UNIVERSITI TEKNOLOGI MARA

MALAYSIA POPULATION DYNAMICS AND THE BAYESIAN PROJECTION MODELLING WITH FUNCTIONAL SCALABLE APPROACH PROJECTION INTERVAL

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ABSTRACT

An understanding of past, present and future population dynamics is necessary for a nation in development planning. The changes in demographic component which are fertility, mortality and migration have led to change in population dynamics. Nowadays, United Nation (UN) had emphasized on using Bayesian models for population projection. However, not much detail description in terms of population dynamics that has been done in the past few years particularly for Malaysia population. In addition, Department of Statistics Malaysia is currently using deterministic approach which is Cohort Component method to project future population in Malaysia. Meanwhile many studies have proven a probabilistic model is better than the deterministic because the model considers uncertainty element. To date, the implementation of the probabilistic model particularly the Bayesian model is still rare. A model was first developed to project individual fertility and then extended to both fertility and mortality. However the combination of all components (fertility, mortality and migration) for total population projection is seen lacking. Thus, this study aims to model population dynamics of Malaysian by considering simultaneously all the three important demographic components using Bayesian model. To study the structure and composition of population in Malaysia, the past and present trend of fertility, mortality as well as migration were examined using graphical presentations and trends analyses. The projections of the total population for 5-year intervals were then performed using two Bayesian models. The first projection model is based on the projected fertility and mortality while the second model is based on all the three components; fertility, mortality and migration. The projection of population was also conducted using exponential growth model. The performance of the Bayesian projection models were compared to the results of the exponential growth model and cohort component method for the same interval period. Functional based discretization method was also proposed to enhance the time point of 5-year intervals projection to annual projection to enable for annual scalable values. All data used in this study were obtained from various agencies which include Department of Statistics Malaysia (DOSM) and National Population and Family Development Board (NPFDB) and cover 50-year period from 1970 to 2020. The results of the analysis indicates that Malaysia has a diverse age structure since 1970 throughout 2020. In 1970, Malaysia had experienced high fertility due to the ‘baby boom’ phenomenon which reflected the high percentage of young aged group and less percentage of the elderly. However, the age structure of Malaysia population had changed drastically in 2010 due to the swings in the fertility and mortality rate from high to low where the fertility rate reached the replacement level at 2.1. Finally, this study demonstrated that the projected of total population in Malaysia using Bayesian technique give a better result as compared to deterministic method. It shows that the population will increase gradually between 33.72 to 35.73 million in 2025. The projected total population will increase more than four million in 2050 to reach between 36.98 to 43.89 million. Thus, the projected median age for the next 30 years where it will be increased from 29.88 years in 2015 to 40.25 years in 2050. Malaysia is expected to be an aged nation by 2025 where the ageing index is 36.10.

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CHAPTER ONE
INTRODUCTION

1.1. Background of Study

The growth of population is a very important set of events that occurs throughout the world. Its change is on a continuous basis and the number of population added to the world everyday are unprecedented and unparalleled in its consequences. According to Marchetti, Meyer, and Ausubel (1996), the world's population since mid-20th century has grown by about 2 percent per year, a rate that will double the population in roughly 35 years from 1970 to 2005. Lam (2011) claimed that there is much to worry about in the coming decades, between 2011 and 2050 where the world will add 2 billion people. The world's population had increased rapidly during the twentieth century passing from 1.65 billion in 1900 to 6.12 billion in 2000 and 7.08 billion in mid 2012 (United Nations, 2013d; Population Reference Bureau, 2012). Historically, the growth rates of world's population had slowly increase during the 17th or 18th centuries due to the decline in mortality rate. It reached a peak during the twentieth century where the growth rate was at 2.1 percent per year between 1965 to 1970. However, the population growth has been declining, mainly as a result of falling fertility rate in developing countries. For the year 2005 to 2010, the growth rate at the world level had reached 1.2 percent per year and projected to reach 0.5 percent per year for the period of 2045 to 2050 and keep decreasing to 0.1 percent per year by 2095-2100 (United Nations, 2013d). However, the pace of population growth is significantly different among developed, developing and less developed countries because fertility decline has not occurred equally in all countries (Gelbard, Haub, & Kent, 1999).

Currently, most developing countries are still having a higher population growth. As reported by Coast (2002), the growth rate was 1.59 percent per year and Africa has the highest growth rate of any major area which exceeded 2.3 percent per year. However, most of the developing countries have experienced rapid changes in the relative numbers of