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AGE STRUCTURAL TRANSITION AND ECONOMIC GROWTH: EVIDENCE FROM SOUTH AND SOUTHEAST ASIA

Kannan Navaneetham

Asian MetaCentre for Population and Sustainable Development Analysis
Institute for Asian Research, National University of Singapore, Singapore

Abstract

This paper examines the age structural transition and its linkages with the economic growth in the countries of South and Southeast Asia: Bangladesh, India, Sri Lanka, Indonesia, Malaysia, Philippines, Thailand and Singapore. The study uses population data from the United Nations and the economic data from the Penn World Tables. The influence of age structure on the economic growth is investigated empirically using annual time series data for individual countries. The study indicated that nature of age structural transition is vary among the South and Southeast Asian countries due to differences in the nature and process of demographic transition. The future share of population in the age group 50-64, where the saving rate would be higher among them, is likely to increase in all the countries of South and Southeast Asia. As regards the relationship between age structural transition and economic growth, we have found that the effect of age structure on the economic growth is not uniform among the countries. We have found that the decline in the dependency ratio is also associated with the increase in the per capita GDP growth rate in many countries. However, the economic growth is not sustained in the later years, despite the decline in the dependency ratios. The study also found that the effect of age shares on the economic growth varied in both direction and magnitude among the countries of South and Southeast Asia. Consequently, we may conclude that population dynamics matter for economic development but likely to be conditioned by the institutional factors.

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1. Introduction

The age structural transition is an integral part of demographic transition where it trajectories are determined by nature and process of mortality and fertility declines. During the initial period of demographic transition, when fertility constant and mortality declines, countries face a large share of young population and therefore a period of increasing young dependency ratios. Later period, when fertility declines and an earlier period of cohort born during constant fertility regime passes through working age, the young dependency ratios decline. Again when the baby boom cohort reaches the old age, the old age dependency ratio increases. The age structural transition is likely to have various implications for social and economic development in the country. Using parametric simulation model it was shown that shift in the age structure of the population influence the age pattern of expenditure in education, health and pensions and therefore leads to major problem in terms of resource allocation (Tuljapurkar, 2000). The changing age structure of population invoked by demographic transition provides a "demographic bonus" or "windows of opportunity" where the working age population gradually increases and dependency ratio declines. In the literature, the period of the windows of opportunity has been characterized as (a) more workers producing more total output, if they are productively employed; (b) greater accumulation of wealth, if savings occur and are productively invested and (c) a large supply of human capital, if appropriate investments are made in its formation (Birdsall & Sinding, 1998). During this period of windows of opportunity, there is a less demand for health services due to decline in the young and old age population. The other opportunity given by the changing age structure is the decline in the growth of school going age population. This opportunity gives a room to improve the quality and coverage of education. In the process of age structural

transition, the window's of opportunity is followed by turbulence to development where there is a increase in the elderly population both in absolute terms and proportional terms which likely to have an impact on the sustainable social security system.

The age structural transition received a renewed interest among the social scientist on studying the relationship between demographic variables and economic growth. The earlier arguments were mainly restricted to the growth rate of the total population without considering the dynamics of its age structure (Coale and Hoover, 1958). However, the recent evidence on the basis of estimated growth models shows that age structure has significant transitional impact on the growth of the economy. These models assumes that the per capita growth of income declines during the early stages of demographic transition due to large young dependent population and small working age population which means that there are relatively few workers and savers. As the demographic transition proceeds, the decline in the youth dependency burdens and increase in the working age population promotes the per capita income growth, as there are more savers. When the transition completes, the old age dependency ratios raises, the income growth deteriorates (Bloom and Williamson, 1997). Several studies have shown that economic growth in the East Asian countries were contributed by the demographic gift driven by the demographic transition in those countries (Mason, 1988, Lee et al., 1997). Bloom & Williamson (1997) have shown based on the cross-sectional analysis of 78 Asian and non-Asian countries that growth of the working age population has had a powerful positive impact on GDP per capita growth, while growth of the total population has had a negative impact. It was also established in their study that growth rate of dependent population (0-14 and 65+) slowed down the economic growth, however, the impact is not uniform between young and old age population. Although, growth of population under age 15 is negative with a decrease in the GDP per capita growth, there was no significant impact from the growth of elderly population. Behrman et al. (1999) presents new evidence on the association between average age of a population and economic outcomes based on the panel data for 164 countries for 1950-1995. The economic outcomes considered in their analysis are macroeconomic aggregates (domestic savings as a share of GDP, GDP per capita, capital per workers and tax revenue as a share of GDP), governmental expenditure in education and health and social indicators (inequality,

unemployment, homicide rates and schooling progression rates). Their results suggested that the economic outcomes clearly follows the age related patterns, and the patterns differ regions by regions and that the pattern differ with different policy regimes related to trade openness, domestic financial market and macroeconomic volatility (Behrman et al, 1999).

Lindh and Malmberg (1999) shown based cross-countries studies that age structure has substantial effects on per-worker GDP growth rates. Between 1950 and 1990, using 5-year data in the OECD countries, their study found that there is a strong positive correlation between initial population shares of middle aged people (50-64 years) and growth in the following period, and a strong negative correlation between growth and the population share of old age population.

All those studies were based on the cross-sectional analysis for single year or cross-country panel data analysis (usually 5 year) and not based on the individual countries. However, recently Andersson (2000) studied the impact of age structural transition on economic growth for Scandinavian countries. Their model is based on the individual countries with annual data from 1950-92. This study indicated a positive influence on economic growth from the mature adults and middle aged. Nevertheless, there was no attempt made to study the influence of age structure changes on economic growth in the context of South and Southeast Asia based on the individual countries. We assume that the impact of population age structure on the economic growth is to be conditioned by environmental and the institutional factors. Although some of the environmental and institutional factors such as openness, institutional quality, access to port were controlled in the cross-sectional analysis, it is important to understand the dynamics of age structure on the economic growth over the period of the transition on the individual countries. The demographic, institutional and environmental factors are also varies in the South and Southeast Asian countries. The study considers eight countries in the South and Southeast Asia. These are Indonesia, Malaysia, Philippines, Thailand, Singapore, Bangladesh, India and Sri Lanka. There are variations in the per capita GDP growth rate in South and Southeast Asian countries. The highest GDP growth rate was observed in Thailand (9.26 percent) during the period 1990-95 followed by Singapore (7.39 percent). The lowest GDP per capita growth rate was observed in Bangladesh

followed by Sri Lanka (see table 1). Further, there are also variations in the demographic and environmental characteristics in these regions (see table 1). The lowest fertility rate is observed in Singapore followed by Thailand. It was 1.8 per woman in Singapore followed by 1.9 in Thailand during 1990-95. The fertility rate was highest in Philippines (4.0) followed by India (3.6) and Malaysia (3.6) during 1990-95. Similarly, the life expectancy at birth was highest in Singapore (76 years) followed by Sri Lanka (72 years). The lowest life expectancy at birth was observed in Bangladesh (56 years) followed by India (60 years) during the same period (United Nations, 2000). As regards the environmental factor, only 10 per cent of land in Bangladesh and 50 per cent of the land in India is subject to tropical climate. In the remaining countries, the entire area is subject to tropical climate. Singapore ranks at the top as regards the institutional quality followed by Thailand. The least rank was observed in Bangladesh and Philippines. It is important to mention that India and Bangladesh were not open for the economy during the period of analysis according to the criteria by Sachs and Warner (1995). As there are variations in the environmental and institutional factors, this study will contribute in understanding of how the relationship between age structural transitions and economic growth vary across these different social, environmental, political structure and policy regimes in the South and Southeast Asia. The objectives of this paper are: (i) to study the nature and process of age structural transition in the selected countries of South and Southeast Asia; (ii) to analyse the relationship between age structural transition and economic growth in the context of South and Southeast Asian countries.

The paper is organised as follows: After an introduction, section 2 discusses data and methodology used in the study and section 3 presents the age structural transition in the South and Southeast Asia from 1950-2050 and likely implications on the economy and society. Section 4 presents results of time series regression analysis linking age structure and economic growth and finally section 5 gives conclusion.

2. Data and Methodology

The population data has been taken from the United Nations (2000). The share of population by different age groups from the year 1950 to 2050 was used to analyse age structural transition. The economic variables such as investment share of

GDP, net foreign balance, share of public consumption expenditure, inflation rate have been taken from Penn World Tables 5.6 (Summers & Heston, 1995). The other economic and environmental variables such as openness, institutional quality and tropical condition has been taken from Sachs and Warner (1995, 1997). We have classified the age groups as 0-14 (young), 15-24 (youth), 25-49 (prime working), 50-64 (middle) and 65+ (old age). This has been classified on the basis of life cycle behaviour in the economy. The young population (0-14) is dependent on the adults and they incur for health and education expenditures in the economy. The youth population (15-24) is consume for health and education, however, the pattern of consumption behaviour is different as compared to young age population, for example cost for higher education. As the enrolment for higher education increases in all the countries as well as the age at marriage, they also depended on the adults. Since the prime working age population are mostly to consume their earned income through a way of buying a house, raising their children and they have little to save. The middle age group 50-64 likely to earn higher income due to their experiences and they will have concern for their old age and therefore likely to save their income. As the old age people (65+) are mostly retired, they depend on the adults for their consumption need, particularly on health.

We used annual time series data covering the period 1950-1992 for studying the relationship between changes in the age structure and economic growth. As the focus of the paper is not on the econometric specification of the age share models on the economic growth, a simple OLS method has been used in the regression models to estimate the effect of age shares on the per capita GDP growth. The variables such as investment share of GDP, net foreign balance, share of public consumption expenditure, inflation rate and openness have been controlled in the models. As the age groups considered for the analysis might be highly correlated, we entered the age group independently in the regression models. We have also carried out regression model using the cross sectional analysis from the panel data of 5 year pooling these eight countries in South and Southeast Asia. The 5 year per capita GDP growth rate during the period 1960-90 has been used as a dependent variable. The age share of the variables was considered at the beginning of the 5-year period. In addition to the macro economic variables listed above, we have also included the contextual variables such as institutional quality and tropical

condition of the country as well as initial GDP per capita in the cross-sectional regression model. There could be some estimation problem in the method we employed here. For example, as the age distribution is comparatively slow moving, it is difficult to discriminate the other potential trends in the data. Also, some of the macro economic variables included in the regression could be also determined by the changes in the age structure and therefore could be leading to a simultaneity bias. However, this analysis could give an indication of how the age share affects the economic growth using the time series data of individual countries.

3. Age structural transition in South and Southeast Asia

Age structural transition is a constituent of comprehensive demographic transition frameworks, integrated with fertility and mortality transitions (Pool, 2000). As the age distribution of the population is determined by the past fertility and mortality, the age structural transition is a process in which a country changes its age structure of the population from broad young age groups to a stable age structure. During the transition, there could be a 'disordered cohort flows' due to combination of nature of fertility and mortality declines. This cohort flows will have varying implications in social, economic and health as they progress from young age to old age. Therefore, the age structural transition is not only to study the structural shift of the population over a period of time, it is also to understand the various implications due to shift in the age structure over the transition. In this section we will discuss about the nature of fertility and mortality transition as well as its effect on the age structural transition in South and Southeast Asian countries.

Fertility has declined in all the countries in South and Southeast Asia. However, the speed and onset of fertility decline was not uniform among these countries (see figure.1). The highest fertility decline was observed in Singapore followed by Thailand. Although both Singapore and Thailand had almost similar level of fertility in 1950-55 and 1990-95, the nature of fertility transition was not same (see figure 1). Between 1950 and 1995, Singapore total fertility rate has declined from 6.4 children per woman to 1.8 children, around 72 per cent declines in the span of 40 years. Similarly Thailand's fertility has declined from 6.6 children per woman in 1950-55 to 1.9 children per woman

in 1990-95 (a decline of 71 per cent). However, in the case of Singapore, fertility started declining from 1955-60 and it was rapid during 1960 to 1980 and reached the below replacement level in 1980s, and thereafter it was remain at the almost same level. In the case of Thailand, rapid fertility decline started only in 1965-70 and reached the below replacement level in 1990-95. Similarly, the fertility rate for Bangladesh and Malaysia were closer to Singapore and Thailand in 1950-55, however, it was significantly higher in 1990-95. Also, the pattern of fertility trend was not same between Malaysia and Bangladesh during the period of transition from high fertility to low fertility. The fertility rate in Malaysia started declining from 1955-60 till 1975-80 and remain at the same level during 1975-90, whereas in Bangladesh, it has increased during the period 1950-70 and started declining only after 1970s. Also, rapid fertility decline was observed in Bangladesh after 1980s. Fertility declined from 5.7 in 1950-55 to 2.2 in 1990-95 in Sri Lanka, however, the rate of decline was uniform during this period. Although, fertility rate in India in 1950-55 was lower than Bangladesh and Malaysia, it did not decline as rapid as these countries and therefore it is almost same as that of Bangladesh and Malaysia in 1990-95. Philippines recorded highest fertility in 1950-55 as well as in 1990-95 among the South and Southeast Asian countries. As observed, the nature and timing of fertility decline varied among the South and Southeast Asian countries. This is likely to have dissimilar age structural transition among the South and Southeast Asian countries.

The highest life expectancy at birth was observed in Singapore (76 years) followed by Sri Lanka (72 years) in 1990-95. The lowest was in Bangladesh (57years) followed by India (60 years). The life expectancy at birth is increased dramatically in all the countries between the period 1950-95 (see figure 2). The largest increase was observed in Indonesia (67 per cent) followed by India (56 per cent) as these countries where in the rank of lowest life expectancy at birth in the initial year 1950-55. Although Malaysia and Sri Lanka were a difference of 8 years in the life expectancy at birth in 1950-55, their difference in e0 was negligible in 1990-95 due to faster increase in life expectancy at birth in Malaysia. Also the gap in the life expectancy at birth has been narrowed down among the countries of South and Southeast Asia.

Figure 2a-2h gives age structural transition of the South and Southeast Asian countries from 1950-2050. Figure 3a-3h shows the trends in the dependency ratios

(young, youth, old and total) from 1950-2050 in the countries of South and Southeast Asia. The age group 25-64 has been used in the denominator for computing the dependency ratios. As the level of education is increasing in many countries, the population in the age group (15-24) most likely dependent on adults for their educational consumption. The youth dependency ratio between the age group 15-24 and 25-64 is also important for understanding the relative cohort size variation, which is likely to have implication on intergenerational conflicts. It is observed from the figures 2a-2h that patterns of age structural transitions are not uniform among the countries of South and Southeast Asia. As mentioned earlier, this could be due to variation in the process of mortality and fertility trends as well as initial age structure of the population in these countries. Among the Southeast Asian countries, Singapore, Thailand and Malaysia occupied a different pattern of the age structural transition. There is a disordered flow of age structural changes during the period between 1950-2050 in these countries. It was noted that young age population in Singapore has increased during the period between 1950 and 1965 and then declined till 1990, and thereafter it is likely to increase till 2005. This example shows that the decline in the school age population does not mean that growth of school age population will not go up again in the future. This disordered flow of young age population likely to have had and will have an implications in the investment and consumption on the health, nutrition and education. As the young age population declined from 1965, the total dependency ratios sharply declined from 1970, mostly contributed by the decline in the young dependency ratios (see figure 3e). This is a window of opportunity for development caused by fertility decline. During the period 1970-75 when the dependency ratio started declining sharply, the per capita GDP growth rate has increased from 9.87 percent in 1965-70 to 11.47 per cent in 1970-75 (see table 2). However, the per capita GDP growth rate has declined in the later periods 1975-80 (5.51 percent) and 1980-85 (3.98 percent), despite decline in the total dependency ratio. It is interesting to note that youth (15-24) dependency ratio is increased during the same period 1975-85. Once the youth dependency ratio started declining in 1985, the per capita GDP growth rate has gone up from 3.98 per cent in 1980-85 to 6.12 per cent in 1985-90. Singapore had a youth bulge during the period 1970-80 and likely will have another youth bulge during the period 2005-2020 (see figure 2e). Consequently the ratio of youth

to working age population increased between 1970 and 1980 (see figure 3e). The largest population size for the age group 25-49 is observed during the period 1995-2005. This will have implications for the labour market due to higher growth of population entering into labour market. If these people are productively employed, it is likely to have a positive impact on the economic growth. The population in the age group 50-64 likely to have huge bulge between the years 2005 and 2025, and thereafter the size of this age group declines. According to the life cycle theory, savings rate would be higher among this age group (50-64) and therefore, it is expected that Singapore likely to have a higher saving rate, if policies encourages savings, during the period 2005-2025 and consequently faster economic growth. Singapore can use this demographic opportunity of larger population size in the age group 50-64 during 2005-2025 to increase the saving rate and make use of this opportunity for economic growth. As the old age dependency ratio is sharply increasing from 2005 onwards and the size of the old age population will be larger in 2025, it is important to make use of the opportunity during 2005 to 2025 to increase the saving rate to meet the future old age burden. A real challenge for Singapore is to cope up with the old age burden after the year 2025, as the growth of workforce population will be declining whereas growth of old age population growing faster before it starts cessation. The disordered age structural transition in Singapore is likely to have various implications in the economy, society and public policies. Some of the implications like changes in the retirement age, immigration policy and health insurance have been extensively discussed in Shantakumar (2000).

In the case of Thailand, the share of young age population has increased till 1975 and then started declining before it cease to grow in 2005. Therefore, the young and total dependency ratios increased from 1960 and then started declining from 1975 onwards. The GDP per capita growth rate is increased during the period 1975-80 (5.14 per cent) compared to previous period 1970-75 (1.97 per cent) (see table 2). However, the per capita GDP growth rate has declined to 2.44 per cent during the period 1980-85. Nevertheless phenomenal increase in the GDP growth rate (7.42 per cent) was observed in the following period 1985-90. The lower GDP growth rate during 1980-85 was also coincidence with the higher youth dependency ratio compared to later period. It could be possible that increase in the youth dependency ratio is likely would have had an impact

on the economy during the period 1980-85. As the cost of higher education is higher than the primary education, a small increase in this age group of population will likely to have negative implications in the short run and positive implications in the long run. Specifically, the share of age group 15-24 (youth) is increased till 1990 and a huge bulge was observed between 1980 and 2000 and then the growth of youth population is ceases to grow. The share of the working age population (15-64) is increased from 1990 and this trend will continue till 2030. Although, old age population is likely to increase significantly after the year 2020, the old age dependency ratio will start increasing from the year 2000 onwards and will surpass the young dependency ratio in 2035. This means that there will be more old people per adult compared to children. It is important to note that window of opportunity is followed by turbulence as evidenced from increase in the dependency ratios in the future.

Similar to Singapore, the disordered flow of population, particularly among the young and youth are also observed in Malaysia. The size of the young age population is increased from 1950 to 2005 and will decline between 2005 and 2025 and remain stable thereafter. However, the total dependency ratio is declining from 1970 contributed by decline in the young population dependency ratio. This is a demographic bonus for economic growth. The per capita GDP growth rate has been increased from 4.28 percent in 1970-75 to 7.10 percent in 1975-80. However, there was a sharp decline in the GDP per capita growth rate in the following period 1980-85 (1.72 per cent) despite continues decline in the dependency ratios. Unlike Singapore and Thailand, the rate of decline in the dependency ratio is not so steep. Like young age group, similar pattern also observed for the age group 15-24, but with a time lag of 10 years. Also it is important to note that relative cohort size between youth and working age population is marginally higher during 1970-80. The size of the working age population and old age population is also likely to grow in the future and consequently old age dependency ratio will also be increased after 2010.

The smooth age structural transition is being observed in Indonesia. The size of the young age population is increased till 1975 and thereafter the growth of the population is ceases to grow. Similarly the youth population cease to grow after 1985. All other countries such as Philippines, Bangladesh, India and Thailand had uniform pattern

of age structural transition in the past with marginal disordered flows in the younger age groups. The dependency ratio is also declining from 1975 in Indonesia, Philippines, India and Sri Lanka and from 1985 in Bangladesh. According to World Bank estimates, the per capita GDP growth rate is increased from 1.65 percent during 1980-85 to 6.12 percent during 1985-90 in Indonesia (see table 2). The per capita GDP growth rate in Bangladesh, India and Sri Lanka has shown an increasing trend when the dependency ratio started declining. However, in the case of Philippines, the negative per capita GDP growth rate was observed during the period 1980-85 (–3.99 percent), although dependency ratio was declining during the same period. It is important to note that the per capita GDP growth rate was only 0.07 percent during the period 1990-95. It shows that Philippines did not make use of the demographic bonus for economic growth. In other words, this seems to indicate that decline in dependency ratios does not automatically leading to economic growth. In all the countries, the future total dependency ratios is likely to increase due to increase in the old age dependency ratios. This shows that window of opportunity is followed by a turbulence induced by the demographic transition.

The age structural transition in the South and Southeast Asian countries has shown that the school age population has declined in almost all the countries. This is a demographic opportunity to reach the universal primary education and quality of education. Countries with the better quality of primary education could be able to divert the expenditure to improve the quality in the secondary education (Jones, 2000). It was also noted that working age population is increasing in all the countries and therefore market should be created to provide employment to meet the demand for large labour force. The old age population is likely to increase in the future and policies should be made to meet the demands of the elderly.

4. Age structural transition and economic growth

Tables 1.1 to Table 1.8 show the estimated regression coefficients of age share of the population on the growth rate of per capita GDP controlling macroeconomic variables. The regression is carried out based on the annual time series data from 1950 to 1990. Table 1.9 shows the estimated regression coefficients from the cross-sectional analysis using panel data. Since the age shares are correlated and therefore leading to a

multi-collinearity problem, the age share variable has been entered separately. Model 1 to Model 5 in the tables shows effect of age share on the GDP per capita growth rate when the age share variables entered separately into the regression. It was observed from the tables that the openness has significant and positively associated with the GDP growth rate in the countries of Singapore, Indonesia. In the other countries such as Malaysia, Philippines and Sri Lanka, openness did not have a significant effect. In the case of Malaysia, the proportion of years the country was open is only 0.90 years, in Philippines it was 0.06 years and in Sri Lanka it was 0.20 years. There seems to be less variability of the variable openness in these countries, and therefore it did not have effect on the economic growth in these countries. The variable openness was not included for Thailand as it was an open economy in all the years during the period of analysis. The same variable was also not included for India and Bangladesh as these countries were closed economy during the period of analysis. The cross-sectional analysis using the panel data also showed that openness has a significant positive effect on the growth rate of GDP per capita.

Growth rate of investment has a positive effect on the GDP per capita growth rate in Malaysia, Indonesia, and Philippines. Also this variable was significant and positive in the cross-sectional analysis. The growth rate of net foreign balance is negatively associated with GDP per capita growth rate in India and Bangladesh. However, this variable is not significant in the cross-sectional panel data analysis. Growth rate of public consumption expenditure is negatively associated with the growth rate of per capita GDP in Singapore and Thailand, whereas it was positively associated in India and Bangladesh. The inflation rate is negatively associated with the per capita growth rate of GDP in Thailand, Indonesia, Philippines, Sri Lanka and India.

Among the macro economic variables, the openness, growth rate of investment has positive effect on the economic growth and growth rate of net foreign balance and inflation rate is negatively associated with the economic growth. It is interesting to note that growth rate of public consumption expenditure has a negative effect in Singapore and Thailand whereas it has a positive effect on the economic growth in India and Bangladesh.

The effect of age shares on the GDP per capita growth rate is not uniform among the countries of South and Southeast Asia. For instance, none of the age shares were significant in Indonesia, Sri Lanka, India and Bangladesh. However, age shares had influence on the economic growth in Singapore, Malaysia, Thailand and Philippines. The magnitude and direction of the effect of the population age share also varied among these countries. For example, contrary to our expectation, it was observed that share of the population in the age group 0-14 is significant and positively associated with GDP per capita growth rate in Singapore and Philippines, however, the magnitude of the effect were not same between the two countries. The positive effect of young population age share is contrary to the results obtained by Bloom and Williamson (1997) using cross sectional analysis. Bloom and Williamson (1997) found using the cross-sectional analysis of 78 countries covering all regions in the world that population age share under 15 is negative and significant on the economic growth. The population age share 25-49 is negatively associated with GDP per capita growth rate in Singapore, but it was not significant in other countries.

As hypothesised, the age share of the population 50-64 is positively associated with the economic growth in the countries of Malaysia, Thailand and Philippines. Similar findings were also observed in other studies. Lindh and Malmberg (1999) based on cross-sectional analysis from 5-year panel data of OECD countries found that the middle age share has positive influence on the economic growth. An analysis on the individual Scandinavian countries based on time series data also showed that middle age share (50-64) has positive effect on the economic growth (Andersson, 2000). However, it is interesting to note that positive impact of the age share 50-64 on the economic growth is always not true. For example, in our analysis, the age share of 50-64 is significant and negative on the per capita GDP growth rate in Singapore. The age share 65 and above has significant negative effect on the per capita GDP growth rate in Singapore. Interestingly, and contrary to our expectation, the age share 65 and above has a positive effect on the economic growth in Philippines. Similar finding is also observed by Bloom and Williamson (1997) in the cross sectional analysis. It seems that in Philippines, old age population are making a significant economic contribution. From the above results, this

gives an indication that direction of effect of age share variable is seems to be not uniform across countries and likely to be determined by the contextual factors.

5. Conclusions

From the foregoing analysis, it was found that the age structural transition is not uniform among the countries of South and Southeast Asia. The differences in the age structural transition is due to variation in the nature of fertility and mortality decline in these countries. The future share of population in the age group 50-64, where the saving rate would be higher among them, is likely to increase in all the countries of South and Southeast Asia. The decline in the share of population in the age group 50-64 and significant increase in the population 65 above after 2025 in Singapore will have implications in the growth of economy in the future. As regards the relationship between age structural transition and economic growth, we have found that the effect of age structure on the growth is not same in all the countries. In all the countries of South and Southeast Asia, the dependency ratio has declined. We have found that the decline in the dependency ratio is also associated with the increase in the per capita GDP growth rate in many countries. However, the economic growth is not sustained in the later years, despite the decline in the dependency ratios. It seems that decline in the dependency ratios and its influence on the economic growth is conditioned by the institutional factors in the country. Previous studies based on cross-sectional studies from panel data in OECD and Scandinavian countries showed age share effect on the economic growth. Similar cross-sectional analysis from panel data in the South and Southeast Asian countries did not show significant effect of age share variables on the economic growth. Moreover, analysis carried out on the individual country showed that the effect of age shares on the economic growth varied in both direction and magnitude. This is an indication that influence of age share on the economic growth is conditioned by the contextual factors. For example, the differences in the educational transition among these countries could also influence the relationship between age share and economic growth. Lutz and Sanderson (2000) argued that age structure and education independently and jointly play an important role in economic growth. We have not made an attempt to control or include

changes in the educational level during the period of analysis in our model. Nevertheless, we may conclude that population dynamics matter for economic development but likely to be conditioned by the institutional factors.

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Table 1. Some indicators for South and Southeast Asian Countries

Countries	GDP per capita growth rate (%) 1990-95	Total fertility rate (per women) 1990-95	Life expectancy at birth (years) 1990-95	Openness 1960-90	Tropics	Institutional quality index, 1980
Indonesia	6.12	2.9	62.6	0.63	1	3.67
Malaysia	5.00	3.6	70.7	0.90	1	6.90
Philippines	2.96	4.0	66.3	0.06	1	2.97
Thailand	9.26	1.9	68.8	1.00	1	6.26
Singapore	7.39	1.8	75.6	0.83	1	8.56
Bangladesh	2.62	3.4	55.6	0.00	0.1	2.74
India	4.92	3.6	60.3	0.00	0.5	5.76
Sri Lanka	2.80	2.2	71.7	0.20	1	4.32

Source: Word Bank (1998), United Nations (2000), Sachs and Warner (1995, 1997).

Table 2 Trends in Per capita GDP growth rate in South and Southeast Asian Countries, 1950-95

Period	Indonesia		Malaysia		Philippines		Thailand		Singapore		Bangladesh		India		Sri Lanka	
	PWT	WB	PWT	WB	PWT	WB	PWT	WB	PWT	WB	PWT	WB	PWT	WB	PWT	WB
1950-55	N.A		N.A		5.07		-3.86		N.A		N.A		2.82		1.66	
1955-60	N.A		2.05		2.50		5.78		N.A		N.A		2.76		2.24	
1960-65	-1.22		3.34		1.85		3.75		2.53		4.04		-0.24		-1.23	
1965-70	3.41		5.15		2.44		5.96		9.87		2.33		1.05		1.03	
1970-75	5.79		4.28		2.92		1.97		11.47		-5.95		0.40		0.70	
1975-80	5.89		7.10		2.94		5.14		5.51		2.47		1.53		4.83	
1980-85	5.06	1.65	1.72	0.29	-3.99	-5.77	2.44	1.36	3.98	2.28	2.28	1.09	3.49	1.15	4.48	2.23
1985-90	3.59	6.12	4.21	5.00	2.66	2.96	7.42	9.26	6.12	7.39	2.67	2.62	3.68	4.92	0.49	2.80
1990-95	N.A	5.95	N.A	6.17	N.A	0.07	N.A	7.00	N.A	6.50	N.A	2.85	N.A	3.54	N.A	3.72

PWT- Penn World Tables; WB- World bank

Source: Penn World Tables (1995) and World Bank (1998)

Table 3.1 Estimated regression coefficient: Indonesia
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.122	0.437	-0.622	0.243	0.163
	(0.301)	(0.598)	(0.847)	(0.287)	(0.170)
GR of investment	0.186	0.190	0.188	0.188	0.187
	(5.23)	(5.235)	(5.436)	(5.26)	(5.213)
GR of net foreign balance	-0.239	0.0004	0.0015	-0.133	-0.191
	(0.031)	(0.061)	(0.197)	(0.017)	(0.024)
GR of public consumption expenditure	0.0321	0.0391	0.0354	0.0343	0.0336
	(0.78)	(0.905)	(0.902)	(0.846)	(0.802)
Inflation rate	0.054	0.0634	0.0598	0.0572	0.0562
	(1.356)	(1.447)	(1.574)	(1.454)	(1.35)
Openness	0.0456	0.0407	0.0358	0.0447	0.0452
	(4.429)	(2.506)	(2.975)	(4.474)	(3.731)
GR of population	0.0251	0.124	-0.078	0.0881	0.0738
	(0.347)	(0.758)	(0.471)	(0.491)	(0.381)
Log age share 0-14	0.0617	-----	-----	-----	-----
	(0.347)				
Log age share 15-24	----	0.0645	------	-----	-----
		(0.315)			
Log age share 25-49	-----	-----	-0.339	-----	-----
			(1.241)		
Log age share 50-64	-----	-----	----	0.038	-----
				(0.023)	
Log age share 65+	-----	----	----	-----	-0.0954
					(0.068)
R square	0.69	0.69	0.71	0.69	0.69
D.W statistic	1.96	1.95	1.98	1.96	1.96
F Value	7.71	7.70	8.37	7.65	7.66

Table 3.2 Estimated regression coefficient: Malaysia
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-0.445	-0.654	-0.492	0.529	-0.965
	(0.631)	(0.743)	(0.687)	(0.655)	(1.056)
GR of investment	0.291	0.290	0.290	0.268	0.289
	(5.045)	(5.041)	(5.037)	(4.866)	(5.084)
GR of net foreign balance	0.0018	0.001893	0.0018	0.0018	0.0017
	(0.734)	(0.744)-	(0.73)	(0.754)	(0.688)
GR of public consumption expenditure	-0.123	0.108	-0.131	-0.4859	-0.114
	(0.894)	(0.815)-	(0.93)	(0.381)	(0.872)
Inflation rate	-0.255	0.902	-0.003	0.0567	-0.0195
	(0.205)	(0.078)	(0.261)	(0.501)	(0.169)
Openness	0.0229	0.0232	0.0226	0.0038	0.1295
	(0.992)	(1.00)	(0.986)	(0.166)	(0.528)
GR of population	-0.192	-0.228	-0.175	-0.347	0.0096
	(0.675)	(0.740)	(0.628)	(1.263)	(0.911)
Log age share 0-14	0.0385	-----	-----	----	-----
	(0.397)				
Log age share 15-24	-------	-0.0516	-----	------	------
		(0.433)			
Log age share 25-49	-----	-----	-0.430	-----	-----
			(0.476)		
Log age share 50-64	------	-----	-----	0.539	-----
				(2.037)	
Log age share 65+	------	-----	-----	-----	-0.0962
					(0.911)
R square	0.59	0.59	0.59	0.64	0.60
D.W statistic	2.013	2.009	2.016	2.158	2.03
F Value	5.77	5.781	5.794	7.155	6.00

Figures in brackets are absolute t values

Table 3.3. Estimated regression coefficient: Philippines
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-0.768	-0.884	-0.603	0.292	0.534
	(2.281)	(2.269)	(0.909)	(0.815)	(1.600)
GR of investment	0.161	0.202	0.186	0.201	0.208
	(4.115)	(5.187)	(4.087)	(4.673)	(5.17)
GR of net foreign balance	0.0003	0.0007	0.0006	0.0009	0.0006
	(0.14)	(0.301)	(0.200)	(0.329)	(0.229)
GR of public consumption expenditure	0.0755	0.209	0.153	0.248	0.222
	(0.628)	(1.73)	(1.12)	(1.74)	(1.781)
Inflation rate	-0.0673	-0.054	-0.063	-0.0573	-0.057
	(1.96)	(1.536)	(1.60)	(1.468)	(1.586)
Openness	0.0115	-0.0327	-0.014	-0.0308	-0.047
	(0.612)	(2.007)	(0.667)	(1.69)	(2.55)
GR of population	-0.580	-0.175	-0.142	-0.0604	0.0103
	(3.04)	(1.507)	(0.804)	(0.502)	(0.098)
Log age share 0-14	0.846	----	----	----	---
	(3.535)				
Log age share 15-24	----	-0.279	----	----	----
		(3.106)			
Log age share 25-49	----	----	-0.193	----	----
			(1.026)		
Log age share 50-64	----	-----	----	0.162	---
				(1.36)	
Log age share 65+	----	-----	----	----	0.139
					(2.702)
R square	0.58	0.56	0.45	0.46	0.53
D.W statistic	1.30	1.32	0.999	1.10	1.308
F Value	6.80	6.08	3.93	4.13	5.496

Table 3.4. Estimated regression coefficient: Thailand
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.214	-0.655	0.199	1.545	1.463
	(0.458)	(1.139)	(0.314)	(1.74)	(1.468)
GR of investment	0.0807	0.0749	0.0795	0.067	0.0919
	(1.14)	(1.077)	(1.09)	(0.984)	(1.347)
GR of net foreign balance	0.0017	0.0014	0.0017	0.0007	0.0010
	(0.642)	(0.550)	(0.662)	(0.294)	(0.403)
GR of public consumption expenditure	-0.230	-0.277	-0.243	-0.180	-0.206
	(1.989)	(2.67)	(2.164)	(1.652)	(1.928)
Inflation rate	-0.258	-0.251	-0.255	-0.237	-0.262
	(2.219)	(2.186)	(2.186)	(2.111)	(2.308)
Openness	----	----	---	----	----
GR of population	0.100	-0.157	0.030	0.264	0.287
	(0.429)	(1.130)	(0.188)	(1.515)	(1.327)
Log age share 0-14	-0.094	---	----	----	----
	(0.543)				
Log age share 15-24	---	-0.175	----	----	----
		(1.187)			
Log age share 25-49	---	----	0.066	-----	-----
			(0.355)		
Log age share 50-64	----	---	---	0.315	-----
				(1.801)	
Log age share 65+	----	----	----	----	0.199
					(1.513)
R square	0.30	0.32	0.30	0.36	0.34
D.W statistic	1.82	1.90	1.82	1.92	1.92
F Value	2.55	2.81	2.51	3.25	3.03

Figures in brackets are absolute t values

Table 3.5 Estimated regression coefficient: Singapore
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.3360	-0.3150	0.147	-0.672	-0.296
	(0.82)	(0.54)	(0.376)	(1.636)	(0.804)
GR of investment	0.0584	0.1130	0.0661	0.0487	0.0407
	(0.70)	(1.14)	(0.437)	(0.561)	(0.48)
GR of net foreign balance	0.0072	0.0041	0.00717	0.008	0.0072
	(0.60)	(0.28)	(0.603)	(0.657)	(0.62)
GR of public consumption expenditure	-0.1860	-0.1440	-0.188	-0.166	-0.179
	(1.505)	(0.974)	(1.516)	(1.313)	(1.473)
Inflation rate	0.0057	0.0382	0.050	0.113	0.081
	(0.45)	(0.247)	(0.397)	(0.851)	(0.64)
Openness	0.0971	0.0429	0.0844	0.123	0.122
	(2.998)	(1.255)	(2.739)	(3.143)	(3.398)
GR of population	0.0083	-0.113	0.126	0.149	0.0511
	(0.54)	(0.58)	(0.781)	(0.881)	(0.34)
Log age share 0-14	0.118	----	-----	------	-----
	(3.316)				
Log age share 15-24	-----	-0.0248	-----	-----	------
		(0.25)			
Log age share 25-49	-----	-----	-0.159	-----	-----
			(3.250)		
Log age share 50-64	-----	-----	-----	-0.430	-----
				(3.035)	
Log age share 65+	-----	----	------	-----	-0.120
					(3.3465)
R square	0.48	0.25	0.48	0.46	0.50
D.W statistic	2.17	1.14	2.13	2.11	2.239
F Value	3.21	1.65	3.13	2.874	3.406

Table 3.6. Estimated regression coefficient: Bangladesh
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-0.181	0.905	-0.537	-0.173	-0.460
	(0.328)	(0.867)	(0.764)	(0.339)	(0.737)
GR of investment	-0.0163	-0.0305	-0.0173	-0.0195	-0.1561
	(0.401)	(0.754)	(0.429)	(0.487)	(0.385)
GR of net foreign balance	-0.0124	-0.0126	-0.0122	-0.0121	-0.1219
	(1.567)	(1.667)	(1.556)	(1.557)	(1.546)
GR of public consumption expenditure	0.540	0.532	0.542	0.544	0.548
	(5.579)	(5.884)	(5.723)	(5.823)	(5.606)
Inflation rate	0.0411	-0.0283	-0.038	-0.0365	-0.0421
	(0.716)	(0.497)	(0.669)	(0.640)	(0.736)
Openness	-----	------	------	------	-----
GR of population	-0.102	0.126	-0.120	0.0034	0.0674
	(0.518)	(0.484)	(0.602)	(0.015)	(0.192)
Log age share 0-14	0.105	-----	-----	----	-----
	(0.336)				
Log age share 15-24	-----	0.341	-----	----	-----
		(1.259)			
Log age share 25-49	-----	----	-0.165	-----	-----
			(0.579)		
Log age share 50-64	-----	----	----	-0.0705	-----
				(0.819)	
Log age share 65+	-----	----	----	----	-0.188
					(0.563)
R square	0.67	0.68	0.67	0.67	0.67
D.W statistic	2.33	2.43	2.37	2.40	2.36
F Value	8.31	9.03	8.416	8.58	8.41

Figures in brackets are absolute t values

Table 3.7 Estimated regression coefficient: India
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.959	1.946	0.148	1.064	0.804
	(0.828)	(1.184)	(0.125)	(0.793)	(0.696)
GR of investment	-0.0014	0.00426	-0.0082	-0.000	-0.0002
	(0.023)	(0.069)	(0.129)	(0.001)	(0.004)
GR of net foreign balance	-3.788	-3.376	-3.887	-3.905	-3.918
	(1.854)	(1.655)	(1.902)	(1.931)	(1.937)
GR of public consumption expenditure	0.291	0.275	0.290	0.298	0.298
	(4.603)	(4.295)	(4.512)	(4.637)	(4.634)
Inflation rate	-0.173	-0.179	-0.188	-0.181	-0.181
	(2.034)	(2.132)	(2.182)	(2.123)	(2.126)
Openness	-----	-----	-----	-----	-----
GR of population	0.462	0.522	0.0721	0.220	0.223
	(0.922)	(1.055)	(0.189)	(0.793)	(0.696)
Log age share 0-14	-0.288	-----	-----	-----	----
	(1.065)				
Log age share 15-24	---	0.333	-----	-----	----
		(1.26)			
Log age share 25-49	----	-----	-0.044	-----	-----
			(0.139)		
Log age share 50-64	----	-----	-----	0.196	-----
				(0.862)	
Log age share 65+	----	-----	-----	---	0.062
					(0.849)
R square	0.45	0.37	0.44	0.45	0.45
D.W statistic	2.25	2.26	2.22	2.26	2.26
F Value	4.83	4.97	4.50	4.73	4.72

Table 3.8 Estimated regression coefficient: Sri Lanka
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-0.0432	0.419	-0.211	0.543	-0.113
	(0.092)	(0.549)	(0.270)	(0.402)	(0.114)
GR of investment	-0.051	-0.0666	-0.0547	-0.0506	-0.0533
	(1.016)	(1.295)	(1.038)	(1.021)	(1.069)
GR of net foreign balance	0.0006	0.00174	0.0103	0.0005	0.0008
	(0.143)	(0.428)	(0.236)	(0.133)	(0.216)
GR of public consumption expenditure	-0.0757	-0.0569	-0.067	-0.0756	-0.070
	(1.033)	(0.805)	(0.866)	(1.067)	(0.956)
Inflation rate	-0.175	-0.128	-0.164	-0.179	-0.168
	(1.831)	(1.244)	(1.562)	(1.892)	(1.774)
Openness	0.0103	-0.0003	0.0132	0.0136	0.0126
	(0.629)	(0.015)	(0.91)	(0.967)	(0.807)
GR of population	-0.00001	0.0218	-0.078	0.067	-0.057
	(0.00)	(0.151)	(0.417)	(0.25)	(0.266)
Log age share 0-14	-0.0602	----	----	---	----
	(0.315)				
Log age share 15-24	----	0.208	----	-----	----
		(0.811)			
Log age share 25-49	----	----	-0.0131	----	----
			(0.053)		
Log age share 50-64	----	----	-----	0.142	----
				(0.537)	
Log age share 65+	----	----	----	----	0.082
					(0.060)
R square	0.26	0.27	0.26	0.26	0.26
D.W statistic	2.77	2.81	2.78	2.76	2.78
F Value	1.60	1.70	1.58	1.60	1.58

Figures in brackets are absolute t values

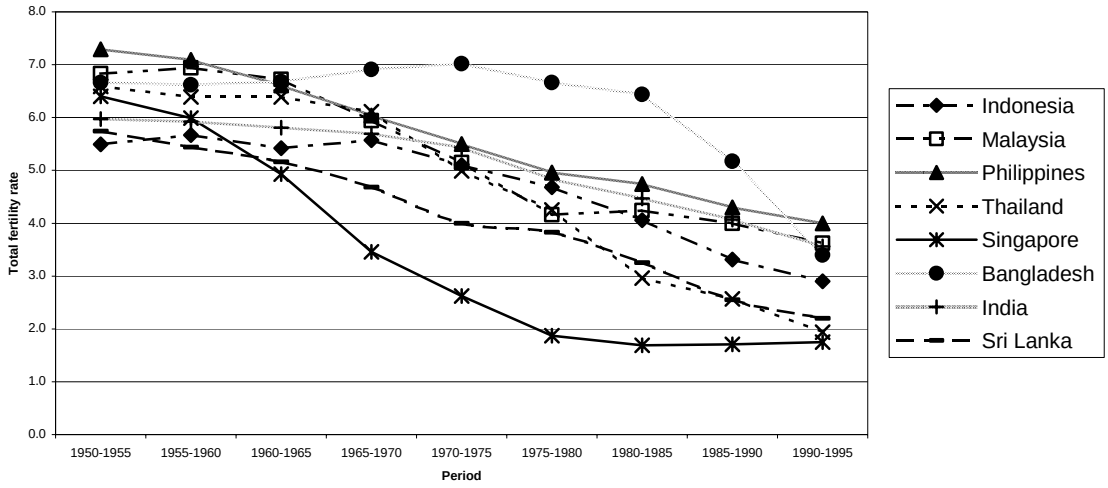
Table 3.9. Estimated regression coefficient: Cross-sectional analysis
Dependent Variable- Growth rate of per capita GDP

Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-0.300	-0.240	-0.383	-0.240	-0.396
	(1.81)	(1.04)	(1.985)	(1.059)	(1.726)
GR of investment	0.175	0.184	0.179	0.180	0.170
	(2.835)	(2.873)	(2.955)	(2.943)	(2.735)
GR of net foreign balance	-0.0004	-0.0003	-0.0004	-0.0003	-0.0004
	(0.359)	(0.264)	(0.355)	(0.288)	(0.402)
GR of public consumption expenditure	0.143	0.146	0.141	0.145	0.134
	(1.552)	(1.585)	(1.55)	(1.574)	(1.439)
Inflation rate	-0.010	-0.004	-0.007	-0.0073	-0.0168
	(0.139)	(0.056)	(0.101)	(0.106)	(0.684)
Openness	0.0370	0.037	0.0356	0.0375	0.0382
	(3.95)	(3.85)	(3.805)	(3.929)	(4.04)
Institutional quality	0.0018	0.0014	0.0023	0.0187	0.0168
	(0.691)	(0.578)	(0.894)	(0.439)	(0.684)
Tropical	-0.0141	-0.0149	-0.0129	-0.0133	-0.176
	(1.05)	(1.066)	(0.964)	(0.933)	(1.237)
Initial GDP (1960)	0.0073	0.0069	0.0056	-0.007	-0.008
	(0.574)	(0.536)	(0.439)	(0.577)	(0.605)
GR of population	-0.105	-0.086	-0.115	-0.085	-0.114
	(1.736)	(1.46)	(2.012)	(1.427)	(1.889)
Log age share 0-14	0.0141	---	---	---	---
	(0.427)				
Log age share 15-24	----	0.010	----	----	---
		(0.199)			
Log age share 25-49	----	----	-0.0404	----	---
			(0.926)		
Log age share 50-64	----	---	----	0.0076	---
				(0.206)	
Log age share 65+	----	----	----	----	-0.0177
					(0.715)
R square	0.61	0.61	0.62	0.61	0.61
D.W statistic	2.17	2.16	2.20	2.16	2.19
F Value	5.60	5.56	5.77	5.57	5.68
N	47	47	47	47	47

Figures in brackets are absolute t values

Figure 1. Fertility and mortality trends in South and Southeast Asia

a. Trends in TFR in the South and Southeast Asian Countries



b. Trends in Life expectancy at birth in the South and Southeast Asian countries

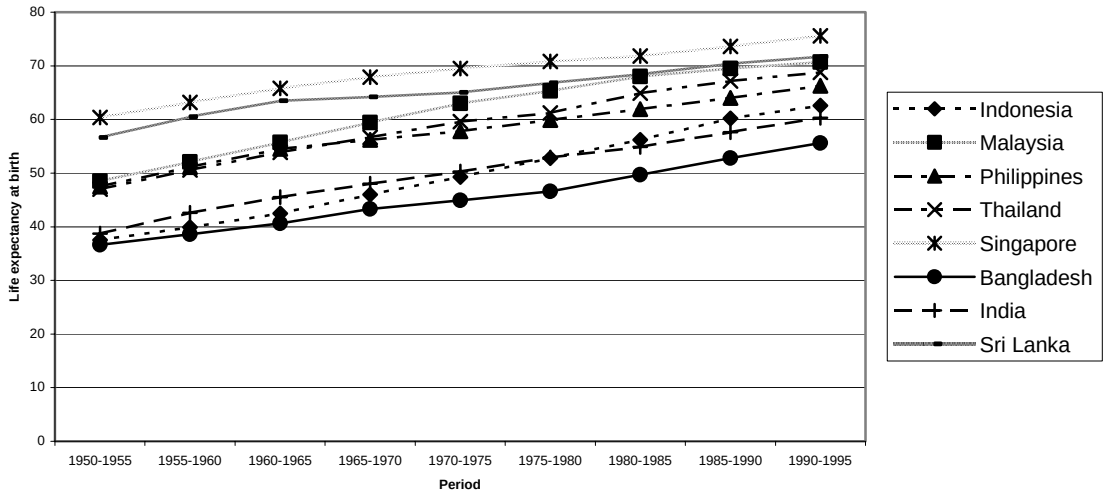
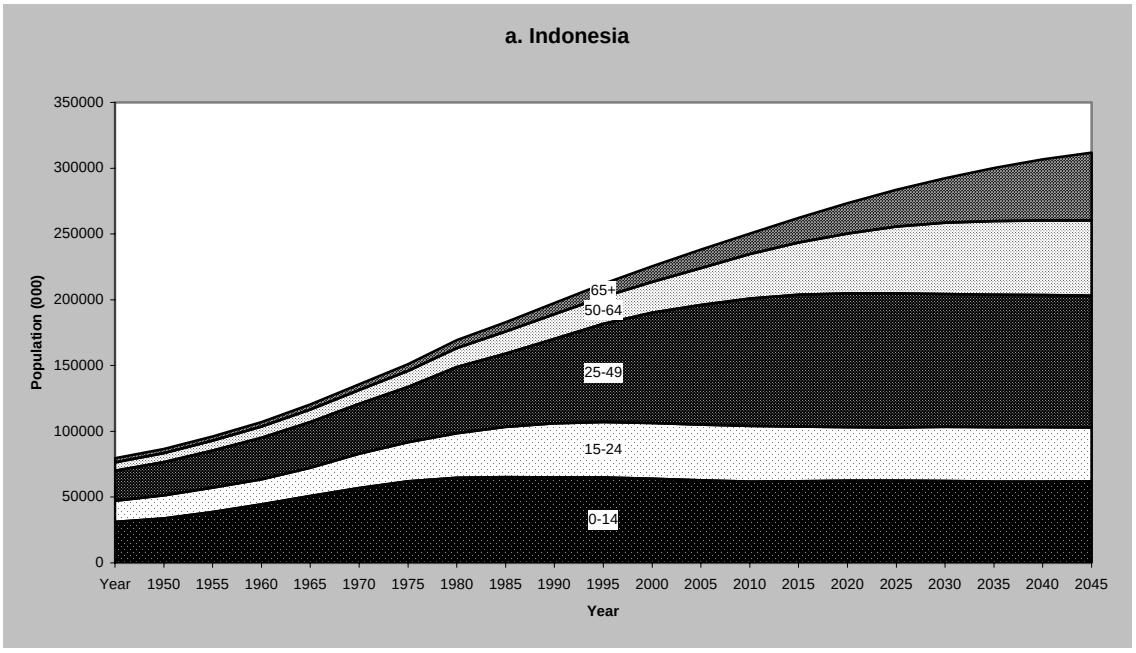
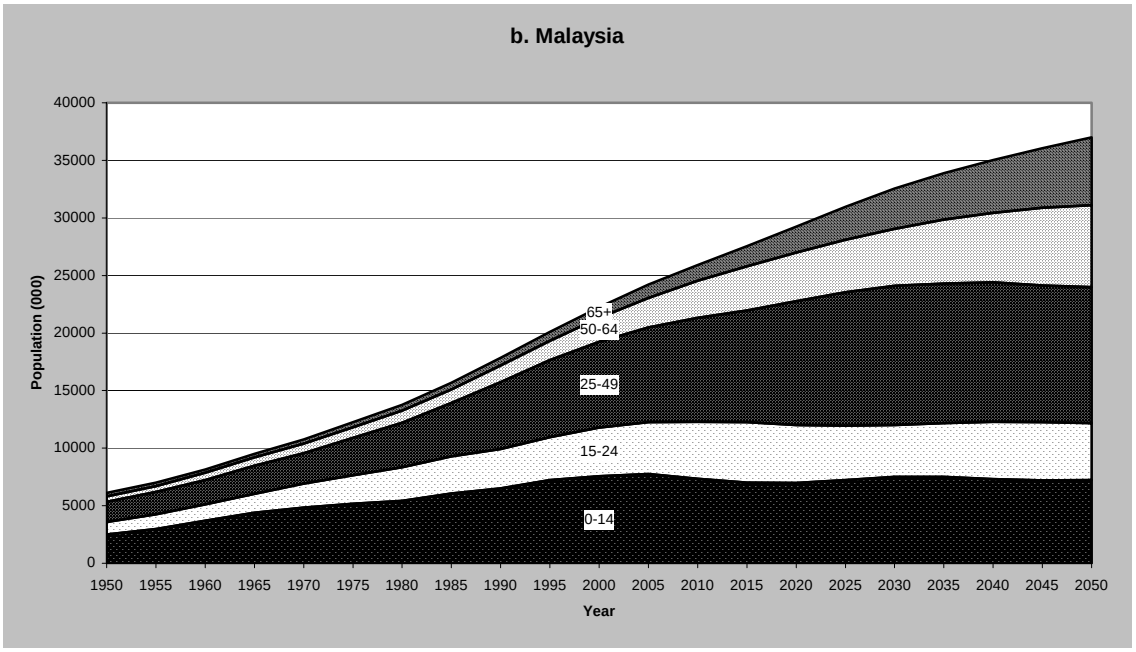
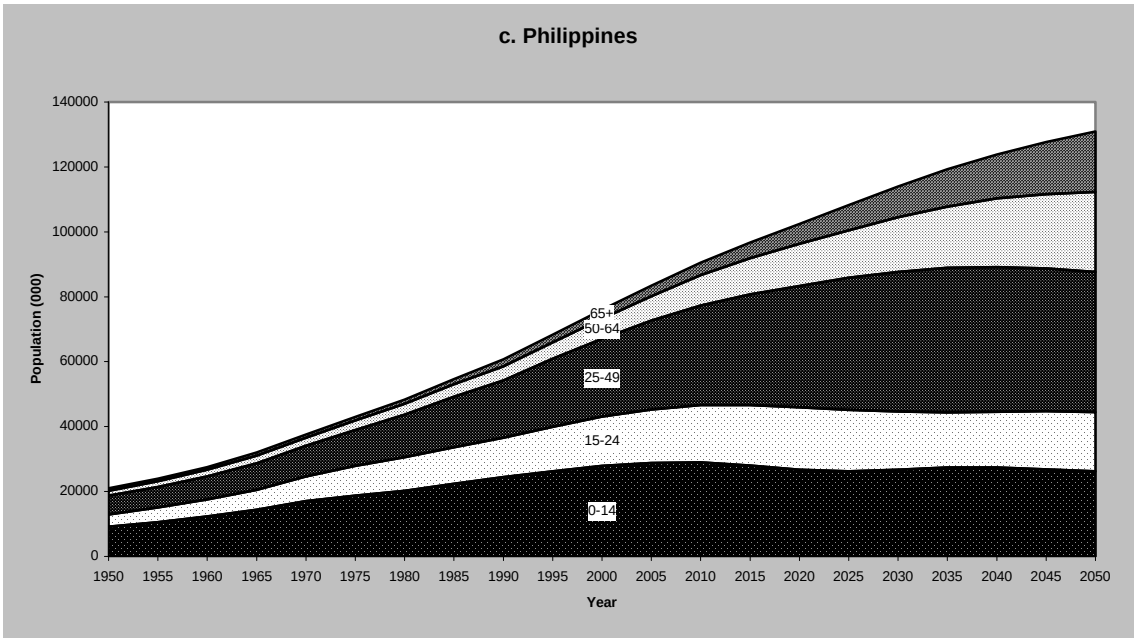


Figure 2. Age Structural Transitions in South and Southeast Asia






c. Philippines
140000
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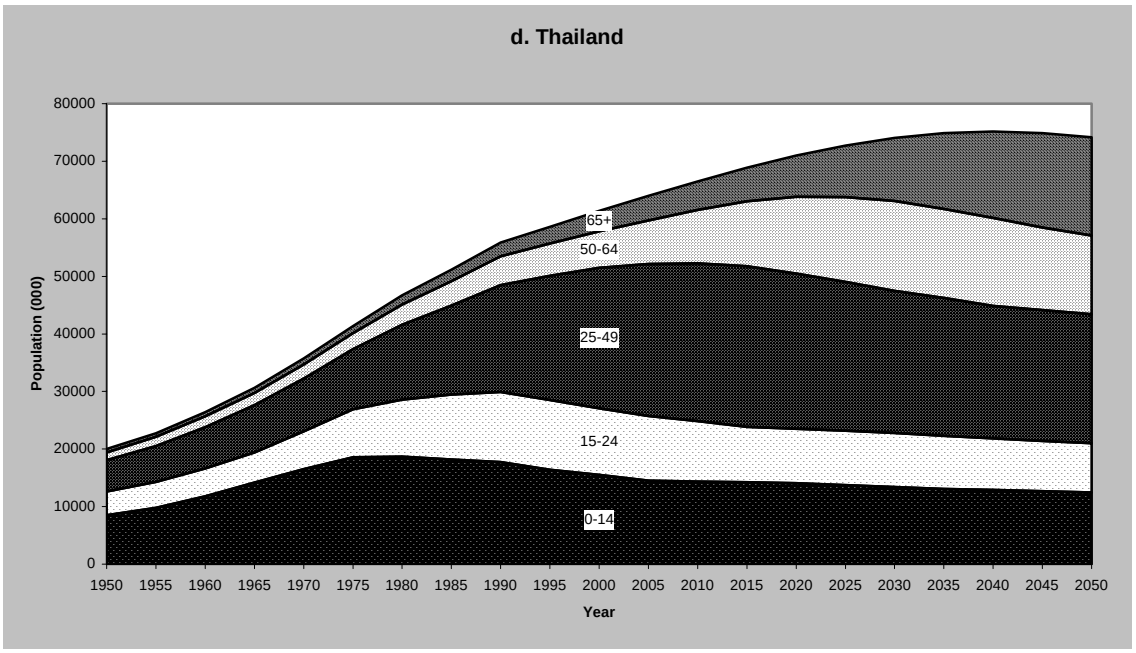
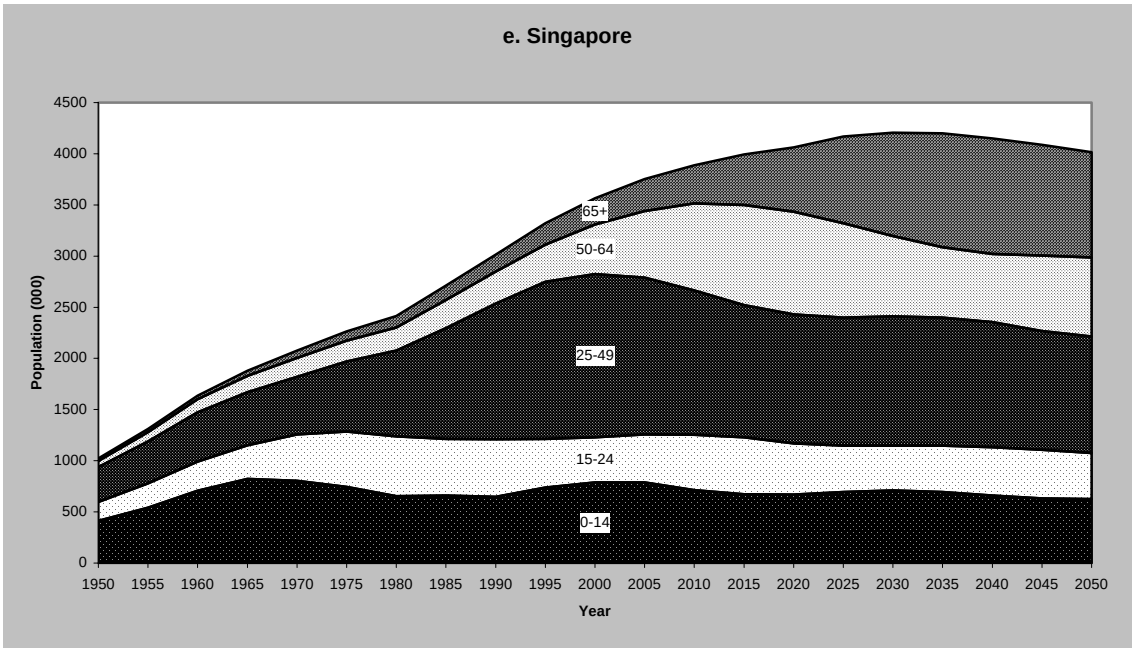
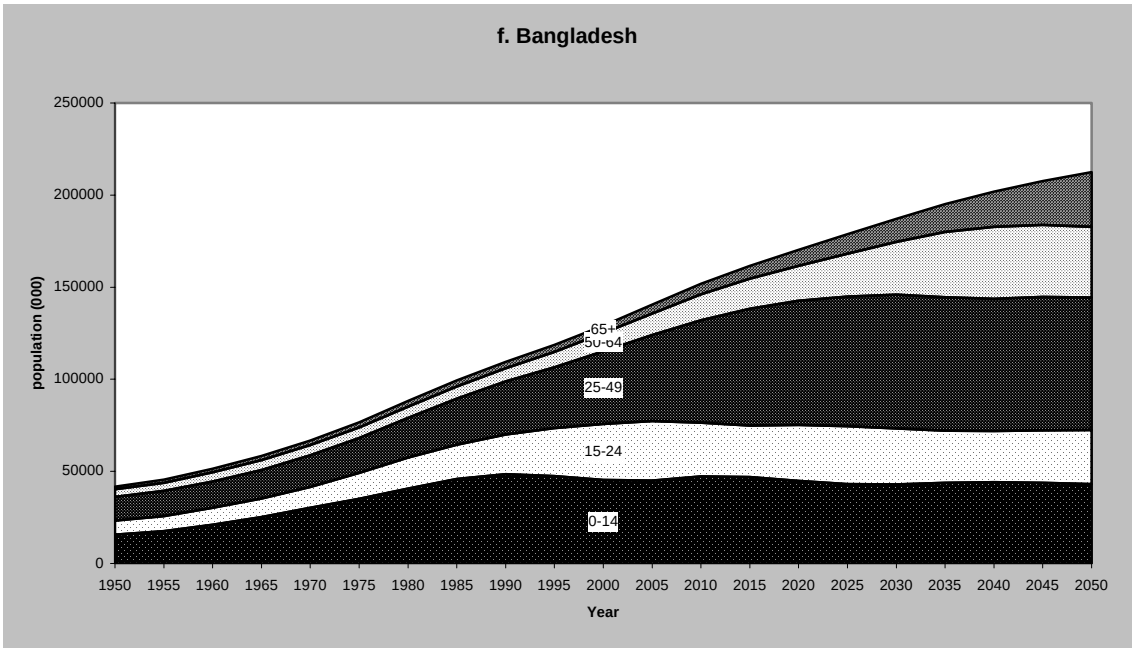
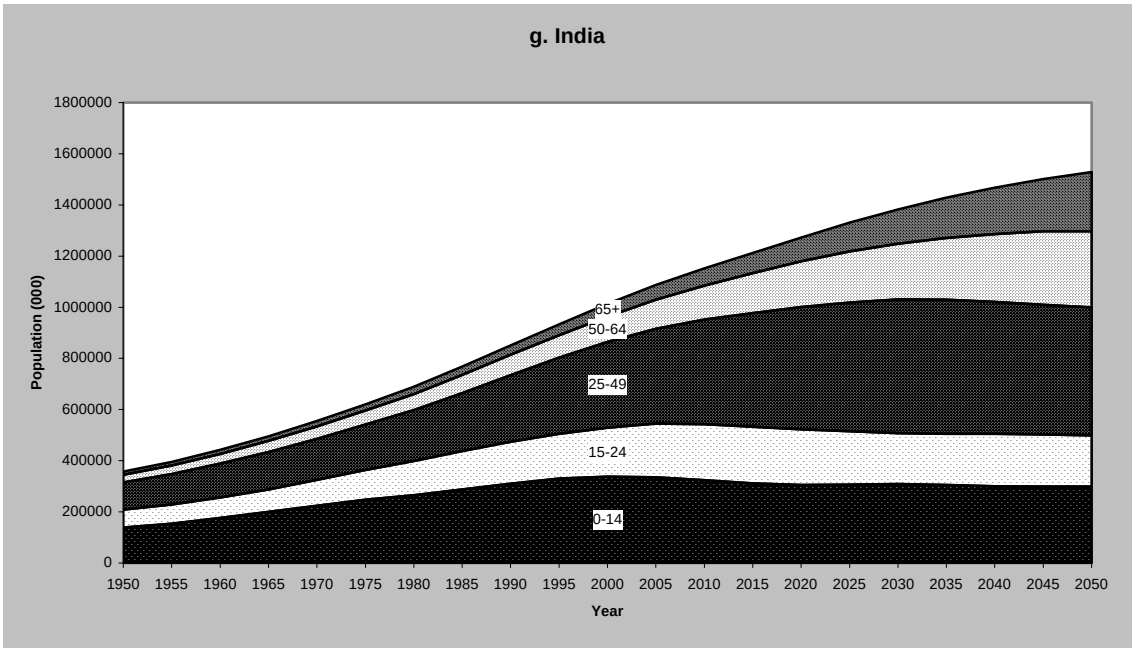
Population (000)
65+
50-64
25-49
15-24
0-14
1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050
Year


d. Thailand
80000
70000
60000
50000
40000
30000
20000
10000
0
Population (000)
65+
50-64
25-49
15-24
0-14
1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050
Year


e. Singapore
Population (000)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
65+
50-64
25-49
15-24
0-14
1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050
Year


f. Bangladesh
population (000)
250000
200000
150000
100000
50000
0
65+
50-64
25-49
15-24
0-14
1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050
Year


g. India
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
Population (000)
65+
50-64
25-49
15-24
0-14
1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050
Year

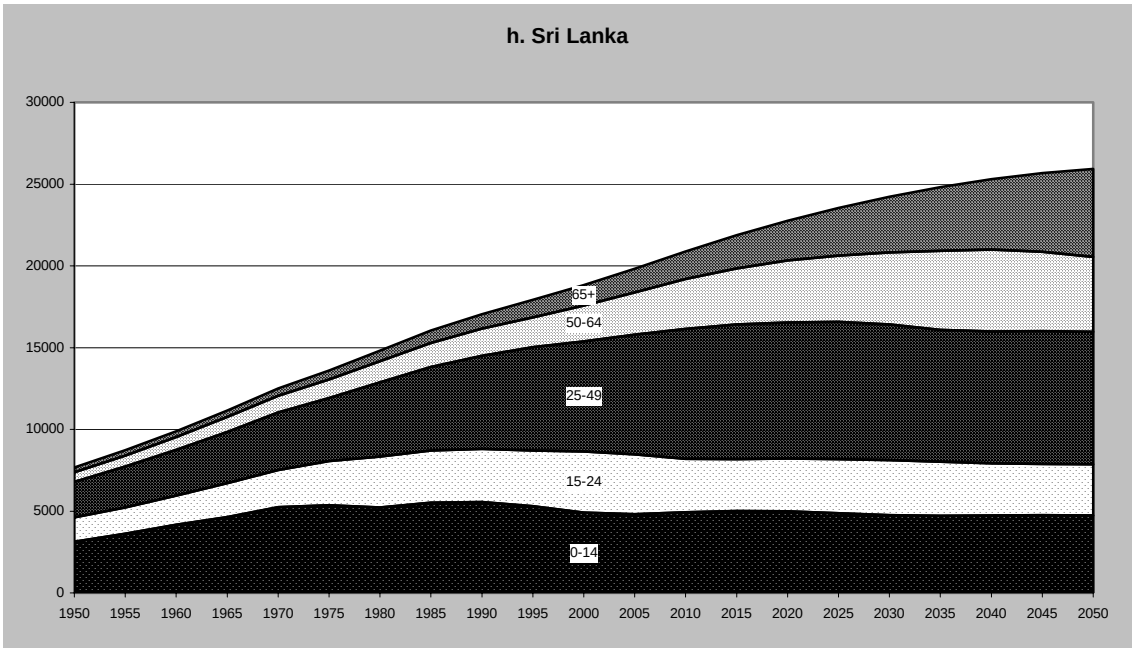
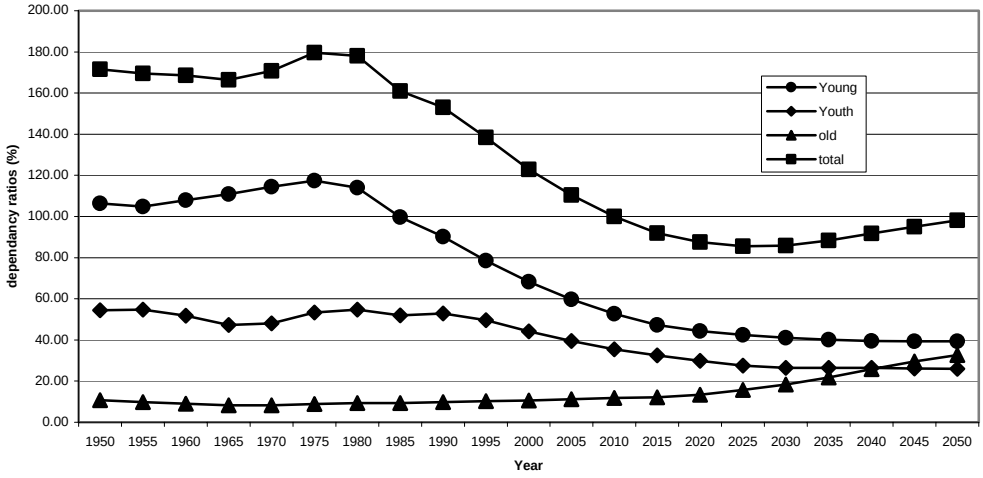
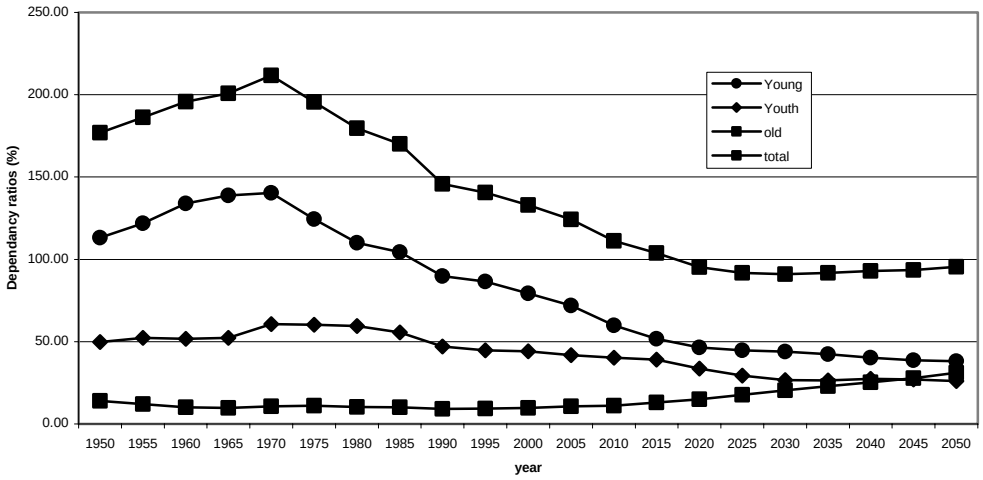

h. Sri Lanka
30000
25000
20000
15000
10000
5000
0
65+
50-64
25-49
15-24
0-14
1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050

Figure 3. Trends in the dependency rations in the South and Southeast Asian Countries

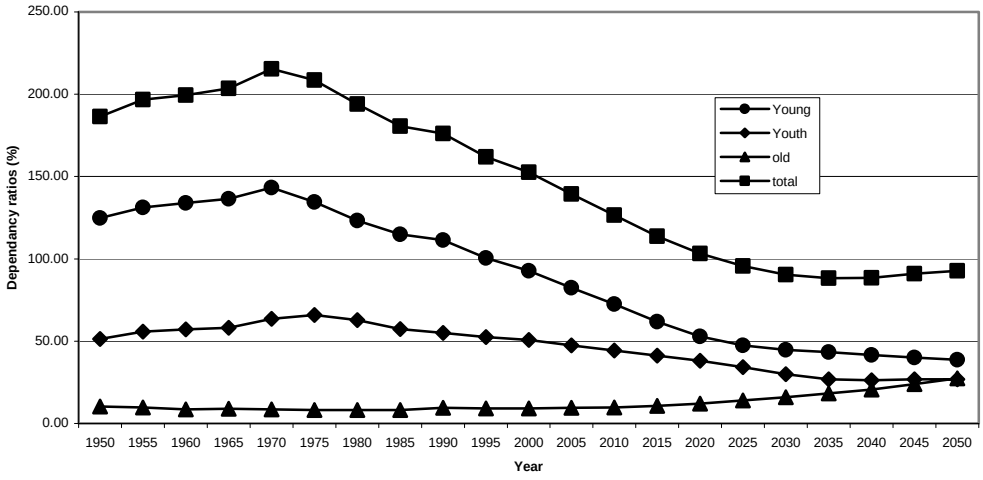
a. Trends in dependancy ratios, 1950-2050, Indonesia



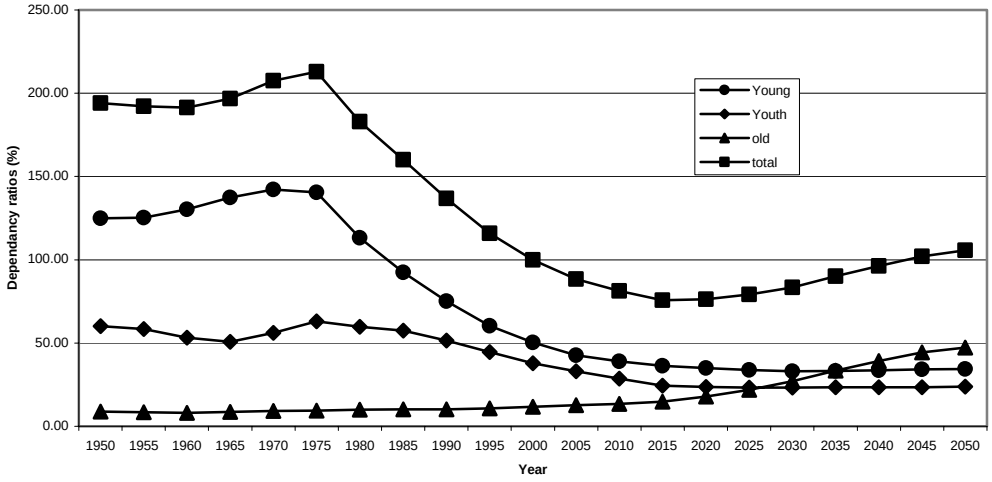
b. Trends in dependancy ratios, 1950-2050, Malaysia



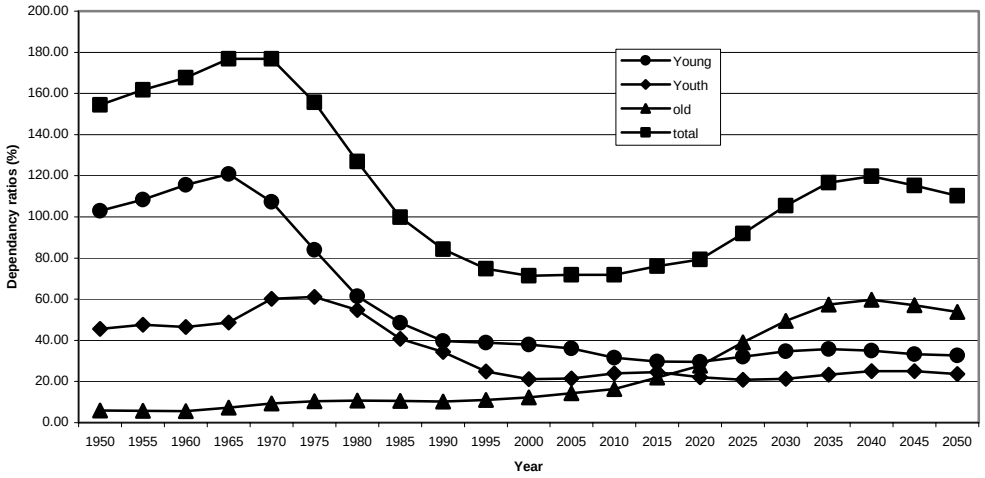
c. Trends in dependancy ratios, 1950-2050, Philippines



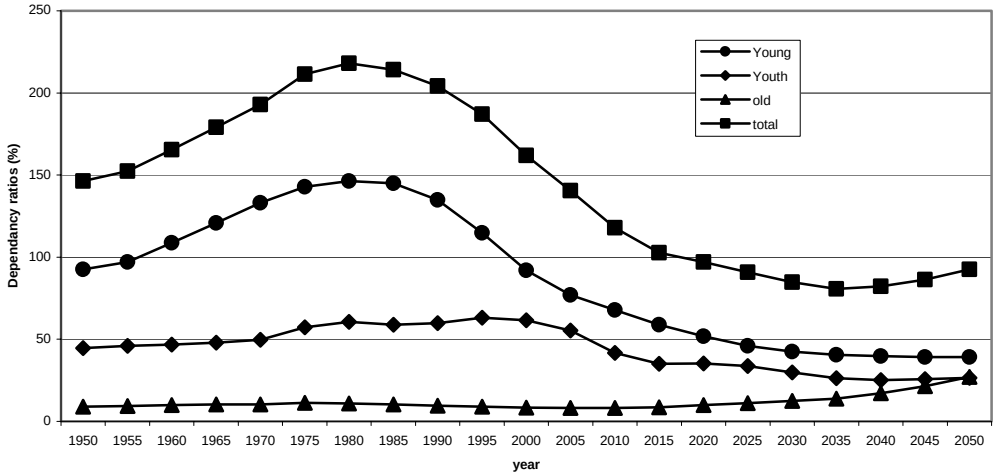
d. Trends in dependancy ratios, 1950-2050, Thailand



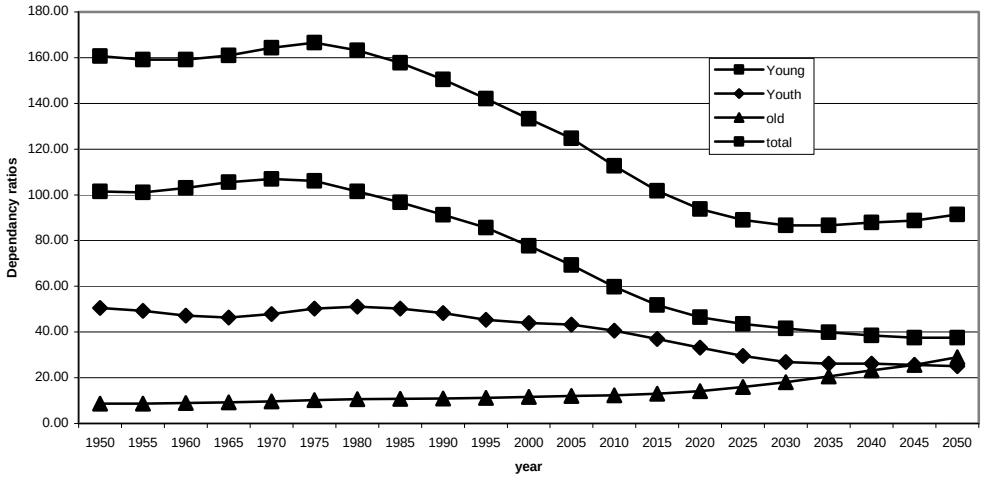
e. Trends in dependancy ratios, 1950-2050, Singapore



f. Trends in dependancy ratios, 1950-2050, Bangladesh



g. Trends in dependancy ratios, 1950-2050, India



h. Trends in dependancy ratios, 1950-2050, Sri Lanka