UNIVERSITI PUTRA MALAYSIA

SURVIVAL ANALYSIS OF FOOD SECURITY IN ASIAN COUNTRIES

ANWAR FITRIANTO

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ANWAR FITRIANTO

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MASTER OF SCIENCE

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2005

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SURVIVAL ANALYSIS OF FOOD SECURITY IN ASIAN COUNTRIES

By

ANWAR FITRIANTO

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

April 2005

DEDICATION

This thesis is dedicated to my wife, Greiche Dian Kusumawardhani, and my sweet daughter, Khazbiika Shahrinaz Anwar. Someones who are not always being forgotten, my parent (Maksum and Sunifah), parent-in-law (Roelche Chairul Syahfri and Hermien Sulianthy), who have always believed in me, and my brother-in-law (Syahfreal Dion Kusumawardhana), my three elder sisters (Mutmainnah, Sulismiati, Sri Kusrini) and my two elder brothers (Imam Hanafi and Nurahmad Fauzi).

Almighty Allah blessed me a livelihood and grace through SEARCA for the scholarship.

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for degree of Master of Science

SURVIVAL ANALYSIS OF FOOD SECURITY IN ASIAN COUNTRIES

By

ANWAR FITRIANTO

April 2005

Chairman : Associate Professor Isa Bin Daud, PhD

Faculty : Science

This study focuses on using the survival analysis on food security application. The technique examines the effects of covariates on food insecurity among Asian countries in the period of 40 years since 1961. The analysis is carried out in order to determine the 'warning sign' of food insecurity condition. The data sources are from FAO and World Bank online database which include some particulars of 32 Asian countries.

It is observed that 21 of 32 (65.62%) countries experienced insecurity food condition. The remaining are censored observations (34.38%). The stepwise Cox's regression is used to select among the 24 independent covariates that are deemed to be significant contribution to the model. Initial run of the SAS code finds that six covariates are significant.

Based on the adopted model, at each time point, the West Asian region are found to be more likely to have insecurity food condition compared to those countries in the other regions. Furthermore, the occurrence of food security for East Asia countries

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are more likely than for those in the other region. Meanwhile, it can also be seen that countries in Lower-middle income group are more likely to reach insecurity food condition than those in the other group. The analysis also shows that the high income countries have high risk of exposure to insecurity food condition.

Since Cox regression analysis has the basic assumption of proportionality, the model was tested whether it meets this condition. We use graphical method and formal test of this assumption . In the presence of ties, the ties-handling method of Breslow, Efron, Exact, and Discrete are compared with respect to Wald statistics, parameter estimate, the hazard ratio, and p-value.

The availability of the determined dataset as in allows assessing categories of food insecurity; Low, Medium, or High, which is useful to describe the nature of the food insecurity conditions. Based on the analysis, we are able to find variables that play important role on each stage of food insecurity condition of each country.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

ANALISIS MANDIRIAN ATAS KESELAMATAN MAKANAN NEGARA-NEGARA ASIA

Oleh

ANWAR FITRIANTO

April 2005

Pengerusi : Profesor Madya Isa Bin Daud, PhD

Fakulti : Sains

Kajian ini tertumpu kepada penggunaan analisis mandirian bagi aplikasi keselamatan makanan. Teknik ini memeriksa pengaruh kovariat bagi ketakselamatan makanan di antara negara-negara Asia selama 40 tahun sejak tahun 1961. Analisis dilaksanakan bagi menentukan tanda amaran akan keadaan ketakselamatan. Data bersumber daripada FAO dan pangkalan data dalam talian Bank Dunia yang meliputi beberapa pembolehubah dari 32 negara-negara Asia.

Daripada 32 negara, 22 negara (65.72%) mengalami keadaan takselamat makanan. Selebihnya merupakan data tertapis (34.38%). Regresi Cox bertingkat digunakan untuk memilih kovariat yang dianggap sebagai penyumbang kepada model dari kesemua 24 kovariat. Berdasarkan operasi yang dijalankan dengan program SAS, didapati 6 kovariat adalah signifikan.

Berasaskan pada model yang digunapakai, pada setiap titik masa, rantau Asia Barat lebih cenderung mengalami keadaan ketidakselamatan makanan berbanding dengan

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negara-negara di rantau lain. Sebaliknya, kejadian keselamatan makanan bagi rantau Asia Timur mempunyai kebarangkalian lebih besar berbanding dengan rantau lain. Sementara itu, dapat juga diperhatikan bahawa negara dengan pendapatan Sederhana-rendah mempunyai kebarangkalian lebih besar dalam mencapai keadaan ketakselamatan makanan berbanding dengan hal serupa bagi negara berpendapatan lain. Analisis juga menunjukkan bahawa negara berpendapatan tinggi mempunyai risiko lebih tinggi untuk terdedah kepada keadaan ketidakselamatan makanan.

Oleh kerana analisis Regresi Cox memiliki anggapan asas kekadaran, maka model diujikaji apakah memenuhi syarat kekadaran. Kami menggunakan kaedah grafik dan ujikaji rasmi untuk anggapan ini. Pada kehadiran seri, kaedah mengawal seri dari Breslow, Efron, Exact, or Diskrit dibandingkan dalam hal statistik Wald, anggaran parameter, nisbah bahaya, dan nilai-p.

Set data sedia ada dan kovariat memungkinkan penaksiran kategori bagi tahap keselamatan makanan samada Rendah, Sederhana, dan Tinggi, yang berguna untuk menjelaskan sifat keadaan ketakselamatan makanan. Berdasarkan kepada analisis berkenaan, kami dapat menemukan pembolehubah yang berperanan penting pada setiap tahap keadaan ketakselamatan makanan bagi setiap negara.

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I certify that an Examination Committee met on 15th April 2005 to conduct the final examination of Anwar Fitrianto on his Master of Science thesis entitled "Survival Analysis of Food Security in Asian Countries" in accordance with Universiti Putra Malaysia (Higher Degree) Act 1980 and Universiti Putra Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Mat Yusoff Abdullah, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Chairman)

Kassim Haron, Ph.D
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Internal Examiner)

Habshah Midi, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Internal Examiner)

Yong Zulina Zubairi, PhD
Associate Professor
Centre for Foundation Studies in Science
Universiti Malaya
(External Examiner)

GULAM RUSUL RAHMAT ALI, PhD
Professor/Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date :

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

ISA BIN DAUD, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Chairman)

NOOR AKMA IBRAHIM, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Member)

MOHD. RIZAM ABU BAKAR, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Member)

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_____

AINI IDERIS, PhD
Professor/Dean
School of Graduate Studies
Universiti Putra Malaysia

Date :

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

ANWAR FITRIANTO

Date : April, 20 2005

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CHAPTER I

INTRODUCTION AND OVERVIEW

1.1 Background

The challenge of sustainable of food production in the 21st Century can be summarized through the following question: Can food productions keep in pace with the population growth, especially in parts of the world where population continue to grow rapidly?

1.1.1 Asia Countries' Population Growth and Food Pressure

In population terms, Asia contributes the most to world population growth, at 50 million people a year, while Africa accounts for only 17 million; although at 2.36 percent, Africa's rate of growth is the highest. Two of every five people alive today are living in China or India. While 10 nations currently have populations that exceed 100 million, the number of nation is expected to rise to 19 by 2050. Half out of these 10 countries are Asian countries (United Nation Population Fund, 2003). The variance in rates of population growth among individual countries will be responsible for substantial change in the top 10 contributors to world population growth in this century.

The United Nations observed that October 12, 1999 as the day of the Sixth Billion - the world's population had doubled since 1960. In some parts of the developing world the population grew even faster, e.g. in Sub-Saharan Africa it increased

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threefold. Asia's number of people grew fastest in absolute terms: by nearly two billion. Based on IFPRI projection on 1995-2020 (Pinstrup-Andsersen, et al., 1999), world population will increase by 32% to 7.5 billion, mostly in cities in developing countries. And 85% of total food demand growth will come from developing countries

The Food and Agriculture Organization of the United Nations (FAO) defines "food security" as a state of affairs where all people at all times have access to safe and nutritious food to maintain a healthy and productive life. Meanwhile, food is an essential requirement for every individual. Besides nourishing the biological needs, it helps to guarantee the welfare of the individual, serves to improve the productivity of the labor force, and hence reduce social expenditure, safeguard political stability. It is thus essential and of primary importance to ensure minimum levels of food security for the poor. Food insecurity is the result of a discrepancy between agricultural production and population growth. The major thrust of food security is to bring about a significant increase in agricultural production in a sustainable way and to achieve a substantial improvement in people's entitlement to adequate food and culturally appropriate food supplies. If the condition is not seriously observed, it is not impossible that world hunger will occur. In other words, the agricultural sustainability must be kept in order to obtain food security.

The analysis of survival data as proposed in this research is the basis for a perspective on world food security risk assessment. The objective is to contribute to the understanding of the dynamic processes that underlies the agricultural food

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production in Asian face as a result of rapid population growth. The method is to estimate the 'survival function' and use the developed model for duration data until 'warning' of food insecurity comes.

1.2 Objectives

The objectives of this thesis are:

- to provide alternative solution on food problem of Asian countries through statistical analysis.,
- to adopt a mathematical model that describes the survivorship of Asian countries on food security,
- to find out factors which influence difference of hazard ratio among Asian countries on food security, so that the insecurity food condition can be detected early,
- to classify current level of food insecurity condition of Asian countries, and to identify factors which influence the condition at each level.
- to predict the survival pattern of different characteristics of the Asian countries.

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