

An analysis of food security in selected ASEAN countries (Analisis keselamatan makanan di negara ASEAN terpilih)

Khairul Hafifi Maidin* and Tapsir Serin*

Keywords: food security, food production, per capita income, access women status

Abstract

This study examined the annual food security situation and its determinants in selected ASEAN countries for the period of 1967 to 2009. The data analysis techniques involved both descriptive and econometric analyses, where ordinary least square procedure of regression was used in the econometric analysis. The results of the study revealed that the selected ASEAN countries were food secure, although, the long run sustainability of food security remains to be an issue. This was based on per capita food availability and dietary energy supply as well as dietary energy requirement. The determinants of food security were analysed in the empirical analysis. Total food production, per capita income and access women status were significant factors in explaining the level of food security in the long term in the selected four ASEAN countries. The regression model showed that 1% increase in total food production would result in increase food security by 0.036%, whereas each 1% increase in per capita income increases the food security by 0.027%. Similarly, access women status has positive relationship with food security, 1% increase in access women status would result in increase food security by 0.397%.

Introduction

There has been a long-standing interest in understanding the relationship between booming in demand side and constraints in supply side and its relation with food insecurity. Since industrial revolution, large part of national investments have been made in industrial sectors, whereas proportion of investment in agricultural production decrease significantly. Besides that the increasing per capita income, population growth, bio fuel production, climatic change and depleting resources are among prominent reasons for food insecurity. These issues have caused more concern about food security.

Food security could be defined as sufficient food availability per capita and

every individual has the capability to access enough food and utilises it in a correct way (Bello 2004), while FAO (2003) described food security as a situation where the population has, at any time, social, economic and physical access to an adequate quantity along with quality of food to meet up every day requirements and food preferences.

The availability of food varies over time (season) and space (geographic location). Food availability can be abundant in some areas and critically scarce in some other areas during certain season. According to Barrett (2002), sufficient food supplies at the national level or global production and stocks do not promise for the household food security as this might be due to inefficient in distribution of resources

*Economic and Technology Management Research Centre, MARDI Headquarters, Serdang, P.O. Box 12301, 50774 Kuala Lumpur

E-mail: khairulhafifi@mardi.gov.my

©Malaysia Agricultural Research and Development Institute 2014

and fluctuation in food production. That was why even if the production increases through time, food insecurity, malnutrition and hunger would still be the prominent issue in some areas.

Malthusian theory of population has been an intention in the most debates since food security has been an issue for world growing population. Accordingly, population grows geometrically, whereas food production merely grows at an arithmetic pattern. Malthus (1798) believed that, an effort to increase food supply for population has been hindered by three major limitations such as land scarcity, limited production capacity and the law of diminishing returns. Based on the points highlighted on the limitation of food supply, he predicted the possibility of situation where population growth surpasses food production.

Fortunately, Malthus prediction of human population and food production were never appeared. Increasing population growth has been mitigated by agricultural and technological developments, changes in government policies as well as changes in society organisation. These mitigating factors coupled with a prevailing attitude of progress borne out of this period of frenetic economic growth, invention and expansion enabled the dire of Malthus prophecies be avoided (Bhalla 2002; Johnson 2009; Bertini and Glickman 2013).

Food security in ASEAN countries

In the 60s and early 70s, majority of ASEAN countries experienced rapid population growth and indirectly exposed many countries of ASEAN to severe food shortage due to decreasing per capita food availability. Nevertheless, after the mid-70s, these countries managed to attain notable development in domestic food production (Bhalla 2002). The remarkable improvement in domestic food production that these countries went through had allowed them to develop their capability in supplying food to their citizens. This success has been

achieved from the implementation of the agricultural technology.

According to FAO (2013), ASEAN's food security has improved steadily since 1990 – 1992, with a decline in proportion of undernourished people from 31.1% in 1990 – 1992 to 10.7% in 2011 – 2013. In Malaysia, less than 5% of population was undernourished in 2011 – 2013. Indonesia and Thailand had about the same level of food security status where the proportion of undernourished people was less than 10% of the total population. Meanwhile in the Philippines, about 16.2% of the population was undernourished.

However, regardless of these accomplishments, these countries still have to go through difficult challenge in future to assure sufficient supply and constant food security to the citizens. This is due to the unstable pattern of agricultural production and fluctuations in food price have made it difficult to predict future food security and overcome starvation in some parts of the ASEAN. Although the developed countries managed to have an excess food, some developing countries showed insufficient calorie intake and lack of food due to lack of purchasing power of a big number of deprived populations. According to Smith et al. (2000), high poverty was the main factor contributing to the food insecurity. This was in line with ADB (2012) which stated that food insecurity in ASEAN countries was due to the problem of food access such as low level income of the population and fluctuation of food price.

The aim of this study was to analyse the current status of food security and to identify the major factors that contribute to food security situation in the region and evaluate the relative importance factors in determining food security in Thailand, Malaysia, Philippines and Indonesia. Wide conception about food security would be examined throughout this study. It would highlight the other side of food security, which was not only meant for assuring sufficient amount and stable condition of

food availability, but also to ensure that all people especially those underprivileged and at risk would have economic access to food.

There were numerous common attributes identified in the selected ASEAN countries. They were recognised as emerging ASEAN countries with strong agricultural base economy with historically colonial past. In 2010, the total population of these four ASEAN countries were nearly 429 million, about 8% of the world population. On top of that, almost 10% of the entire world's poor were residing in these four ASEAN countries.

Monitoring food security

Food security is a critical and multidimensional condition which goes beyond production. Ensuring food security in a country captures not just production and availability issues, but access to food and its effective utilisation are also the major challenges for net food importers and low income countries. Economic contraction, increased inequality, poverty, war, conflicts, overpopulation, corruption, environmental degradation and weaknesses of policies can be some of the causes of food insecurity.

One of the ongoing aims of ASEAN public policy in the second half of the 20th century has been to guarantee that all populations have sufficient food to eat. Lately, these countries have joined other countries in pledging to decrease by at least half the occurrence of hunger, each within its own jurisdiction, by a goal date early in the 21st century (Chandra and Lontoh 2010). Either viewed globally, within the country, the state, or in local communities, food security is a vital, universal element of household and personal well-being. The deficiency of basic need represented by food insecurity and hunger are unwanted in their own right and also are possible precursors to nutritional, health and developmental problems. Monitoring food security can assist in identifying and understanding this fundamental aspect of well-being of the population and to discover

population subgroups or regions with unusually severe conditions.

Food insecurity and starvation in the ASEAN countries can be overcome through various public and private nutrition support plans, working at national, state and local levels. Precise inspecting and monitoring of these situations can assist policy makers, service providers, public officials and the community in general to evaluate the shifting required for efficiency of prepared programmes.

Methodology

Both descriptive and econometric approaches were employed to enhance the effectiveness of analysis and to show empirical evidences of food security conditions and the related determinant factors in the four ASEAN countries. Descriptive method was employed to explain the level and extent of food security among the different demographic and socio-economic variables in the area. For the econometric method, the regression functions were estimated using the Ordinary Least Square (OLS) method to enlighten the contributing factors for determinants of food security in the selected countries.

Model specification

The food security regression model was constructed by using Per Capita Food Availability (PCFA) as a proxy for food security and its relationship with predicted contributing factors as stated below.

$$PCFA = \beta_0 + \beta_1 PROD_{it} + \beta_2 PCI_{it} + \beta_3 AWS_{it}$$

Where, the subscript 'i' refers to the country and 't' stands for the time period of the study. The dependent variable of the model was the PCFA as a proxy for food security. While the predicted independent factors were Production (PROD) as a proxy for food availability, Per Capita Income (PCI) as a proxy for food access and lastly, Access Women Status (AWS) consists of female to male life expectancy ratio and female

secondary school enrolments as a proxy for food utilisation.

Total food production was the sum of agricultural-based food i.e. rice and animal-based food i.e. milk, meat, egg and fish. The selection of these types of food for calculation of food production was based on method used by Shahid (2010) and consideration of priority of food consumption in the studied countries, whereas, access women status was measured by comparing female life expectancy at birth to male life expectancy at birth. This was based on Smith and Haddad (2001) where they used women's education and women's life expectancy relative to men for access women status. Women's education and women's life expectancy relative to men were strongly influenced both the quality of care for mothers and children for food security.

The sample data of the study was mainly obtained from World Bank database and FAO. The annual data of four ASEAN countries for the year 1967 – 2009 were used. Those countries were selected due to the fact that they were main trading partner of the food in the ASEAN region. Moreover, these four nations had common knowledge and experience of green revolution. Besides that, these countries were having related consumers' features such as outline of food intakes and income status. The study period was also confined to that period as significant policy changes had occurred during this period.

Results and discussion

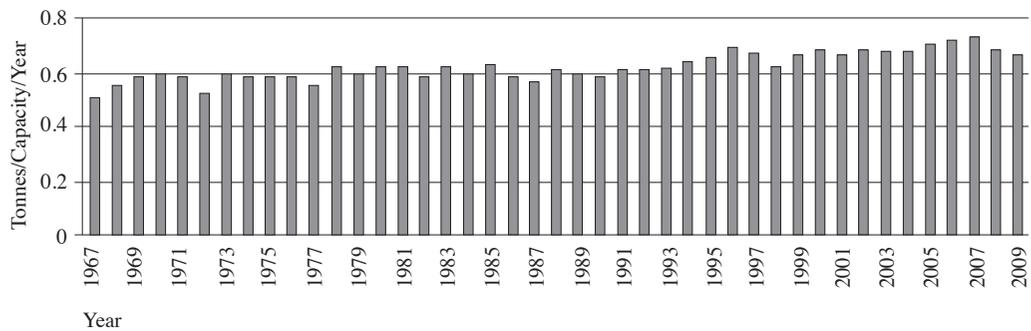
Situation of food availability and consumption

The current level of food security status must be first determined to effectively analyse the food security situation in the four selected countries. The indicators of food security status were Per Capita Food Availability (PCFA), average Dietary Energy Supply (DES) and Dietary Energy Requirement (DER).

The indicators of PCFA and DES were higher since early 70s until the beginning years of this century (*Figure 1* and *Figure 2*). It exhibited positive growth of food security due to enhancing per capita food availability through significant increase in domestic food production. The mean value of DES (2,034 kcal/ca/day in 1967 and 2,747 kcal/ca/day in 2009) showed improvement (from 166 kcal/ca/day below DER in 1967 to surplus above DER of 713 kcal/ca/day in 2009) for household in the selected countries. The average kilocalorie intake per day was above DER since 1977. The benchmark of 2200 kcal/ca/day was used as a DER, minimum calorie prerequisite to allow an adult to survive a healthy and fairly active life and as a demarcation to differentiate food secure and insecure among the households as suggested by WHO (Maxwell and Frankenberger 1992; Sisay and Edriss 2012).

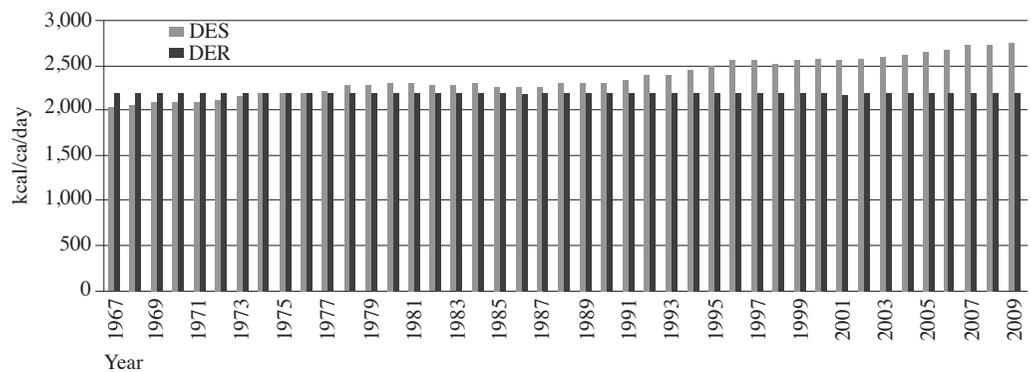
Bhalla (2002) emphasised that, the majority of ASEAN countries were capable to improve and stabilise the food production. Accordingly, improvement in food production mainly contributed by effective government policies such as inclusion of food production into a country's economic development agenda. It was consistent with Timmer (2004), who argued that, ASEAN countries have showed an improvement in reducing hunger rates. This improvement might be contributed by two fundamentals policies: stabilising food prices and enhancing income growth.

According to World Bank (1993), fast economic development has been the most important medium by which majority of ASEAN countries have managed to decrease their poverty level and improve food security. However, these four ASEAN countries were experiencing extensive year to year fluctuations in their agricultural and food production (*Figure 1*). Therefore, providing constant food availability still remains a big challenge. In addition, Brown and Kane (1994) using economic projection or simulation representation based on



Source: FAO (2012)

Figure 1. Average Per Capita Food Availability (PCFA) for four selected ASEAN countries



Source: FAO (2012)

Figure 2. Average Dietary Energy Supply (DES) and Dietary Energy Requirement (DER) for four selected ASEAN countries

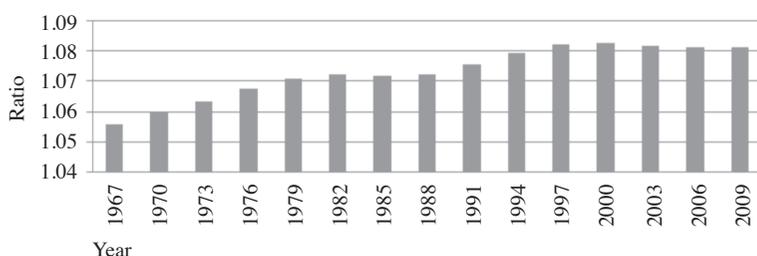
resource availability and environmental, tend to predict that adequate universal food supply will not last longer and ASEAN indirectly will be affected since some countries are net importers.

Thus, based on the two figures above, all the general indicators depicted similar profile although their specific figure showed some differences. Food security in the selected countries found to be much better based on the pattern of per capita food availability and average dietary energy supply and dietary energy requirement. Nevertheless, the long run sustainability of food security remains to be an issue as there is a possibility of population growth to catch up food production growth due to the increasing population and per capita food demand. Land expansions alone would not

be an effective measure anymore, but green technology without compromising with harmful environment should be emphasised together with changing the attitude of population by concerning more on the natural resources conservation practice rather than profit oriented farming.

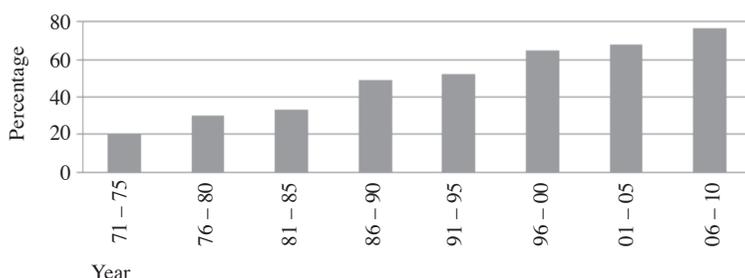
Determinant of food security

Generally, the majority of researchers use female to male life expectancy ratio (LFEXPRAT) or female secondary school enrolments (FEMSED) as an indicator for AWS (Smith and Haddad 2001; Shahid 2010). For this study, LFEXPRAT was used as an indicator for access women status in regression analysis. In general, both Figure 3 and Figure 4 show almost similar pattern where LFEXPRAT and FEMSED



Source: World Bank (2012)

Figure 3. Average female to male life expectancy ratio



Source: World Bank (2012)

Figure 4. Average female secondary school enrolments

constantly increased from 1967 to the end of the study year. This shows that women in the selected countries had better access than previous years in terms of health and education. In fact, women who were healthy and educated were vital components in ensuring food security directly or indirectly. They could contribute to economic development through involvement in national economic activities and capability to prepare a healthy food for family.

Figure 5 shows PCI is a proxy for food access in the food security model for selected ASEAN countries. Based on the previous studies, food access was among the most important component towards country's food secure. Generally, most of developed countries have been relatively food secure as compared to developing countries due to the purchasing power ability and better access to resources. On average, the selected countries were relatively stable in PCI growth since 1967 except a few series of economic downturn which somehow threatened the food security of the country involved.

Factors affecting food security

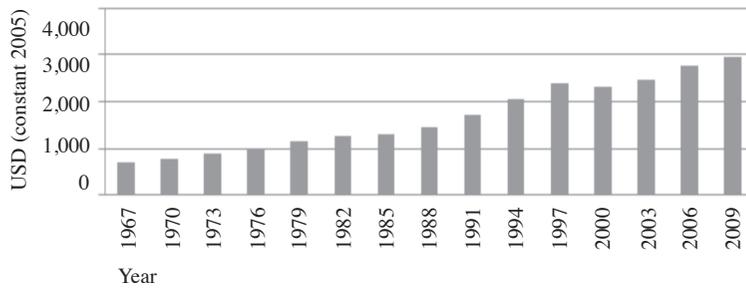
The results of regression model which was applying loglinear model were as follows:

$$\ln PCFA = -1.8873 + 0.03654 \ln PROD + 0.0275 \ln PCI + 0.39731 \ln AWS$$

t-stat	(3.7778)*	(2.6057)*	(11.2707)*
--------	-----------	-----------	------------

*Significant at $p = 0.05$

The regression coefficients indicated that total food PROD, PCI and AWS were significant factors in explaining level of food security in selected four ASEAN countries. The total food PROD, a proxy for food availability demonstrated a positive sign indicating that, increase in total food PROD would lead to increase in food availability. Result showed that food security was improved by 0.03654% for each 1% increase in the total food PROD. Similarly, the positive significant relationship was revealed between PCFA and PCI which was used as a proxy for food access. It indicated that as income of the people increases, PCFA also increases. Any 1% increase in the PCI would result in 0.0275% increase in food security.



Source: World Bank (2012)

Figure 5. Average per capita income

This finding was consistent with theoretical and empirical evidences, where the capability of the population to buy sufficient food due to increase in PCI would indirectly increase the consumer purchasing power to meet the minimum food requirement and contribute to the food security. In ASEAN, despite an overall fluctuation in the availability of per capita food supply, the percentage of under-nutrition has been declining overtime due to the improvement in physical and financial access. Furthermore, the PCI increased significantly due to government policy in emphasising in high technology industrial sectors. The improvement of food security in most ASEAN countries due to enhancement in PCI growth was also reviewed by World Bank (1993). In depth, household earnings, family size and level of formal education were among the factors contributed to the food security (Tacoli 2000).

Lastly, AWS was considered as a proxy for food utilisation. The positive significant coefficient showed that any 1% increase of AWS would directly increase food security by 0.3972%. It suggested that, women access in education and economic activities have contributed to the food security. Educated women have the ability to recognise the quality of food especially in terms of nutritious effect. That was the rationale why women access status was an imperative variable with regards to food utilisation. These knowledgeable women would be able to assist in providing the

country healthy productive work forces which resulted in raising the per capita food availability. The women role in food security should be more significant as percentages of educated female increase over year. The relations between women status and family food security have also been discussed by Pfeiffer et al. (2001) and Hindin (2006). They argued that women can improve health condition and nutrition level as they have additional autonomy in the house decision making due to education and income-earning ability. In addition, women's levels of education and knowledge as well as awareness on the environment quality were significant factors for children's nutrition status (Timmer 1992, 2004). Hence, it is possible to infer from the result that the women empowerment should not be neglected for future food security either at the household or national level.

Compare and contrast of the results on food security

Regardless of domestic food production accelerates in expansion rate, the overall food demand is possible to surpass domestic production in a number of countries with a great margin in the long run. This situation takes place due to higher growth of PCI, and the condition of lack of food in those countries which is enclosed by quite a number of imports. On top of that the availability of food per capita from both imports and domestic production stays roughly instable due to severe crisis like

worldwide food fluctuation, increasing food price and unpredicted production breakdown that may directly affect food supply stability. If these scenarios happen in future, this may severely affect the poor households in the ASEAN countries. This was obvious in 2008, where international prices of many foodstuffs including wheat, sugar and more importantly rice, increased dramatically.

Majority of these countries have also attempted to tackle the problem of food production instability by preserving sufficient food reserves, though, it is very expensive. Bello (2004) showed that instability of food security become prominent in ASEAN due to weak intra-ASEAN trading. In other words, there is no equilibrium achieved as some countries experiencing food deficits whereas others with food surpluses.

In fact, majority of the ASEAN countries' population growth rate have begun to slow down in the present decades. Nevertheless, for the absolute amount, the number of population is increasing over time. The rapid increase of the population particularly in developing countries will lead to serious problems for sustainable food supply on a global basis (Conway 1997).

Conclusion

The demographic and other socio-economic characteristics of the selected countries explored some interesting specific indications. Throughout 43 years period from 1967 to 2009, four selected ASEAN countries were found to be food secure started from green revolution until 2009. During that period, food production index has always been above the population growth index.

Although PCI of the population increased due to involvement in the high-tech commercial industries, their achievement in food security would be affected by the fluctuation and contraction of food availability. Food utilisation was predicted to be much better in future through enhancement in the quality of life due to

empowerment and involvement of women in economics activities and preparation of nutritious and healthy food for the family. At the same time, climatic change, environment and sustainability have made food production increasingly inconsistent and unpredicted. The ASEAN countries must aware of the potential social discontent as a result of food insecurity in their country. Hence, instilling public confidence that food is available, affordable and accessible is essential. Climate change, policy and trade, supply and demand and commodity price, as well as farm level factors, are crucial inter-related determinants that contribute to food insecurity, while the main strategy to overcome food security issue is still enhancing domestic food production.

References

- ADB (2012). Food security and poverty in Asia and the Pacific: Key challenges and policy issues. Asian Development Bank
- Barret, C. (2002). *Food security and food assistance programs*. (Hand Book of Agricultural Economics), Vol. 2, (Gardner, B. and Rausser, G., eds.). Amsterdam: Elsevier Science
- Bello, A.L. (2004). Ensuring food security – A case for ASEAN integration. *Asian Journal of Agriculture and Development* 2(1): 87 – 108
- Bertini, C. and Glickman, D. (2013). Advancing global food security, the power of science, trade, and business. Report issued by an Independent Advisory Group on Global Agricultural Development
- Bhalla, G.S. (2002). Food security in South and South East Asian countries. A paper prepared for The South Commission Institute for Studies in Industrial Development NarendraNiketan
- Brown, L.R. and Kane, H. (1994). *Full house: Reassessing the earth's population carrying capacity*. New York: Norton
- Chandra, A.C. and Lontoh, L.A. (2010). Regional food security and trade policy in Southeast Asia, the role of ASEAN. Series on Trade and Food Security – Policy Report 3
- Conway, G. (1997). *The doubly green revolution: Food for all in the twenty-first century*. London: Penguin Books

- FAO (2003). The state of food insecurity in the world 2003: Monitoring progress the world food summit and the millennium development goals, Food and Agriculture Organization
- (2012). Retrieved on 11 May 2012 from <http://faostat.fao.org/site/609/default.aspx>.
- (2013). The state of food insecurity in the world: The multiple dimensions of food security
- Hindin, M.J. (2006). Women's input in household decision and their nutritional status in three resource-constrained settings. *Public Health Nutr.* 9: 485 – 493
- Johnson, R. (2009). Food security: The role of agricultural trade. IPC Discussion Paper, International Food and Agricultural Trade Policy Council
- Malthus, T.R. (1798). An essay on the principle of population. Oxford World's Classics reprint
- Maxwell, S. and Frankenberger, T. (1992). *Household food security: Concepts, indicators, measurement. A technical review.* Rome: International Fund for Agricultural Development/United Nation Children's Fund
- Pfeiffer, J., Gloyd, S. and Ramirez, L.L. (2001). Intra-household resource allocation and child growth in Mozambique: An ethnographic case-control study. *SocSci Med.* 53: 83 – 97
- Shahid, A. (2010). Food security analysis of Pakistan time series approach. *Interdisciplinary Journal of Contemporary Research business* 2(7): 288 – 307
- Sisay, E. and Edriss, A.K. (2012). Determinants of food insecurity in Addis Ababa City, Ethiopia. *Journal of Economics and Sustainable Development* 3(3): 8 – 16
- Smith, L.C., El Obeid, A.E. and Jensen, H.H. (2000). The geography and causes of food insecurity in developing countries. *Agricultural Economics* 22: 199 – 215
- Smith, L.C. and Haddad, L. (2001). How important is improving food availability for reducing child malnutrition in developing countries? *Agricultural Economics* 26: 191 – 204
- Tacoli, C. (2000). Achieving urban food and nutrition security in developing world: Rural urban interdependence, International Food and Policy Research Institute
- Timmer, C.P. (1992). Agriculture and economic development revisited. *Agricultural Systems* 38(5): 1 – 35
- (2004). Food security and economic growth: An asian perspective. Center for Global Development working paper No. 51, Washington, DC
- World Bank (1993). The East Asian miracle: Economic growth and public policy. Oxford: Oxford University Press
- (2012). Retrieved on 11 May 2012 from <http://data.worldbank.org/indicator>

Abstrak

Kajian ini meneliti kedudukan dan penentu kepada jaminan makanan di negara-negara ASEAN yang terpilih dari 1967 hingga 2009. Teknik analisis data melibatkan analisis deskriptif dan ekonometrik yang menggunakan kaedah regresi kuasa dua terkecil. Keputusan kajian menunjukkan makanan di negara-negara ASEAN yang dipilih adalah dalam keadaan terjamin, walaupun masih lagi menjadi isu untuk jangka masa panjang. Keputusan ini adalah berdasarkan analisis empirikal terhadap indeks ketersediaan makanan per kapita dan bekalan tenaga daripada pemakanan serta keperluan tenaga diet. Jumlah pengeluaran makanan, pendapatan per kapita dan status akses wanita telah dikaji dan didapati menjadi faktor penting dalam menjelaskan tahap jaminan makanan dalam jangka panjang di negara-negara ASEAN yang terpilih. Model regresi menunjukkan bahawa 1% peningkatan dalam jumlah pengeluaran makanan akan meningkatkan sekuriti makanan sebanyak 0.036%, manakala setiap 1% peningkatan dalam pendapatan per kapita meningkatkan keselamatan makanan sebanyak 0.027%. Begitu juga, tahap wanita akses mempunyai hubungan positif dengan keselamatan makanan iaitu peningkatkan 1% dalam tahap wanita akses akan meningkatkan sekuriti makanan sebanyak 0.397%.