, per capita
consumption growth pattern is similar to total consumption but increases at a slightly lower rate because it is pushed by Vietnamese population growth.

Nutritional energy intake obtained from food consumption, according to scenario 1, is expected to improve due to per capita food consumption increases over the period. There is moderate growth of nutritional energy obtained from rice consumption while increases in meat and vegetable oil consumption provide small increases in nutritional energy. In addition, according to scenario 2, Vietnamese people are provided with significantly increasing nutritional energy from higher growth of per capita rice, vegetable oil and sugar consumption while energy from meat increases at a slower rate compared to that in scenario 1 due to the slower growth rate of per capita meat consumption.

**Figure 5.20** Total energy obtained by people below the poverty line in Vietnam

![Figure 5.20](image)

Source: Projection results from the Food Security Assessment Model.

According to Figure 5.20, after implementing the EU-27 and ASEAN free trade agreement with tariff elimination only, Vietnamese people who live below the poverty line are provided with nutritional energy of 1,836 kcal in 2015 and 1,849 kcal in 2020. The amount of nutritional energy is higher than the minimum dietary energy requirement (FAO’s MDER for Vietnam = 1,810 kcal). Furthermore, these Vietnamese people can reach beyond the MDER when the FTA is implemented.
with elimination of both TBs and NTBs, ranging between 1,850 and 1,887 kcal throughout the period.

In conclusion, trade liberalisation between the EU-27 and ASEAN can improve impoverished people’s lives in Vietnam; however, FTA with elimination of both TBs and NTBs is expected to improve their lives more rather than with tariff elimination only.
Figure 5.21 The group of other ASEAN countries’ projected food production, domestic prices and imports

Source: Projection results from the Food Security Assessment Model.
Figure 5.22 The group of other ASEAN countries’ projected food consumption, per capita consumption and nutritional energy intake

Source: Projection results from the Food Security Assessment Model.
5.3.6 Results for the Group of other ASEAN countries

The group of other ASEAN countries (including Brunei, Cambodia, Laos PDR and Myanmar) is estimated to experience increasing trends in production, domestic price and imports for all foods including meats, vegetable oils and sugar when the free trade agreement between the EU-27 and ASEAN countries is implemented in 2014. In addition, almost every index estimated from scenario 2 exceeds that from scenario 1 throughout the period since NTBs are taken into account, as in the most cases of the other ASEAN countries.

Food production in the group of other ASEAN countries is estimated to rise by 1-2 percent approximately throughout the period except sugar whose production increases almost 10 percent for scenario 1. In comparison, results derived from scenario 2 illustrate higher growth in vegetable oil production, accounting for about 3 percent while meat, rice and sugar production experience considerable growth, ranging between 5 and 11 percent respectively during 2015 – 2020. In the meantime, domestic food prices in the group of other ASEAN countries are projected to increase slightly by approximately 1 percent throughout the period after only tariffs are eliminated. For scenario 2, domestic prices of all foods are estimated to rise at a higher rate than those derived from scenario 1, especially the rice price increasing by 9 percent by 2020. In the case of food imports, according to scenario 1, countries in the group of other ASEAN countries are also expected to experience a slight increase in food imports at about 1-2 percent projected growth by 2020. For all indices, results estimated in scenario 2 are higher than those of scenario 1. Countries in the group of other ASEAN countries encounter a higher increase in food imports in scenario 2; rice imports experience the highest growth of 8 percent by 2020 while meat, vegetable oil and sugar imports face a rise of 2-3 percent approximately.

As a result, people who live in countries in the group of other ASEAN countries face changes in food consumption due to changes in food production, domestic prices and imports. According to Figure 5.23, 26 percent of the population live below the poverty line and the 2013 Lorenz curve for countries in the group of other ASEAN countries indicates that those people possess only 11.39 percent of
national income. In addition, a result derived from the income/consumption model indicates that they have a share of 19.89 percent of food for consumption.

**Figure 5.23** Lorenz curve for the group of other ASEAN countries (year 2013)

![Lorenz curve](image)

Source: Constructed by the 2013 World Bank income distribution database.

For the population in the group of other ASEAN countries, after only tariff barriers are eliminated (scenario 1), according to Figure 5.22, food consumption for people who live below the poverty line is improved throughout the period; rice, meat and vegetable oil consumption experience small growth of 1-2 percent while sugar consumption is projected to rise by approximately 5 percent by 2020. In comparison, the food consumption trend estimated after eliminating both TBs and NTBs (scenario 2) exceeds that of scenario 1. People experience a much higher increase in rice and sugar consumption, accounting for approximately 6 percent by 2020 while meat and vegetable oils are increasingly consumed at 2-3 percent growth rate during 2015-2020. In the meantime, per capita consumption growth pattern is similar to total consumption but increases at a slightly lower rate because it is pushed by population growth.
In the case of nutritional energy obtained from food consumption, in scenario 1, it is expected to improve due to per capita food consumption growth over the period. There is a slight growth of nutritional energy obtained from vegetable oil consumption while increases in rice, meat and sugar consumption provide higher growth of nutritional energy intake. Moreover, according to scenario 2, people are provided with significantly increasing nutritional energy from higher growth in per capita rice consumption while other foods provide moderately increasing energy, compared to those in scenario 1.

**Figure 5.24** Total energy obtained by people below the poverty line in the group of other ASEAN countries

![Figure 5.24](image_url)

Source: Projection results from the Food Security Assessment Model.

As a result of nutritional energy intake, according to Figure 5.24, people who live below the poverty line in the group of other ASEAN countries are provided with nutritional energy of 1,697 kcal in 2015 and 1,707 kcal in 2020. However, the amount of nutritional energy is still below the minimum dietary energy requirement (average FAO’s MDER for this group = 1,790 kcal). By contrast, those people can reach the MDER when the FTA is implemented with elimination of both TBs and NTBs. Even though the target MDER for the group of other ASEAN countries is not reached during 2015-2019, people are expected to reach it in 2020 with nutritional energy intake of 1,791 kcal.
In conclusion, trade liberalisation between the EU-27 and ASEAN can improve impoverished people’s lives in the group of other ASEAN countries; however, FTA with elimination of both TBs and NTBs is expected to improve their lives substantially more than with tariff elimination only.
5.4 Conclusions

The simulation results of the EU-ASEAN FTA, according to both scenarios (with TBs elimination only and with TBs and NTBs elimination), lead to the following conclusions.

1. Some of the ASEAN countries, such as Thailand and Vietnam are highly dependent on the role of the food sector as national food production accounts for a large proportion of overall consumption while food imports are important for some of the ASEAN countries such as Malaysia and the Philippines.

2. Changes in domestic food prices influence food security in ASEAN countries in terms of the effects on the population’s capacity to buy domestically produced foods. However, on the supply side, higher domestic food prices can generate higher food production, resulting consequently in more food consumption. In the meantime, changes in world food prices also influence food security in the region through their impact on purchasing power to buy imported foods. World food commodity prices have remained at relatively high levels until implementing the FTA (until 2013), continuing their pressure on household budgets and commercial import capacity in food-importing developing countries.

3. Nevertheless, according to the results from chapter 4, ASEAN countries generally experience economic growth with GDP rising by 0.3 percent on average when the FTA is implemented. This growth leads to higher food production and import capacity, reaching into the people living below the poverty line. As a result, those people’s access to food is improved and the improved food access also leads to improved nutritional status in ASEAN countries.

4. The food security situation is projected to improve in the ASEAN region. In most of the ASEAN countries (except the Philippines), per capita food consumption is projected to reach or exceed the nutritional target after the FTA is implemented. However, long-term improvement in food security is expected in case of the FTA with tariff and non-tariff elimination, considerably more than FTA with tariff elimination only.
5. In addition, the most food secure country in the region is expected to be Thailand where people who live below the poverty line are projected to consume at or above the minimum nutritional target after 2015. This is because of a projected increase in per capita consumption resulting from a big increase in food production and imports after implementing the EU-ASEAN free trade agreement.

6. Food consumption increases across all ASEAN countries in both scenarios (except Malaysia for scenario 1 and the Philippines for scenario 2), with respect to overall calorie levels, due to higher consumption of foods such as rice, meats and vegetable oils while the Malaysians and the Filipinos encounter a decline in food consumption after implementing the FTA with TBs elimination only and with both TBs and NTBs elimination respectively. However, many countries in the region still face a lack of recommended levels of nutritional energy intake in scenario 1. Only Thailand and Vietnam, the countries with the highest food consumption levels in ASEAN, can exceed the minimum dietary energy requirement (MDER) in the first year (2015) after implementing the FTA while the Philippines is estimated to reach the MDER in 2016, according to scenario 1. However, Indonesia and the group of other ASEAN countries cannot reach their MDERs during the period while Malaysia is projected to face nutritional deterioration due to decreasing per capita food consumption after implementing the EU-ASEAN FTA with tariff elimination only. For scenario 2, most of the ASEAN countries can reach the MDER in earlier years with the exception of the Philippines which encounters nutritional deterioration due to declining per capita food consumption after the EU-ASEAN FTA with both TBs and NTBs elimination is implemented.

7. Average regional calorie consumption levels are below the average dietary energy requirement (ADER) of 2,100 kcal throughout the period, with the group of other ASEAN countries, having the lowest income, consuming below 1,800 kcal. Lower-middle income country consumption in Indonesia, the Philippines and Vietnam, is also below the 2,100 kcal target in both scenarios. Thailand is the most food secure country when the EU-ASEAN
FTA with both TBs and NTBs elimination is implemented, reaching the ADER target in 2020.
Chapter 6 Conclusion

This chapter presents the conclusions of this study. The general background on the limitations of previous studies and the implications for this study are summarised in subsection 6.1 while the summary of findings are presented in subsection 6.2. The contributions of the thesis and its economic policy implications are shown in subsection 6.3.

6.1 Limitations of previous studies and implications for this study

Despite ASEAN being a leader in agricultural product exports in 2012, some ASEAN countries have suffered from food insecurity due to, for example, the declining performance of agriculture, a rise in food prices and food price volatility and increasing fuel prices. Apart from the above-mentioned factors likely threatening food security in ASEAN, trade liberalisation is also a significant factor affecting food security. The impact of trade liberalisation can be categorised onto five main economic variables including imports, exports, real income and equality, investment and employment. Consequently, after implementing the free trade agreement between the EU-27 and ASEAN, changes in those variables can subsequently affect food consumption of people who live under the poverty line in ASEAN countries.

Most of the previous studies aimed to evaluate the impact of free trade on agricultural sector in broad economic points of view such as the impact on imports, exports and production. On the other hand, there are few studies reviewed proposing to assess the impact of FTA on rural livelihoods and poverty. However, the issue of food security is not concerned directly despite being one of the most vital problems currently occurring in many countries, particularly in developing countries.

In relation to assessment methods, a variety of research methodologies for assessing the impact of trade liberalisation on agriculture have been applied to previous studies. The most popular method for the study of the impact on food security is field survey using questionnaires. However, the field survey is appropriate for the
ex-post evaluation. Since the thesis aims to study the ex-ante impact, the field survey may be inappropriate. Furthermore, even though other methodologies for analysing trade liberalisation impact like cross-sectional regressions can describe the impact of tariff reduction on food security; their results are probably unclear in some questions such as gainers and losers from the impact.

As GTAP is a type of CGE model, it accounts for economic changes in all sectors. Agricultural trade liberalisation not only affects the agricultural sector directly such as changes in production and prices but also takes some impact to other sectors including households in an indirect way that reflects on their livelihoods and food security (Plummer et al, 2010). Moreover, the GTAP model is relatively accessible compared to other CGE models. In addition, the GTAP database associated with the model is peer-reviewed and fully documented with high quality and internal consistency (Hertel, 2009).

In addition, for the ex-ante impact assessment, most of the reviewed articles and studies mentioned in 2.5 employed the GTAP model to evaluate the effects from trade policies. However, most of the studies are interested in assessing only the impact of tariff barrier reduction, in other words, there are very few studies applying the effects of NTBs elimination into the assessment.

Therefore, the aim of the thesis is to study the impact of trade liberalisation on food security using the GTAP model with the impact assessment of both TBs only and TBs and NTBs elimination. In addition, results obtained from the GTAP model will be used to evaluate food security using food security indicators and the food security assessment model.

6.2 Thesis findings

6.2.1 The ad valorem tariff equivalent of non-tariff barriers

The Gravity equation explains that the levels of non-tariff barriers are high on all the selected foods indicated by a low $R^2$ value in each model accounting for 50 percent on average, meaning that about only 50 percent of the variation in the imports of these products can be explained by all the variables in the Gravity
equation. It can be inferred that the economic variables specified in the model may not be able to provide a comprehensive explanation of the trading pattern for these foods. The other explanatory variables may likely be a relatively strong interference in the staple food markets in the trade partner countries.

When taking the residual $\varepsilon$ derived from the Gravity equation into the ad valorem tariff equivalent calculation following Anderson and Wincoop’s (2003) methodology, the tariff equivalent of non-tariff barriers is clearly much higher than the tariff barriers in both the EU-27 and ASEAN. Thailand’s NTBs for rice and meat are equivalent to 195 and 175 percent respectively, the highest AVEs for rice and meat imports in ASEAN; while the AVEs levied on sugar is highest in the Philippines and Indonesia. In addition, non-tariff barriers in Singapore against food imported from the EU-27 are also high despite zero tariffs for food imports. Similarly, the EU-27’s non-tariff protection against ASEAN imports is higher than its tariff rates. The AVEs on rice exported from ASEAN countries to the EU-27 is higher than 250 percent on average while the AVEs levied on meat and vegetable oil imports is relatively low compared to those levied on other food imports. The results are reliable since not only the explicit trade restrictions between the EU-27 and ASEAN are shown in the figures but the implicit effects from all related factors that may affect trade costs are also revealed. In addition, the high level of non-tariff barriers shown in this result is in line with those of other studies, such as the study of Ando and Obashi (2010).

6.2.2 The simulation of the augmented GTAP model

After designing and simulating two scenarios, namely an FTA with only a 100 percent tariff reduction and an FTA with tariffs and non-tariffs elimination, the concluding results can be presented as follows.

Overall, the ASEAN countries experience an economic expansion after eliminating all tariff barriers under scenario 1 in line with international trade theory, leading to an increase in GDP values for all the ASEAN countries. Thailand gains the most in real income while Vietnam experiences the least growth. In addition, Thailand and Indonesia enjoy the largest rise in export values, resulting in the largest trade
surpluses compared to other ASEAN countries. However, Malaysia and the Philippines encounter a trade deficit after implementing the FTA. All the price indices (of exports, imports and consumption) are higher in all the ASEAN members, particularly in the group of other ASEAN countries including Brunei, Cambodia, Laos PDR and Myanmar which encounter price indices of imports increasing over that of exports leading to a decline in the terms of trade.

For the EU-27, GDP value and real income remain unchanged after implementing the free trade agreement. Private consumption is also constant since real income stays unaffected. However, since free trade results in a greater increase in import value than that in export value, the EU-27 faces a trade deficit. Furthermore, the price index of exports falls under that of imports, leading to a drop in the terms of trade.

In scenario 2, the simultaneous elimination of both tariff and non-tariff protection is taken into account, and the overall impact is greater than that in scenario 1. Almost every ASEAN country, with the exception of Singapore, benefits from an increase in GDP value. Indonesia experiences the largest increase in real income instead of Thailand in scenario 1, whereas the group of other ASEAN countries, Vietnam and Thailand, which enjoy a rise in real income in scenario 1, encounter a drop instead. This could be because the growth rate of inflation rises over that of income in these countries. In addition, Indonesia and Thailand are still at the top of ASEAN countries which gain the largest increase in trade balance while the trade balances for the Philippines and Malaysia drop more than those estimated in scenario 1. Indonesia and Thailand experience an increasing export-import price gap compared to that in scenario 1, leading to the biggest increases in terms of trade; by contrast, the terms of trade in Singapore and Vietnam become negative.

For the EU-27, GDP value and real income increase after opening the free trade agreement with tariff and non-tariff elimination. Conversely, all the price indices face a drop, implying that people living in member states of the EU-27 experience cheaper prices. However, since the 100 percent reduction of both tariff and non-tariff barriers is applied, the import value increases while the export value declines, leading to an increasing drop in the trade balance.
According to the results by products, in general, the impact estimated from scenario 2 is greater than that estimated from scenario 1 and the EU-27 faces negative effects; however, there is an exception for some cases. Thailand is the country which enjoys the greatest benefits in the rice sector while Malaysia encounters the worst situation in a decrease in rice production, exports and real wages after eliminating tariffs only. However, Malaysia enjoys positive economic variables after opening the FTA without non-tariff barriers levied on rice. This is because the elimination of very high rates of NTBs leads to higher comparative competitiveness in the rice sector in Malaysia and the country can therefore increase rice production and exports. By contrast, after eliminating NTBs, the Philippines faces a drop in rice imports due to a higher import price while the domestic price increases and its rice production rises slightly. This possibly leads to food insecurity in the Philippines.

For the meat sector, Thailand is still the country which gains the most; by contrast, The Philippines face the biggest trade deficit after eliminating tariffs only. However, Indonesia encounters a trade deficit and a decline in production after implementing the EU-ASEAN trade liberalisation with taking non-tariff barriers elimination into account. This is because the elimination of NTBs results in lower comparative competitiveness in meat in Indonesia compared to other countries. In addition, Vietnam encounters a drop in real wages in both scenarios.

Major ASEAN vegetable oil exporters, Indonesia, Malaysia and the Philippines, are the group which gains the most in the vegetable oil trade, production and real wages while the economic variables in other ASEAN countries either change slightly or remain unchanged. The results are similar in both scenarios.

For the sugar sector, the group of other ASEAN countries gains the most on all economic variables such as trade balance, production and real wages while other countries experience slight changes. However, after opening the FTA without non-tariff barriers levied on sugar , Thailand and Indonesia face a trade deficit as well as a decrease in sugar production while the trade balance of sugar in the EU-27 changes from a trade deficit to a trade surplus; in addition, production and exports also rise. This leads to a decline in real wages in the sugar sector in Thailand and Indonesia while the EU-27 enjoys a rise in real wages in that sector.
6.2.3 Projected food security situation in ASEAN countries

According to the simulation results obtained from the food security assessment model, there are seven main points listed in conclusion as follows.

First, some of the ASEAN countries, such as Thailand and Vietnam are highly dependent on the role of food sector as national food production accounts for a large proportion of overall consumption while food imports are important for some of the ASEAN countries such as Malaysia and the Philippines.

Second, changes in domestic food prices influence food security in ASEAN countries in term of effects on their capacity to buy domestically produced foods. However, on the supply side, higher domestic food prices can generate higher food production, consequently resulting in more food consumption. In the meantime, changes in world food prices also influence food security in the region through their impact on their capacity to purchase imported foods. World food commodity prices have remained at relatively high levels until implementing the FTA, continuing the pressure on budgets and commercial import capacity in food-importing developing countries.

Third, nevertheless, according to the results from chapter 4, the ASEAN countries generally experience economic growth with GDP rising by 0.3 percent on average when the FTA is implemented. This growth leads to higher food production and import capacity, reaching into the people living below the poverty line. As a result, those people’s access to food is improved and the improved food access also leads to improved nutritional status in ASEAN countries.

Fourth, the food security situation is projected to improve in the ASEAN region. In most ASEAN countries, per capita food consumption is projected to reach or exceed the nutritional target after the FTA is implemented. However, long-term improvement in food security is expected in the case of the FTA with tariff and non-tariff elimination rather than with tariff elimination only.

Fifth, in addition, the most food secure country in the region is expected to be Thailand where people who live below the poverty line are projected to consume at or above the minimum nutritional target. This is because of a projected increase in
per capita consumption resulting from a big increase in food production and imports after implementing the EU-ASEAN free trade agreement.

Sixth, food consumption increases across all ASEAN countries in both scenarios (except Malaysia for scenario 1 and the Philippines for scenario 2), with respect to overall calorie levels, due to higher consumption of foods such as rice, meats and vegetable oils. However, many countries in the region still face a lack of recommended levels of nutritional energy intake in scenario 1. Only Thailand and Vietnam, the countries with the highest food consumption levels in ASEAN, can exceed the minimum dietary energy requirement (MDER) in the first year after implementing the FTA while the Philippines is estimated to reach the MDER in later years. However, Indonesia and the group of other ASEAN countries cannot reach their MDERs throughout the period while Malaysia is projected to face nutritional deterioration due to decreasing per capita food consumption after implementing the EU-ASEAN FTA with tariff elimination only. For scenario 2, most of ASEAN countries can reach the MDER in earlier years with the exception of the Philippines which encounters nutritional deterioration due to declining per capita food consumption after the EU-ASEAN FTA with both TBs and NTBs elimination is implemented.

Seven, average regional calorie consumption level is below the average dietary energy requirement (ADER) of 2,100 kcal throughout the period, with the group of other ASEAN countries, having the lowest income, consuming below 1,800 kcal. Lower-middle income country consumption in, Indonesia, the Philippines and Vietnam, is also below the 2,100 kcal target in both scenarios. Thailand is the most food secure country when the EU-ASEAN FTA with both TBs and NTBs elimination is implemented, reaching the ADER target in 2020.

6.3 Contributions of the study, economic policy implications and the potential of future research

In summary, the contributions obtained from this study are that this study investigates the projected food security situation in ASEAN countries after the EU-ASEAN trade liberalisation is implemented, taking the effects of non-tariff barrier
elimination into account in order to compare the effects between the elimination of TBs only and the elimination of both TBs and NTBs for each ASEAN country. All of the reviewed previous studies just concerned the impact of FTA on food security by focusing on TBs elimination only. In addition, the combination of the GTAP model and the Food Security Assessment model is first introduced in this study. For the reviewed previous studies, the shock magnitude which is used to insert shock into the food security assessment model is applied by assuming or using basic statistics such as average values while this study employs the GTAP model to estimate the shock magnitude and then uses the magnitude to insert shock into the food security assessment model. The GTAP model is popular and appropriate for studies in the field of international economics; therefore the results derived from the GTAP model should be more reliable than those obtained from basic statistics or assumption.

Some economic policy implications might be taken from this study. The results from the GTAP model indicate that the EU-ASEAN trade liberalisation can create production expansion for net food exporting countries such as Thailand and Vietnam while net food importing countries such as Malaysia and the Philippines are estimated to encounter contraction in food production and to depend on more imports. In the meantime, the volatility in global food prices is estimated to continue until 2020 (USDA, 2013); net food importing countries may therefore face severe threats on food imports while encountering a decline in food production. In addition, the elimination of both TBs and NTBs is expected to result in more positive effects than that of TBs elimination only; however, after both TBs and NTBs are eliminated, the Philippines is projected to experience negative effects due to a large decrease in rice imports. Since The Philippines are highly dependent on rice imports, the decrease in rice imports consequently leads to a significant drop in rice consumption and nutritional energy intake.

Another important issue is the low nutritional energy level obtained from food consumption by ASEAN people who live below the poverty line. This potential threat to food security generally occurring in the lower-income countries results from income inequality. The Lorenz curve constructed in this study illustrates a high level of income inequality in ASEAN, particularly in Malaysia and the
Philippines. Furthermore, in the Philippines and the group of other ASEAN countries including Brunei, Cambodia, Laos PDR and Myanmar, poverty rates are at the highest level, accounting for 26.5 and 26 percent respectively. These results translate into low purchasing power for lower income households. As a result, nutritional energy has been consumed by those people at a level below the minimum dietary energy requirement (MDER). Even though the free trade agreement is expected to increase their food consumption, the nutritional energy consumption level just rises over the MDER and it is still far from reaching the average dietary energy requirement (ADER). In other word, the consumption gap between people with good livelihoods and those in poverty is still wide.

These estimations imply that the differences among ASEAN members’ economies should be considered when the EU-ASEAN FTA is implemented. The ASEAN countries with the exception of the Philippines should encourage the implementation of an EU-ASEAN free trade agreement focusing on the elimination of both tariff and non-tariff barriers in food sectors while the Philippines should encourage the establishment of an FTA with tariff elimination only. In addition, the net food importing countries such as The Philippines and Indonesia should increase their food production, at least for more domestic consumption since food imports are estimated to drop after implementing the FTA. Their governments should earnestly consider policies in relation to technological research and development for agriculture because it is a crucial tool to increase food production.

Furthermore, income inequality should be decreased; however, raising the minimum wage may not be a good policy instrument because it eventually raises commodity prices. Instead, all people, especially people living with poverty, should have opportunity to access quality education. When those people are educated to higher levels with good quality educational institutes, they will have more opportunity to choose high-income jobs or apply the knowledge they have to develop their homelands. These can lead to food-secure livelihoods for the lower-income population.

There are three potential ways to develop from this thesis for future research. First, since the standard GTAP model is mainly constructed with neoclassical economic principles, the market structure in the model is assumed to be perfectly competitive.
In the real world, the economic structure comprises both perfectly and imperfectly competitive markets. Therefore, the effects derived from imperfectly competitive market should be taken into account for future research. Second, the assumption on technological and capital movement should be taken into account since the full free trade agreement should allow these two movements across the regions. The movements may result in additional changes in economic variables such as production, prices and patterns of trade. Third, in this study, income distribution is assumed constant during the projection period; however, in reality, income distribution may change over time period due to population growth. Dynamic change in population and income distribution should be taken into account for future research.
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