Population Review

Volume 44, Number 1, 2005

Type: Article pp. 36-55

Completion of Vital Transition and Changing Migration in Indonesia: Empirical Results and Projection Scenarios

Authors: Aris Ananta, Ph.D., and Salahudin Muhidin, Ph.D.
Affiliations: Institute of Southeast Asian Studies (ISEAS), Singapore (Dr. Ananta); Départment de Démographie, Université de Montréal, Canada (Salahudin Muhidin)
Corresponding author/address : Dr. Aris Ananta, Institute of Southeast Asian Studies (ISEAS), Singapore (aananta@iseas.edu.sg)

Abstract

This paper describes population dynamics in Indonesia, with a focus on the possible relationship between declining fertility and mortality trends on one hand and changing levels of internal migration on the other. The high variability in the levels of fertility, mortality and migration among Indonesian provinces provides a rich opportunity to perform a statistical analysis on the possible relationship between these demographic components. The analysis utilizes data from the 1980 and 1990 Indonesia population censuses, and the 1995 intercensal population survey with province as the unit of analysis.

The result of this study provides important inputs to improve population projection, particularly for Indonesia, by going one step beyond conventional migration scenarios where little attention is given to the possible correlation with fertility and mortality. More work should be done to further examine the possible relationship between fertility, mortality and migration, particularly over the next 30 years when fertility in all provinces will have declined to below the replacement level.

Keywords

Indonesia, demographic transition, fertility, population projection, migration, mortality

*This paper is a revised version of a paper presented at a workshop on ‘Fertility Decline, Below Replacement Fertility and the Family in Asia” at National University of Singapore, April 2002.

1. Introduction

The 1960s witnessed a growing concern with population problems in developing countries, including those in Southeast Asia where high population growth rates were seen as a burden for economic development. Thus, efforts were made to lower the population growth rate through family planning programs. By 1970 Indonesia, Malaysia, Philippines, Singapore, and Thailand had adopted anti-natalist policies (Jones 1999). Both fertility and mortality rates have fallen considerably since then.

However, success always brings other problems. The declining fertility produces an ageing population, with rising old dependency ratio.[1] The problem shifts from young to old dependency ratio. The transition in age structure is also often accompanied by a transition from a low to a high level of human capital. As the transition progresses, a region can experience shortage of laborers to work on 3-D (dirty, dangerous, and difficult) jobs because the locals may shun the work and there are not enough young, unskilled, local workers. This can lead to increasing rural-urban migration and international labor migration.

Zelinsky (1971) attempted to relate the vital (fertility and mortality) transition to the mobility transition. He divided both vital and mobility transitions into five phases: the pre-modern society, early transitional society, late transitional society, advanced society, and future super-advanced society. Each phase is characterized by different fertility and mortality behavior on the one hand and mobility behavior on the other hand. For example, in the early transitional society, fertility rises slightly or remains relatively constant at a high level, while mortality declines sharply, resulting in a rapid natural increase. At the same time, in this phase, there is massive movement of people from rural to urban areas, large flow of labor to foreign destinations, some (though small) immigration of skilled workers from the more advanced countries, and rising circulation. In advanced societies, the fertility transition has been completed, and fertility fluctuates unpredictably at low levels. The natural rate of increase is very low or zero. Concurrently, residential mobility remains high, though fluctuating, rural to urban migration continues but the magnitude and rate have declined. In addition, immigration of unskilled and semiskilled workers from less advanced countries rises significantly, and out migration or circulation of skilled and professional workers rises.

Zelinsky's attempt to relate vital transition to mobility transition was relevant both for mobility within a country and mobility among different countries. Yet, he also admits the difficulty of finding any consistent pattern of relationship between vital transition and mobility transition at the international level because of the nature of politics and government intervention in each country. Twenty years later, Stahl and Appleyard (1992) confirmed this difficulty by showing that international migration has been increasingly under strict government regulations.

On the other hand, Nayyar (1994) discussed the international mobility transition in the context of economic development. The relationship of the shift from labor-sending countries to labor-receiving countries depends very much on the economic growth and the structure of the economy. The turning point is reached when the country has reached full employment, though temporarily advance in technology, imports of goods, and exports of capital can avert the need to receive labor, especially the unskilled and semi-skilled, from other countries. Eventually, however, the in-migration from other countries becomes unavoidable. In the case of Indonesia, Hugo (1997) argues that economic and social developments have been of

[1] Declining mortality strengthens the case of ageing population, but it is the fertility decline that causes the ageing process.

critical importance in the mobility transition. However, Indonesia has not reached the turning point.

Skeldon (1992) takes the middle path. He argues that fertility decline in East and Southeast Asia has significantly impacted the volume of migration via a change in the age structure of the population. This change in age structure is expected to affect migration behavior because migration is age-specific. While changes in overall mortality have little effect on the age structure of a population, changes in fertility have a marked effect, regardless of mortality changes (Hinde 1998). Hence, a change in fertility is hypothesized to affect migration. Skeldon (1997) was curious as to why there has not been any new model specifying the relationship between fertility and migration since Zalinsky's seminal work in 1971.

However, Skeldon also sees that the demographic effect is only one of the determinants of the mobility transition, with economic development as another important one. He suggests more refined regional and small area data to examine the relationship between mobility and fertility.

It is pertinent, therefore, to examine the effects, if any, of fertility and mortality decline on changing patterns of migration. This study focuses on internal migration (rather than international migration) to avoid the problems arising from national politics and government interventions in the international flow of labor. It utilizes data on Indonesia, a large country with a rich diversity in demographic (fertility, mortality, and migration) transitions among the provinces. Some have reached below replacement level fertility in the early 1990s, while others are in relatively early stages of demographic transition.

The need to specify a model on the relationship between fertility (and mortality) and migration is also particularly great in the work on multi-state population projection, with interdependence among the three demographic parameters and among regions as the main features. The work pioneered by Rogers (1968), culminating in Rogers and Willekens (1986) and Rogers (1995) has explicitly treated the interdependence among the three demographic parameters and among the regions. Works on multi-state population projection have already started in Indonesia (Putera 1999; Prihastuti 2000; and Muhidin 2002). However, they still assume that the future of migration behavior is independent of the future behavior of fertility and mortality. The assumption is made because of the lack of information on the relationship between the vital rates and migration rates.

The objective of this paper is to explore the possible association between fertility and mortality on the one hand and internal migration on the other hand. It is not a study on the determinants of migration, nor a study on the relationship between demographic (fertility, mortality, and migration) changes and economic development. Rather, it simply attempts to examine whether there exists any statistically significant relationship between fertility and mortality on the one hand and migration on the other hand. Further studies should complement this study by introducing socio-economic-political variables to unravel the relative contribution of demographic changes and development on migration behavior.

2. Demographic Convergence

Wilson (2001) documented the rapid global demographic changes in the last half of the twentieth century and predicted that global trends will soon experience a demographic convergence. Most of the world's populations will become demographically 'modern' even though their economies may be still far from modern. The gap in the demographic parameters between developing and developed countries will narrow, and the parameters among developing countries themselves will have much smaller variations.

He provides a simple illustration. The total fertility rate in USA in 2000 was 2.1, similar to 2.3, the global median. Life expectancy in USA was 76, close to the 68, the global median.

On the other hand, the GNP per head of the USA in 1998 (calculated on purchasing power parity basis) was $30,600, very much higher than the $3,030 of the global median. Though the economic gap between rich and poor nations may continue to widen, the world is moving to a convergence of demographic parameters. It should be noted, however, that Wilson only discusses fertility and mortality. He does not examine the trend of migration.

Skeldon (1997) attempted to find global convergence in migration. In regions of highest development (western Europe, North America, Australasia, and Japan), convergence is found in that all countries have become countries of destination from poorer countries; all have gone through the phase of population concentration followed by a phase of population de-concentration; and all have taken part in international circulation of highly skilled labor. Convergence in family structure and life style has also reduced, though not eliminated, differences in population mobility. However, the convergence becomes blurred with the arrival of unskilled laborers from different ethnic and religious backgrounds.

Regions in the newly industrialized economies of Singapore, Hong Kong, South Korea, and Taiwan show similar convergence. The third group is the so called "core extensions and potential cores" including particular areas in East and Southeast Asia and southwards from the US. They are outliers from the first two, but they have the potential to become the first two. Being late comers, they have experienced the convergence in a relatively shorter time than the ones in the first group. The time of transition has been reduced from the first to the second and to the third. Skeldon, however, has not been able to conclude whether convergence will also be seen in the remaining regions of the world.

The trends among the Indonesian provinces follow the convergence tendency. The transition in vital rates in Indonesia started in the 1950s, indicated by the decline in mortality (Ananta and Wongkaren 1996). However, even with a drastic decline in IMR, the norms of having children did not change immediately, which resulted in a rising population growth rate and the so-called population explosion. After the government of Indonesia introduced the national family planning programme in the late 1960s, however, the TFR declined from 5.6 to 2.8 by the first half of the 1990s. This decline in fertility was experienced at an earlier phase of economic development than had been experienced in the more advanced countries. Miranti (2000) finds that Indonesia also has been in a better position to facilitate a reduction in fertility relative to economic conditions compared with more developed countries. For example, Singapore, with an income per capita (measured at parity purchasing power) of US$1,739, achieved a TFR of 5.46 (in 1961), while Indonesia with an income per capita US$1,703 in 1987 achieved a TFR at 3.39.

It should be noted that there is a large variation in vital rates among the different provinces. In the islands of Java and Bali, fertility levels have been relatively low, near replacement level or even below replacement level. During the Period 1991-1994 TFRs ranged from as low as 1.9 in Jakarta, 2.0 in Yogyakarta and 2.0 in Bali, to as high as 4.0 in East Nusa Tenggara or 3.8 in Irian Jaya (Table 1). In addition, the IMR at the national level has declined from 145 deaths per 1,000 live births in the period 1967-1971 to 51 deaths per 1,000 live births in the period 1991-1995.[2] At the provincial level, IMRs in the period 1967-1971 were as high as 221 in West Nusa Tenggara and 167 in Southeast Sulawesi, West Java, Bengkulu and South Kalimantan. The lowest rates were in Yogyakarta (102), East Kalimantan (104), and North Sulawesi (114). During the period 1991-1995, Jakarta and Yogyakarta had entered the last stage in mortality transition (IMR below 30). The provinces of Bali (34.1) and Central Kalimantan (34.3) were near to the completion of mortality transition, though high

[2] Empirical data on adult mortality are available only for the late 1990s in the National Socio-Economic Surveys (SUSENAS). Therefore, the discussion here is only focused on the infant mortality rate (IMR).

IMRs were still observed in provinces such as in West Nusa Tenggara (101), South Kalimantan (78) and Central Sulawesi (72) (Table 1).

Table 1. Total fertility rate (TFR) and infant mortality rate (IMR) in Indonesia and its provinces, 1976-1995

Region/Province	*Total Fertility Rate (TFR)*[a]				*Infant Mortality Rate (IMR)*[b]			
	PC71 1967-70	*PC80 1976-79*	*PC90 1986-89*	*IPS95 1991-94*	*PC71 1967-71*	*PC80 1976-80*	*PC90 1986-90*	*IPS95 1991-95*
Indonesia	5.6	4.7	3.3	2.8	145.2	108.7	71.3	51.1
Sumatra								
Dista Aceh	6.3	5.2	4.4	3.3	142.5	93.1	58.4	37.0
North Sumatra	7.2	5.9	4.3	3.5	121.3	88.7	60.9	45.1
West Sumatra	6.2	5.8	3.9	3.4	152.4	121.1	74.0	60.3
Riau	5.9	5.4	4.1	3.3	146.3	109.8	65.0	39.0
Jambi	6.4	5.6	3.8	3.1	154.5	120.9	73.6	44.7
South Sumatra	6.3	5.6	4.2	3.1	155.3	101.7	71.1	54.2
Bengkulu	6.7	6.2	4.0	3.2	166.9	111.0	69.3	60.1
Lampung	6.4	5.8	4.1	3.3	145.9	99.3	69.3	48.0
Java								
Jakarta	5.2	4.0	2.3	1.9	128.9	81.8	43.1	22.4
West Java	6.3	5.1	3.5	2.9	167.4	133.7	90.3	56.0
Central Java	5.3	4.4	3.1	2.6	144.0	98.6	65.0	38.9
Yogyakarta	4.8	3.4	2.1	2.0	102.1	62.1	41.7	23.0
East Java	4.7	3.6	2.5	2.3	120.3	97.3	63.6	56.2
Nusa Tenggara								
Bali	6.0	4.0	2.3	2.0	130.5	92.5	51.3	34.1
West N. Tenggara	6.7	6.5	5.0	3.7	220.5	189.0	144.6	101.2
East N. Tenggara	6.0	5.5	4.6	4.0	153.8	128.1	77.0	58.7
East Timor	n.a	n.a	5.7	5.1	n.a	n.a	84.6	73.0
Kalimantan								
West Kalimantan	6.3	5.5	4.4	3.5	144.2	118.8	81.3	57.4
Central Kalimantan	6.8	5.9	4.0	3.2	129.5	100.2	57.7	34.3
South Kalimantan	5.4	4.6	3.2	3.1	165.2	123.2	90.8	77.6
East Kalimantan	5.4	5.0	3.3	3.0	103.7	100.3	58.4	45.8
Sulawesi								
North Sulawesi	6.8	4.9	2.7	2.7	113.8	93.3	63.0	41.3
Central Sulawesi	6.5	5.9	3.9	3.3	150.1	130.1	92.3	72.0
South Sulawesi	5.7	4.9	3.5	3.1	161.4	110.6	70.3	55.9
Southeast Sulawesi	6.5	5.8	4.9	3.7	167.4	116.1	77.3	55.2
Maluku	6.9	6.2	4.6	3.7	143.3	123.2	76.4	57.9
Irian Jaya (Papua)	7.2	5.4	4.7	3.8	85.9	104.8	80.3	58.4

Notes: a. The TFR is estimated indirectly by using the own children method
b. The IMR is estimated indirectly by using the Brass method.
PC = population census, IPS = intercensal population survey, and n.a.= not available

Source: Tables 2.4 and 2.11 (Muhidin 2002:16 & 32).

In other words, the process of vital transition has not occurred at the same speed among the Indonesian provinces. This regional variation has resulted in populations characterized by different age structures. The population pyramid for Indonesia as a whole has changed from the broad-based shape in 1961 towards a bell shape in the 1990s. In 1990, the population pyramid of provinces such as Yogyakarta was relatively narrow based, with swollen young productive ages and a slowly narrowing population at older ages. This shape is in contrast to the one of West Sumatra, which is still a broad base with rapidly narrowing numbers of the population at older ages.

Because of changes in the age structure of the Indonesian population, the child dependency ratio (ratio of population below 15 to population 15-64) is decreasing. For Indonesia as a whole, it declined from 82.2 in 1971 to 54.9 in 1990; in Yogyakarta, where the ratio is the lowest, it declined from 74.6 to 33.6. In 1990, the highest child dependency ratio was in the province of Southeast Sulawesi (66.1). Conversely, the old dependency ratio (ratio of population 65 and over to population 15-64) is increasing. In 1990, it ranged from 1.6 in Irian Jaya, 2.6 in Jakarta and 3.3 in East Kalimantan, to 11.3 in Yogyakarta, 8.4 in Bali and 7.8 in Central Java and West Sumatra (Muhidin 2002).

From 1975-1980 to 1985-1990, the number of recent migrants (those who did not live at the same province five years prior to the survey) at the national level has risen from 3.7 million to 5.3 million. With the exception of in-migration to Lampung and North Sulawesi, the number of in- and out-migrants in all provinces has increased.[3] In terms of migration rates; however, the pattern varies among provinces. All provinces in Java except Jakarta experienced an increase in rates of recent in-migration from 1975-1980 to 1985-1990. In terms of out-migration, all provinces experienced an increase. In Sumatra, all provinces except West Sumatra experienced rising rates of out-migration; in-migration declined in all provinces except West Sumatra and Riau. In Kalimantan, all have experienced declining in-migration and rising out-migration rates. An exception is South Kalimantan, with a rising in-migration rate.

There is one emerging pattern of migration: the narrowing range of differences in the rates of in-migration, from between 0.7% (Central Java and East Java) and 11.8% (Jakarta) in the period 1975-1980, to between 0.7% (Dista Aceh) and 6.5% (Jakarta) in the period 1990-1995. However, the range of the rates for out-migration has remained almost stable and may even have risen. The range was between 1.1% (Dista Aceh, Lampung, and West Kalimantan) and 6.3% (Jakarta) in the period 1975-1980, and between 1.2% (West Java, East Java) and 8.8% (Jakarta) in the period of 1990-1995. An overall convergence in migration rates is observed clearly when migration is measured by the total migration rate (TMigR), an age-standardized measurement of both in- and out-migration (Table 2).[4] It is noteworthy that the rate of population mobility varies strikingly among provinces and TMigR is always the highest in Jakarta, reflecting some resonance with the mobility transition phases discussed in Zelinsky (1971) and Skeldon (1990). Similar to the different experiences of fertility and mortality, mobility patterns and rates differ from one province to another, with some already in the relatively late stages of mobility transition and others still in the early stages.

---

[3] There is no attempt to describe the migration patterns before the period 1975-1980 because there is no such data for these periods.

[4] Total migration rate is the summation of age-specific migration rate. Rogers and Castro (1986) call it "gross migra-production rate." Because there is out- and in-migration. There is also a total out-migration rate and a total in-migration rate.

Table 2. Crude migration rate (CMigR) and total migration rate (TMigR) in Indonesia by province, 1975-1995

Region/Province	*Crude Migration Rate (CMigR)*						*Total Migration Rate (TMigR)*					
	CIMigR per 1000			*COMigR per 1000*			*TIMigR per 100*			*TOMigR per 100*		
	75-80	*85-90*	*90-95*	*75-80*	*85-90*	*90-95*	*75-80*	*85-90*	*90-95*	*75-80*	*85-90*	*90-95*
Sumatra												
Dista Aceh	4.4	3.6	1.7	2.7	3.2	2.8	6.5	5.8	2.3	4.3	5.0	3.8
North Sumatra	2.5	2.3	2.0	4.5	5.6	3.9	4.4	4.0	3.7	6.9	9.3	5.6
West Sumatra	6.0	6.9	6.9	9.8	9.1	7.3	9.6	11.4	9.9	15.1	14.8	10.5
Riau	9.9	15.9	8.4	5.6	6.3	7.0	15.3	28.2	12.8	8.4	11.2	11.3
Jambi	16.0	14.3	5.3	5.8	7.0	4.7	25.0	24.1	8.7	11.2	12.5	6.6
South Sumatra	10.3	7.1	3.8	6.4	6.7	5.5	16.2	11.7	7.6	9.8	11.3	10.3
Bengkulu	18.9	14.9	10.3	5.1	5.6	5.6	30.4	23.7	18.4	8.7	8.9	7.9
Lampung	23.5	7.5	3.7	2.5	4.9	5.3	41.2	14.2	8.0	4.0	7.8	8.7
Java												
Jakarta	25.3	21.2	14.2	14.2	25.3	19.0	39.0	30.1	19.5	23.9	43.4	28.6
West Java	4.5	8.1	6.2	3.8	3.1	2.5	6.9	12.1	8.4	5.7	4.4	3.6
Central Java	1.6	2.9	2.5	7.3	8.3	5.3	2.6	4.3	3.6	10.6	11.3	7.3
Yogyakarta	7.7	11.5	11.7	5.7	8.8	8.3	10.3	15.2	15.3	7.8	11.9	11.3
East Java	1.5	2.1	2.5	4.1	4.1	2.6	2.6	3.0	3.6	5.9	5.7	3.8
Nusa Tenggara												
Bali	3.3	5.0	4.3	4.5	4.2	3.3	5.0	7.3	5.5	6.4	5.6	4.5
West N. Tenggara	2.1	2.3	2.2	3.0	2.4	2.0	3.5	4.2	2.9	6.5	3.8	4.2
East N. Tenggara	2.1	1.8	1.5	2.6	2.9	2.6	4.1	2.9	2.3	5.7	4.0	3.4
East Timor	0.0	7.4	5.4	0.0	3.8	3.3	0.0	9.6	6.7	0.0	8.0	4.2
Kalimantan												
West Kalimantan	3.4	2.9	2.6	2.5	2.9	2.0	6.0	4.6	4.6	4.4	5.2	2.7
Cent. Kalimantan	11.1	11.8	5.0	3.8	5.8	5.6	18.5	18.1	6.6	7.1	10.2	7.8
South Kalimantan	6.5	7.9	5.0	4.9	6.3	4.3	9.4	12.9	6.7	8.7	9.9	5.7
East Kalimantan	19.7	21.6	12.7	4.1	8.3	7.2	33.6	31.5	19.2	6.9	14.3	13.4
Sulawesi												
North Sulawesi	4.7	3.0	1.7	3.9	4.3	3.9	8.2	5.0	2.4	5.9	6.2	4.9
Central Sulawesi	14.0	8.7	7.9	3.1	3.6	3.1	23.8	15.3	15.7	5.6	5.4	4.9
South Sulawesi	2.4	3.6	3.5	5.1	4.8	4.3	4.0	5.3	5.3	8.1	7.7	6.7
Southeast Sulawesi	11.8	11.2	7.6	6.9	6.0	5.3	19.3	20.2	11.4	12.3	9.4	9.4
Maluku	7.3	7.8	2.4	4.2	4.5	4.9	12.4	11.8	3.2	7.0	7.4	6.5
Irian Jaya (Papua)	6.4	9.5	6.0	3.4	4.3	2.9	12.4	19.6	8.0	8.6	10.7	5.1

Source: Calculated from the 1980 population census, 1990 population census and 1995 intercensal population survey data.

In summary, demographic (mortality, fertility, and migration) transition in Indonesia has occurred at different times, speeds and magnitudes among different provinces. The question is therefore "Is there any significant relationship between changes in vital rates and migration rates in Indonesia?" Yet, there are only very few studies addressing this question.

Ananta and Wongkaren (1996) have examined this question by arguing that the future Indonesian population will be characterized by longer life expectancies, fewer children per family and a better quality of life. Living longer may imply more opportunity to travel and see other regions or to move to other places. Having fewer children could mean that parents have more resources to contemplate migration; it could also mean more investments in children and, hence, a rising level in human capital in the labor force after a lag of at least 15 years (age of entry into the labor force). A rise in the quality of the labor force may mean better alternatives and, hence, increased mobility. Therefore, these two demographic revolutions might induce more mobility among the Indonesian population, in particular movement of unskilled and young labor from regions with relatively high mortality and fertility rates to those with relatively low mortality and fertility rates. Similarly, the relatively low supply of skilled labor in regions with relatively high fertility and mortality may attract skilled labor from regions with relatively low fertility and mortality.

The assumption that declining fertility may imply increased mobility finds some support from Muhidin (2001). Using data from the 1995 Indonesian intercensal survey, he found that lower fertility is associated with a higher probability of household migration. (A household is defined as having migrated if at least one member of the household has lived somewhere else in the five years preceding the survey.)

3. Data and Methods

The macro-level analysis taking the province[5] as the unit of analysis attempts to find possible associations between vital rates (TFR and IMR) and migration rates (TMigR and CMigR). The study considers two separate dependent variables: out-migration and in-migration rates. Each of them is measured by age-standardized TMigR and non-age-standardized CMigR. The two independent variables are TFR (age-standardized rate) and IMR (used as a crude indicator of the general mortality level).

It should be emphasized that the study does not attempt to establish the determinants of migration and, hence, does not include socioeconomic variables such as education and income per capita in the independent variables. Rather, the sole focus is on whether there is any significant association between fertility and mortality on the one hand, and migration on the other. Though the study is not aimed at finding the causality between vital rates and migration rates, this study introduces a lag variable in its efforts to find a possible statistically significant relationship between vital rates and migration rates. The empirical result of the regression analysis can be used to produce future migration scenarios and migration projections based on the projected fertility (and mortality) rates prepared by Muhidin (2002), which, in turn, can be utilized to improve multi-state demographic projections in Indonesia.

3.1 Data

The study uses data from the 1980 and 1990 Indonesia population censuses, and the 1995 intercensal population survey (SUPAS). This is a pooling of cross-sectional and time series data sets. The fertility rates (TFR) and mortality rates (IMR) are estimated indirectly and the values quoted here are mostly derived from the reports compiled by the Indonesian Central Board of Statistics (CBS). Recent (lifetime) migration data, obtained by comparing the place of current residence with the place of previous residence five years prior to the census/survey, are used to present a picture of inter-provincial migration. For children below five years of age at the time of the census/survey, information on place of residence is replaced by the place of birth.

---

[5] Since 1998 several new provinces have been created in Indonesia. However, during the period this paper was written, sufficient information from the 2000 population census regarding fertility, mortality, and migration was not available. Therefore, the names of provinces used in this paper refer to the “old” names.

In the migration data sets, Period 1 refers to the period 1975-1980, Period 2 to 1985-1990, and Period 3 to 1990-1995. In the fertility data sets (TFR), Period 1 refers to the period 1976-1979, Period 2 to 1986-1989, and Period 3 to 1991-1994. In the mortality data sets (IMR), Period 1 refers to 1976-1980, Period 2 to 1986-1990, and Period 3 to 1991-1995.

3.2 Method

In order to investigate the possibility of a relationship between vital rates and migration rates, four models are applied in the analysis. *Model 1,* pooling data. All the data are pooled together and a regression model is performed with migration as the dependent variable. TFR and IMR are the two independent variables. The data comprise 26 provinces in the 1980 census, 27 provinces in the 1990 census and 27 provinces in the 1995 intercensal survey; there are altogether 80 observations. Migration is measured in four ways: TOMigR, or total out migration rates; TIMigR, or total in migration rates; COMigR, or crude out-migration rate; and CIMigR, or crude in-migration rate.

$$Migration = a_1 + b_1 TFR + b_2 IMR + \varepsilon \qquad \text{(Eq.1)}$$

Model 2, pooling data with dummy for period. Similar to Model 1, but with dummy variables inserted for the periods considered (Z1=1 if the observation refers to Period 1, and Z3=1 if the observation refers to Period 3).

$$Migration = a_1 + b_1 TFR + b_2 IMR + cZ_1 + eZ_3 + \varepsilon \qquad \text{(Eq. 2)}$$

Model 3, for different periods. Similar to Model 1, the regression is run for each of the three periods separately.

$$Migration_{75-80} = a_1 + b_1 TFR_{76-79} + b_2 IMR_{76-80} + \varepsilon \qquad \text{(Eq. 3.1)}$$

$$Migration_{85-90} = a_2 + b_1 TFR_{86-89} + b_2 IMR_{86-90} + \varepsilon \qquad \text{(Eq. 3.2)}$$

$$Migration_{90-95} = a_2 + b_1 TFR_{91-94} + b_2 IMR_{91-95} + \varepsilon \qquad \text{(Eq. 3.3)}$$

Model 4, data with 15-year lag. In this model, a lag variable is considered. Fertility and infant mortality will affect migration after 15 years, the age of labor force entry. The dependent variable is migration in Period 3, while the independent variables are fertility and mortality in Period 1. In this case, there are 26 observations, since there are only 26 provinces in Period 1.

$$Migration_{90-95} = a_1 + b_1 TFR_{76-79} + b_2 IMR_{76-80} + \varepsilon \qquad \text{(Eq. 4)}$$

4. Statistical Findings

4.1 In-migration

Table 3 shows that with either age-standardized TIMigR or non-age-standardized CIMigR, the only significant relationship is observed with the pooled (1980, 1990, and 1995) data sets, controlled with dummy variables for the respective periods (Model 2). Fertility has no significant relationship, but mortality is negatively associated with migration. The dummy for Period 3 (1995 data set) is significant with a negative sign, implying that the migration rate in Period 3 (1990-1995) is lower than that in the previous periods.

The result shows no relationship between fertility and in-migration. Yet, regions having higher (lower) mortality are associated with regions having lower (higher) in-migration. In other words, regions in a relatively early phase of mortality transition tend to experience a lower rate of in-migration, and those in a relatively late phase tend to experience a higher rate of in-migration.

Table 3. Results of linear regression for in-migration

Model		*Total in-migration rate (TIMigR)*			*Crude in-migration rate (CIMigR)*		
		beta	*Sig.t* [a]	*Sig.F* [a]	*beta*	*Sig.t* [a]	*Sig.F* [a]
1. Pooling data							
Model 1.1	α	0.057	(12.8)	(13.7)	0.005	(3.9)	(27.7)
	TFR	0.029	(5.6)		0.002	(11.1)	
	IMR	-0.001	(20.6)		0.000	(20.4)	
Model 1.2	α	0.064	(8.4)	(12.2)	0.005	(2.3)	(33.0)
	TFR	0.014	(12.2)		0.001	(33.0)	
Model 1.3	α	0.105	(0.0)	(58.9)	0.007	(0.0)	(94.4)
	IMR	0.000	(58.9)		0.0000	(94.4)	
2. Pooling data with dummy period							
Model 2.1	α	0.159	(0.2)	(1.7)	0.012	(0.0)	(2.2)
	TFR	0.020	(19.4)		0.001	(36.1)	
	IMR	-0.001	(2.2)		-0.000	(1.7)	
	Z1(1980)	0.036	(25.7)		0.003	(16.6)	
	Z3(1995)	-0.065	(1.3)		-0.004	(1.2)	
Model 2.2	α	0.135	(1.0)	(8.1)	0.010	(0.2)	(12.9)
	TFR	-0.001	(94.8)		-0.001	(54.2)	
	Z1(1980)	0.012	(70.1)		0.001	(54.4)	
	Z3(1995)	-0.050	(5.3)		-0.003	(5.4)	
Model 2.3	α	0.201	(0.0)	(1.6)	0.014	(0.0)	(1.4)
	IMR	-0.001	(5.9)		-0.000	(2.1)	
	Z1(1980)	0.046	(13.1)		0.003	(9.4)	
	Z3(1995)	-0.067	(0.9)		-0.004	(0.9)	
3A. Period 1 (using the 1980 census data)							
Model 3.1	α	0.068	(64.3)	(14.7)	0.006	(51.1)	(18.1)
	TFR	0.061	(8.4)		0.003	(12.2)	
	IMR	-0.002	(7.4)		-0.000	(8.3)	
Model 3.2	α	0.023	(88.0)	(42.5)	0.003	(72.8)	(54.7)
	TFR	0.023	(42.5)		0.001	(54.7)	

Model 3.3	α	0.243	(4.0)	(36.8)	0.016	(3.1)	(31.8)
	IMR	-0.001	(36.8)		-0.000	(31.8)	
3B. Period 2 (using the 1990 census data)							
Model 3.1	α	0.200	(1.7)	(39.8)	0.015	(0.6)	(25.9)
	TFR	0.008	(71.3)		0.000	(93.9)	
	IMR	-0.001	(20.3)		-0.000	(16.4)	
Model 3.2	α	0.164	(3.7)	(66.4)	0.012	(1.6)	(39.2)
	TFR	-0.008	(66.4)		-0.001	(39.2)	
Model 3.3	α	0.216	(0.2)	(18.7)	0.015	(0.1)	(9.7)
	IMR	-0.001	(18.7)		-0.000	(9.7)	
3.C. Period 3 (using the 1995 survey data)							
Model 3.1	α	0.150	(0.7)	(38.2)	0.011	(0.3)	(22.9)
	TFR	-0.015	(44.3)		-0.001	(42.2)	
	IMR	-0.000	(64.3)		0.000	(45.5)	
Model 3.2	α	0.148	(0.6)	(18.7)	0.011	(0.3)	(11.9)
	TFR	-0.021	(18.7)		-0.002	(11.9)	
Model 3.3	α	0.120	(0.1)	(24.5)	0.009	(0.0)	(12.6)
	IMR	-0.001	(24.5)		-0.000	(12.6)	
4. Model with lag (15 years)							
Model 4.1	α	0.128	(8.9)	(51.6)	0.012	(2.2)	(35.1)
	TFR	0.005	(78.0)		-0.000	(70.9)	
	IMR	-0.001	(29.5)		0.000	(37.3)	
Model 4.2	α	0.115	(12.0)	(64.9)	0.011	(2.8)	(25.2)
	TFR	-0.006	(64.9)		-0.001	(25.2)	
Model 4.3	α	0.142	(1.2)	(26.0)	0.010	(0.6)	(15.8)
	IMR	-0.001	(26.0)		0.000	(15.8)	

Note: Statistics are considered significant if less than or equal to 5.0

4.2 Out-migration

Table 4 shows that with either the age-standardized TOMigR or the non-age-standardized COMigR, mortality seems to have a more dominant effect on out-migration. With a lag of 15 years (Model 4), the IMR is the only significant (with a negative sign) variable affecting out-migration. A region with high (low) mortality tends to have low (high) out-migration rates 15 years later, but the region's fertility is not associated with out-migration 15 years later.

Serious multicollinearity seems to have occurred in some data sets. With the pooled data set (Model 1) both TFR and IMR have a significant negative association with the COMigR if they are not controlled with each other. When these two variables are put together in the equation, neither has a significant relationship, though the F statistic is significant. For the TOMigR, the significant association is seen only when the analysis is controlled with dummies for the period (Model 2). In other words, the effect of either the TFR or IMR cannot be separated after being controlled with the other one: either the TFR or IMR has a negative association with the out-migration rate. Regions with high (low) TFRs or IMRs tend to be those with low (high) rates of out-migration.

Serious multicollinearity is also observed in the TOMigR with the 1995 data set (Model 3.C). With the TFR and IMR put together in the equation, the F statistic is significant but none of the t statistics is significant. After either the TFR or IMR is dropped, the remaining variable becomes significant (negative). Again, here, the effect of the TFR cannot be separated from the IMR. Yet, the result also shows that regions with high (low) TFRs or IMRs are associated with those having low (high) standardized out-migration rates.

There is no significant relationship between the TFR and IMR and out-migration rates with the 1980 data set (Model 3.A). The 1990 data set reveals that the IMR is the only variable significantly associated with the TOMigR (Model 3.B). TFR is negatively associated with the COMigR, but the association disappears after it is being controlled with the IMR. On the other hand, the effect of the IMR remains even after being controlled with the TFR. In other words, the 1990 data set indicates that mortality has a more dominant association with out-migration. The result for the COMigR using the 1990 data set is similar in the 1995 data set.

Table 4. Results of linear regression for out-migration

Model		*Total out-migration rate (TOMigR)*			*Crude out-migration rate (COMigR)*		
		beta	*Sig.t* [a]	*Sig.F* [a]	*beta*	*Sig.t* [a]	*Sig.F* [a]
1. Pooling data							
Model 1.1	α	0.122	(0.0)	(18.9)	0.009	(0.0)	(2.6)
	TFR	-0.005	(58.5)		-0.001	(31.1)	
	IMR	-0.000	(57.6)		-0.000	(52.4)	
Model 1.2	α	0.124	(0.0)	(8.1)	0.009	(0.0)	(0.8)
	TFR	-0.010	(8.1)		-0.001	(0.8)	
Model 1.3	α	0.114	(0.0)	(8.1)	0.008	(0.0)	(1.2)
	IMR	-0.000	(8.1)		-0.000	(1.2)	
2. Pooling data with period							
Model 2.1	α	0.196	(0.0)	(0.8)	0.013	(0.0)	(0.1)
	TFR	-0.012	(19.3)		-0.001	(5.8)	
	IMR	-0.001	(6.4)		-0.000	(3.7)	
	Z1(1980)	0.029	(14.2)		0.002	(5.5)	
	Z3(1995)	-0.045	(0.6)		-0.003	(0.6)	
Model 2.2	α	0.184	(0.0)	(1.5)	0.013	(0.0)	(0.2)
	TFR	-0.023	(0.4)		-0.002	(0.0)	
	Z1(1980)	0.017	(37.1)		0.001	(19.9)	
	Z3(1995)	-0.038	(1.8)		-0.002	(2.2)	
Model 2.3	α	0.171	(0.0)	(0.7)	0.011	(0.0)	(0.1)
	IMR	-0.001	(0.2)		-0.000	(0.0)	
	Z1(1980)	0.022	(24.2)		0.002	(14.3)	
	Z3(1995)	-0.043	(0.8)		-0.002	(1.0)	

3A. Period 1 (using the 1980 census data)							
Model 3.1	α	0.137	(2.0)	(61.1)	0.010	(0.5)	(27.0)
	TFR	-0.007	(58.4)		-0.001	(41.6)	
	IMR	-0.002	(74.0)		-0.000	(52.4)	
Model 3.2	α	0.133	(1.9)	(34.5)	0.010	(0.5)	(13.3)
	TFR	-0.010	(34.5)		-0.001	(13.3)	
Model 3.3	α	0.116	(0.8)	(40.2)	0.008	(0.2)	(15.9)
	IMR	-0.000	(40.2)		-0.000	(15.9)	
3B. Period 2 (using the 1990 census data)							
Model 3.1	α	0.238	(0.1)	(7.2)	0.016		
	TFR	-0.012	(49.5)		-0.001	(22.1)	(0.0)
	IMR	-0.001	(13.9)		-0.000	(15.1)	
						(0.0)	
Model 3.2	α	0.205	(0.2)	(7.8)	0.014		
	TFR	-0.028	(7.8)		-0.002	(2.0)	(0.0)
						(0.0)	
Model 3.3	α	0.215	(0.0)	(2.7)	0.013		
	IMR	-0.002	(2.7)		-0.000	(1.5)	(0.0)
						(0.0)	
3C. Period 3 (using the 1995 survey data)							
Model 3.1	α	0.178	(0.0)	(3.1)	0.012	(36.7)	(0.0)
	TFR	-0.015	(39.5)		-0.001	(6.7)	
	IMR	-0.001	(11.6)		-0.000	(0.0)	
Model 3.2	α	0.173	(0.1)	(3.4)	-0.002	(2.0)	(0.0)
	TFR	-0.031	(3.4)		0.010	(0.0)	
Model 3.3	α	0.150	(0.0)	(1.2)	-0.000	(0.5)	(0.0)
	IMR	-0.001	(1.2)		-0.000	(0.0)	
4. Model with lag (15 years)							
Model 4.1	α	0.177	(1.2)	(16.3)	0.013	(0.5)	(8.8)
	TFR	-0.003	(86.4)		-0.000	(73.3)	
	IMR	-0.001	(15.6)		-0.000	(11.9)	
Model 4.2	α	0.161	(2.2)	(20.4)	0.012	(1.0)	(11.9)
	TFR	-0.016	(20.4)		-0.001	(11.9)	
Model 4.3	α	0.169	(0.1)	(5.5)	0.012	(0.1)	(2.8)
	IMR	-0.001	(5.5)		-0.000	(2.8)	

Note: Statistics are considered significant if less than or equal to 5.0

4.3 Mixed results

The present study has a mixed result with regard to the hypothesized significant association between fertility and migration. The association is the weakest with in-migration. The hypothesis of the existence of an association between fertility and in-migration is rejected. Indeed, in the pooling data set (Model 1) a significant association between mortality and in-migration is present.

The association is stronger in the case of out-migration. In some of the models without lag (Models 1, 2 and 3) the hypothesis is not rejected, though mortality plays a significant role in affecting migration. Nonetheless, the hypothesis is rejected in other models without lag. In the models with lag (Model 4), the hypothesis of the association between fertility and out-migration is rejected, but there is a significant association between mortality and out-migration.

Mortality seems to have played a more dominant role in the association with migration. However, this pattern may change in the future, as more and more provinces enter the last phase of their vital (fertility and mortality) transition, characterized by below replacement level fertility.

5. Migration Projection

5.1. Previous works

Wilson's study (2001) shows that the world will soon experience a demographic convergence. In other words, differences in demographic parameters between developing and developed countries will be much narrower and the parameters among developing countries themselves will have a much smaller variation.

Indonesia should not be an exception. The earlier discussion on demographic changes in this paper shows that the demographic parameters in Indonesian provinces are showing much smaller variations. This tendency of convergence may continue in the future. With this convergence assumption, Muhidin (2002) has produced a multi-state population projection for Indonesia until 2020.

Muhidin projects fertility (TFR) using a logistic curve. The choice of the assumption reflects an expert judgment that the fertility in each province will be below replacement level by 2020. Each province will have finished its fertility transition by 2020. Some provinces already started being below replacement level in the beginning of the 1990s and the remaining provinces will experience below replacement level during the period 2000-2020. The TFR will reach 1.6 some time before 2020 and will fluctuate around it until 2020. Therefore, he fixes TFR to be 1.6 in 2020.

Muhidin also uses a logistic curve to project mortality (IMR), with the lower value set at 20 for males and 15 for females in 2020. This choice is also a reflection of an expert judgment that by 2020 each province will have been in the hard rock phase of the mortality transition, that all provinces will have finished their mortality transition. Some provinces were already completing the mortality transition by the beginning of the 1990s.

Muhidin, however, does not attempt to make any migration projection as he does for fertility and mortality. In his population projection, he makes two scenarios: with and without migration rate. Once the migration is considered, he assumes that the migration rates remain constant as the rates in the period 1985-1990. Similar practice has been embraced by many others working on Indonesian population projection; such as Nitisastro (1970), Iskandar (1976), Ananta and Adioetomo (1990), Ananta and Anwar (1994), and Indonesian CBS (1998). Researchers embracing this methodology assume that future internal migration levels in Indonesia and its provinces will be similar to currently observed migration levels.

This paper attempts to go one step beyond the work of Muhidin and others in projecting migration. Migration scenarios are produced based on Muhidin's projected fertility and mortality.

5.2. In-migration scenarios

Because the significant relationship is only found when the regression is controlled with dummy variables for the periods, it is difficult to use the results in models 2.2 and 2.3 (for in-migration, both standardized and unstandardized) to make a projection of in-migration rate based on projected mortality. If dummy variables for each period were included, there would be so many future periods.

Furthermore, fertility has no significant association with in-migration. Therefore, from the point of view of policy it is not feasible to reverse the trend in in-migration by reversing the trend in mortality. It is unethical to increase mortality or slow down the rate of decline in mortality.

In addition, the projection prepared by Muhidin is in the context of multi-state demographic projection, where out-migration from region A to region B is the same as in-migration to region B from region A. With this approach, the population projection of each province is performed simultaneously. There is, therefore, no need to project in-migration separately (for a similar view see Rogers 1995). As a consequence, there is no special scenario for future in-migration.

5.3. Out-migration scenarios

First, using the lag of 15 years, out-migration scenarios are produced. Model 4.3 is utilized in both standardized and unstandardized rate of out-migration. As shown in Model 4.3, the projected migration is a function of projected mortality (IMR) only.

Second, the results from the models without lag are applied. The results of the regression analyses are different from one period to another, but the association with IMR seems to be more prevalent, especially on the unstandardized rate of out-migration. To get the most recent pattern, the result of the 1995 data set is taken into account.

The crude out-migration rate (COMigR) is projected using Model 3.1, with insignificant TFR. However, because there is no significant result in Model 3.1 for the total out-migration rate (TOMigR), two scenarios of projected TOMigR are produced. One is using Model 3.2, which uses the projected TFR, without being controlled by IMR. The other is utilizing Model 3.3, which uses the projected IMR, without being controlled by TFR.

There are, therefore, two scenarios for projected crude out-migration rate (COMigR) and three scenarios for projected total out-migration rate (TOMigR). In addition, the scenarios are compared with those prepared by Muhidin (2002). All scenarios applied for out-migration are summarized as follows:

COMigR 1 = projected with model 4.3 (lag 15 years, only IMR significant)
COMigR 2 = projected with model 3.1 (IMR significant, TFR insignificant)

TOMigR 1 = projected with model 4.3 (lag 15 years, only IMR significant)
TOMigR 2 = projected with model 3.2 (only TFR significant)
TOMigR 3 = projected with model 3.3 (only IMR significant)

5.4. Results

Because the projected TFR and IMR produced in Muhidin (2002) do not use province as the unit of analysis, the projections of migration here do not use province as the unit of analysis. Muhidin uses 12 clustered regions made according to their geographical positions. The clustering is made because of the difficulties in obtaining data on age-specific migration flows (origin-destination) needed in the multi-state projection for all the 27 provinces in Indonesia. This projected migration can be used to revise the multi-state population projections prepared earlier by Muhidin (2002).

Table 5. Projected total out-migration rate (TOMigR) for Indonesian regions, 1995-2020

		Base data	Projected TOMigR (x100)					
	Regions	1990	1995	2000	2005	2010	2015	2020
			Model 4.3 (with lag 15 years)					
1.	Northern Sumatra	5.596	8.172	11.445	12.533	13.467	14.136	14.594
2.	Southern Sumatra	7.066	7.307	10.907	12.565	13.623	14.331	14.778
3.	Jakarta	43.431	9.985	13.266	14.483	15.094	15.443	15.634
4.	West Java	4.400	5.584	9.264	11.386	12.790	13.789	14.442
5.	Central Java	11.301	8.560	11.409	13.748	14.496	14.926	15.162
6.	Yogyakarta	11.872	11.655	13.385	14.597	15.061	15.360	15.550
7.	East Java	5.726	8.670	11.528	13.268	13.998	14.500	14.835
8.	Bali	5.614	9.077	12.571	13.550	14.250	14.703	14.988
9.	Nusa Tenggara	3.400	3.477	3.939	11.706	13.491	14.425	14.865
10.	Kalimantan	5.922	7.542	10.811	12.047	13.026	13.767	14.302
11.	Sulawesi	4.184	7.379	10.500	11.852	12.942	13.756	14.329
12.	Maluku+Papua	6.385	7.254	10.277	13.416	13.869	14.241	14.542
			Model 3.2 (TFR significant)					
1.	Northern Sumatra	5.596	6.923	8.446	9.658	10.528	11.119	11.554
2.	Southern Sumatra	7.066	8.229	9.938	11.026	11.647	11.989	12.175
3.	Jakarta	43.431	11.430	11.927	12.175	12.269	12.331	12.331
4.	West Java	4.400	8.229	9.409	10.280	10.901	11.336	11.678
5.	Central Java	11.301	9.037	9.969	10.653	11.181	11.523	11.771
6.	Yogyakarta	11.872	11.771	12.082	12.238	12.300	12.331	12.362
7.	East Java	5.726	10.373	10.963	11.367	11.678	11.865	12.020
8.	Bali	5.614	11.150	11.678	11.989	12.175	12.269	12.300
9.	Nusa Tenggara	3.400	5.556	7.731	9.441	10.621	11.367	11.802
10.	Kalimantan	5.922	8.570	10.062	11.026	11.585	11.927	12.113
11.	Sulawesi	4.184	8.322	9.782	10.746	11.398	11.771	12.020
12.	Maluku+Papua	6.385	6.395	7.980	9.254	10.186	10.870	11.336
			Model 3.3 (IMR significant)					
1.	Northern Sumatra	5.596	9.138	10.271	11.046	11.559	11.891	12.085
2.	Southern Sumatra	7.066	9.403	10.601	11.357	11.815	12.086	12.233
3.	Jakarta	43.431	11.892	12.482	12.806	12.981	13.075	13.120
4.	West Java	4.400	7.994	9.683	10.789	11.476	11.888	12.116
5.	Central Java	11.301	10.879	11.607	12.007	12.223	12.337	12.392
6.	Yogyakarta	11.872	11.835	12.343	12.664	12.864	12.986	13.056
7.	East Java	5.726	10.037	10.886	11.453	11.821	12.057	12.190
8.	Bali	5.614	10.464	11.231	11.712	12.008	12.189	12.284
9.	Nusa Tenggara	3.400	9.179	10.759	11.505	11.843	11.993	12.051
10.	Kalimantan	5.922	8.392	9.646	10.552	11.183	11.614	11.881
11.	Sulawesi	4.184	8.251	9.627	10.598	11.255	11.690	11.942
12.	Maluku+Papua	6.385	9.820	10.449	10.957	11.365	11.689	11.944

Table 5 shows the three scenarios of total out-migration rate (TOMigR) until the year 2020. It is interesting to see that the projected rates show a convergence tendency. In 2020, the rate tends to cluster around 15.0 by using model 4.3 and around 12.0 by using models 3.2 and 3.3. The results indicate that when mortality (and fertility) converges to a low level, out-migration similarly converges to a certain rate.

In all regions and projection years, the projected rates are larger than the ones from the base year. An exception is Jakarta, where the projected rates are always smaller than the data from the base year. In the base year, the rate in Jakarta is much different from the remaining regions.

A similar pattern is seen with the projected crude out-migration rate (COMigR). The projected rates tend to converge around 10.0 with Model 4.3, and 10.5 with Model 3.1. Table 6 shows that the rate in Jakarta in the base period is conspicuously larger than the others. Therefore, the projected rates in Jakarta are the only ones smaller than those in the base period.

Table 6. Projected crude out-migration rate (COMigR) for Indonesian regions, 1995-2020

		Base data	Projected COMigR (x1000)					
	Regions	1990	1995	2000	2005	2010	2015	2020
			Model 4.3 (with 15-year lag)					
1.	Northern Sumatra	3.331	5.441	7.844	8.643	9.328	9.819	10.155
2.	Southern Sumatra	4.189	4.807	7.449	8.666	9.443	9.962	10.290
3.	Jakarta	25.341	6.772	9.181	10.073	10.522	10.778	10.919
4.	West Java	3.066	3.542	6.243	7.800	8.831	9.564	10.044
5.	Central Java	8.254	5.726	7.817	9.534	10.083	10.399	10.572
6.	Yogyakarta	8.780	7.998	9.268	10.157	10.498	10.718	10.857
7.	East Java	4.108	5.807	7.905	9.182	9.717	10.086	10.332
8.	Bali	4.209	6.106	8.670	9.389	9.903	10.235	10.444
9.	Nusa Tenggara	2.192	1.995	2.334	8.035	9.346	10.031	10.354
10.	Kalimantan	3.523	4.979	7.379	8.285	9.004	9.548	9.941
11.	Sulawesi	2.762	4.860	7.150	8.143	8.943	9.540	9.961
12.	Maluku+Papua	3.597	4.768	6.987	9.291	9.623	9.896	10.117
			Model 3.1 (IMR significant, TFR insignificant)					
1.	Northern Sumatra	3.331	8.923	9.550	9.978	10.263	10.446	10.554
2.	Southern Sumatra	4.189	9.070	9.732	10.150	10.404	10.554	10.635
3.	Jakarta	25.341	10.447	10.773	10.952	11.049	11.101	11.126
4.	West Java	3.066	8.290	9.225	9.836	10.216	10.445	10.570
5.	Central Java	8.254	9.886	10.289	10.510	10.630	10.693	10.723
6.	Yogyakarta	8.780	10.415	10.696	10.874	10.984	11.052	11.090
7.	East Java	4.108	9.420	9.890	10.204	10.407	10.538	10.612
8.	Bali	4.209	9.656	10.081	10.347	10.511	10.611	10.664
9.	Nusa Tenggara	2.192	8.946	9.820	10.232	10.419	10.502	10.534
10.	Kalimantan	3.523	8.510	9.204	9.705	10.054	10.293	10.440
11.	Sulawesi	2.762	8.432	9.194	9.730	10.094	10.335	10.474
12.	Maluku+Papua	3.597	9.300	9.648	9.930	10.155	10.334	10.475

Another conclusion from the scenarios is that out-migration rates tend to increase with progress of vital (fertility and mortality) transition. The transition of mortality seemingly has a stronger impact on out-migration. Because the data sets utilized comprise only few regions experiencing below replacement level--and they just experienced it in the early 1990s--the relatively unimportant effect of fertility may not hold in the future when more and more provinces reach below replacement level fertility. The conclusion should be taken cautiously because future relationship between fertility and mortality on one hand and migration on the other hand may change when most provinces have finished their vital transition.

It should also be mentioned that when out-migration rises in-migration should increase because out-migration from one province is an in-migration to another province. In other words, migration is predicted to keep rising along with the progress of vital transition in Indonesia.

One should also be wise not to interpret the migration changes as mainly an outcome of mortality changes. It is unethical to deliberately slow down or reverse the decline in mortality. The scenarios based on projected mortality simply indicate what will happen to migration if mortality follows a certain path. Readers are warned to be cautious in interpreting the results because the analysis has not been controlled with changing socio-economic conditions, such as education and income per capita.

More works should follow to further examine the possible relationship between fertility (and mortality) on migration, especially the relationship during 2000-2030 when all provinces will no doubt reach below replacement level fertility.

6. Conclusion

The paper has shown the tendency towards convergence in demographic parameters in Indonesia since the late 1960s. It produces mixed results for the hypothesized association between fertility and migration. The association is weakest for in-migration. Indeed, the hypothesized association between fertility and in-migration is rejected. However, the analysis with the pooled data set (Model 1) finds a significant association between mortality and in-migration.

In the case of out-migration the association is stronger. In some of the models without a lag (Models 1, 2 and 3) the hypothesis of the relationship between fertility and migration is not rejected, though mortality also plays a significant role in affecting migration. In the models with a lag (Model 4) the hypothesized association between fertility and out-migration is rejected, but there is a significant association between mortality and out-migration.

Mortality seems to play a more dominant role in the association with migration. One explanation may be that in the Indonesian context mortality is more closely (inversely) associated with level of economic development than is fertility. If differential opportunities resulting from different levels of economic development are the main trigger for migration, then a closer association could be expected between mortality and migration. This could be tested by models incorporating data on levels of economic development. On the other hand, as only few regions have reached below replacement level, and this just occurred in the early 1990s. The unimportant effect of fertility may not hold in the future as more provinces enter the last stage of their vital transition characterized by below-replacement-level fertility. The hypothesized relationship between fertility and migration is based on the experiences of countries already experiencing below replacement level fertility.

References

Ananta, A. and S.M. Adioetomo. (1990). Perkembangan Penduduk Indonesia menuju Tahun 2005 [Development of Indonesian Population toward the Year 2005]. Jakarta: Demographic Institute, University of Indonesia.

Ananta, A. and E.N. Anwar. (1994). Projection of Indonesian Population and Labor Force: 1995-2025. Jakarta: Demographic Institute, University of Indonesia.

Ananta, A. and T.S. Wongkaren. (1996). "Pembangunan ekonomi dan mobilitas penduduk [Economic development and population mobility]." In: A. Ananta and Chotib, editors. Mobilitas Penduduk [Population Mobility]. Jakarta: Lembaga Demografi, Fakultas Ekonomi Universitas Indonesia and Kantor Menteri Negara Kependudukan/ BKKBN: p.149-164.

Central Bureau of Statistics [Indonesia]. (1998). Proyeksi Penduduk Indonesia per Propinsi 1995-2005 [Projection of Indonesian Population by Province: 1995-2005]. SUPAS Series S7. Jakarta: CBS-Indonesia.

Hinde, A. (1998). Demographic Methods. New York: Oxford University Press.

Hugo, G. (1997). "Changing Patterns and Processes of Population Mobility." In: G. W. Jones and T.H. Hull, editors. Indonesian Assessment. Population and Human Resources. Singapore: Australian National University and Institute of Southeast Asian Studies.

Iskandar, N. (1976). Beberapa Proyeksi Penduduk untuk Indonesia Menurut Pulau-pulau Utama 1971-2001 [Some Population Projections for Indonesia by Main Islands, 1971-2001]. Jakarta: Demographic Institute, University of Indonesia.

Jones, G.W. (1999). "The population of Southeast Asia." Working Papers in Demography No. 81. Canberra: the Research School of Social Sciences, Australian National University.

Miranti, R. (2000). "The Role of Human Capital in Economic Growth and the Crisis: A Descriptive and Empirical Account." Unpublished Masters Thesis, Department of Economics, National University of Singapore, Singapore.

Muhidin, S. (2001). "An Assessment of the Effect of Family Variables to Migration in Indonesia." Paper presented at the workshop on Migration and the Asian family in a Globalising World, Asian MetaCentre, Singapore, 16-18 April 2001.

Muhidin, S. (2002). The Population of Indonesia: Regional demographic scenarios using a multiregional method and multiple data sources. Amsterdam: Rozenberg Publishers.

Nayyar, D. (1994). "International Labor Movements, Trade Flows and Migration Transitions: A Theoretical Perspective." Asian and Pacific Migration Journal, vol. 3, no. 1.

Nitisastro, W. (1970). Population Trends in Indonesia. Ithaca: Cornell University Press.

Prihastuti, D. (2000). "Model Pertumbuhan Penduduk Lanjut Usia (lansia) di Indonesia dengan Pendekatan Multiregional [Growth Model of Old Population in Indonesia using Multiregional Approach]." Unpublished Masters Thesis, Graduate Program on Population and Labor, University of Indonesia.

Putera, R. (1999). "Proyeksi Penduduk Indonesia 1995-2025 dengan Pendekatan Demografi Multiregional [Projection of Indonesian Population 1995-2025 using Multiregional Demography Approach]." Unpublished Masters Thesis, Graduate Program on Population and Labor, University of Indonesia.

Rogers, A. (1995). Multiregional Demography: Principles, Methods and Extensions. Chichester: Wiley.

Skeldon, R. (1990). Population Mobility in Developing Countries: A Reinterpretation. London: Belhaven.

Skeldon, R. (1992). "On Mobility and Fertility Transitions in East and Southeast Asia." Asian and Pacific Migration Journal, vol. 1, no. 2.

Skeldon, R. (1997). Migration and Development. A Global Perspective. Harlow, Essex, England: Addison Wesley Longman limited.

Stahl, C.W and R.T. Appleyard. (1992). "International Manpower Flows in Asia: An Overview." Asian and Pacific Migration Journal, vol. 1, nos.3-4.

Wilson, C. (2001). "On the Scale of Global Demographic Convergence 1950-2000." Population and Development Review, 27(1):155-172.

Zelinsky, W. (1971). "The Hypothesis of the Mobility Transition." Geographical Review, 61(2):219-240.