Population Studies Center

Research Report

Comparative Study of Elderly in Asia

Albert I. Hermalin, Mary Beth Ofstedal,
and Rebbeca Tesfai

Future Characteristics of the Elderly in Developing Countries and Their Implications for Policy

Report 06-62
May 2006

Population Studies Center
University of Michigan
Institute for Social Research

Future Characteristics of the Elderly in Developing Countries and Their Implications for Policy

Albert I. Hermalin, Mary Beth Ofstedal
Population Studies Center
University of Michigan

Rebbeca Tesfai
Health Management and Policy
School of Public Health
University of Michigan

Comparative Study of the Elderly in Asia Research Report 06-62

Support for this project was provided by the National Institute on Aging (Grant Nos. R01 AG20072-01 and P30 AG012846, Michigan Center on the Demography of Aging). Many people were helpful in obtaining data, and clarifying issues. These include: John Knodel; Cheong Kim; Leticia Marteleto; Zeinab Khadr; Zeng Yi; Napaporn Chayovan; Chanpen Saengtienchai; Angelique Chan; Feng Wang; Justin Thomas; Grace Cruz; Kathryn Yount; and Haiyan Zhu. Macro International kindly made available needed DHS files where special tabulations were needed. We also wish to extend special thanks to Yan Fu, the Population Studies Center's reference librarian who helped in tracking down considerable data; Norman Solomon who assisted in designing an EXCEL program to expedite the projections; Nicole Eby for helping with final manuscript preparation; and Sherry Briske for downloading and organizing the DHS data.

Abstract

Many countries in the developing world are experiencing rapid population aging, prompting concerns that this will have adverse effects on their socioeconomic advancement and on the well-being of older populations. How these forces play out in the coming years is subject to many unknowns, including world and country specific economic conditions, social changes related to family dynamics, urbanization and education, and the policies and programs adopted. What can be foreseen with more clarity is the composition of the future elderly in terms of characteristics like education, marital status, and number of children, which relate directly to their well-being on several dimensions as well as to trends in the larger society. This paper uses the demographic technique of cohort succession to generate profiles of the elderly to 2050 on key characteristics for a set of thirteen developing countries that vary by region, size, economic level, and cultural traditions. Findings show dramatic shifts in the educational attainment and family size of the elderly over the next 30-40 years. Implications of these changes for policy and program development are discussed.

INTRODUCTION

Population aging is now a worldwide phenomenon. United Nations projections indicate that both developed and developing regions will face notable increases in the proportions that will be above age 60 in the next 45 years and that, within this older segment, the proportions above age 80 will increase rapidly (United Nations, 2003). For example, in the more developed regions, the proportion of the population 60 years or older is estimated to advance from 19 percent to 32 percent between 2000 and 2050, with those 80 years and older constituting better than one out of four of the elderly at the future date. For the developing regions, the comparable growth in the percentage of those 60 and older is from 8 percent to 20 percent, with those 80 and older growing to one-out-of six elderly.

This unprecedented demographic shift has potentially adverse affects on socioeconomic development and the well-being of the older population, and these consequences of population aging have received increasing scrutiny in recent years (The World Bank, 1994; United Nations, 2004; Organisation for Economic Co-operation and Development, 1998). Among many older industrialized countries these trends have been in evidence for some years, but for many developing regions this is a relatively new phenomenon and gives rise to a somewhat different set of concerns. Among these is the fact that many of these countries are experiencing rapid population aging at lower levels of socioeconomic development than the currently industrialized nations. As a result, they may face a more limited range of societal responses to a situation where the future elderly have smaller size networks while ongoing social trends such as increased education and migration have disrupted their traditional sources of support.

How these forces will play out in the coming years is subject to many unknowns, including world and country specific economic conditions, social changes related to family dynamics, urbanization, education, and the policies and programs adopted. Policymakers in many developing countries are well aware of the changing numbers and proportions of elderly that lie ahead. Less attention has been paid to the fact that the future elderly will be quite different on many characteristics than the current elderly, and this has implications for program and policies that will be needed in the coming years. Several key characteristics of the future elderly can be foreseen with reasonable accuracy; these include educational attainment, marital status, and number of children, which relate directly to the well-being of older individuals, as well as to trends in the larger society. This paper proposes to use the well-known demographic technique of cohort succession to generate profiles of the elderly to 2045 on these dimensions, and to examine the implications of these profiles for policy and program development. These profiles will be generated for a set of developing countries that vary by region, size, economic level, and cultural traditions.

COHORT SUCCESSION APPROACH

The approach to using cohort succession for tracing the elderly over time has been discussed by Hermalin and Christenson (1992) and Preston (1992). Christenson and Hermalin (1991) have also carried out a fairly detailed examination of educational characteristics across five countries from census data as of 1980. This paper proposes to update the analyses to the 2000 census and add several large and important countries in different regions of the world, so that the profiles of the elderly can be extended forward in time and a broader comparative framework achieved.

The essential technique is to select socio-demographic characteristics that are relatively fixed early in adulthood and to utilize these as identifying aspects of age-sex cohorts as they age. For example, if 20 percent of

25-29 year old males have a secondary or better education in the year 2000, it can be assumed, with some cautions to be discussed below, that 20 percent of 65-69 year old males in 2040 will also have a secondary or better education. If for 2040 one also has a projection of the age-sex composition (as available for example from the United Nations, 2003), then a weighted average of the proportions in each educational category can be readily derived for those 65 and older or for any age grouping of interest.

Although the technique is straightforward, several assumptions are required. One is that the characteristic chosen is indeed fixed within narrow bounds as a cohort ages, so that, for example, significant amounts of adult education do not alter the educational composition assigned to a cohort. This concern is minimized by selecting characteristics where there is little likelihood that subsequent adult behaviors will significantly alter the cohort attributes. A more serious concern is that differential mortality associated with the trait will occur as the cohort ages, altering the level or distribution of the trait over the cohort's lifetime. The question of the impact of differential mortality has been treated by Christenson and Hermalin (1991), and Preston (1992) and a summary of the main findings are presented in Appendix A. In general, they demonstrate that unless the level of differential mortality by characteristic within cohorts is very high relative to the amount of change across cohorts, the absence of an adjustment for mortality is not likely to distort the general trends over time or the differences across countries.

A third concern is that significant amounts of in- or out-migration can alter the level of the trait for a given cohort. Out-migration of the more educated within a cohort will change that cohort's average educational level, for example, as can in-migration of people with a different educational profile than their age-sex cohort. Even if migration does not alter the level attributed to a cohort, it may alter that cohort's relative size in ways not anticipated by the age-sex projections, and this will affect its relative weight in determining the over-all level for the older population.

Several of these issues will be treated further below, but they serve as a caution that the projections to be derived are general orders of magnitude of what is likely to develop and they should be viewed as highlighting likely trends, as well major differences across countries. Even with these restrictions, we believe that they will be useful in identifying a number of policy relevant aspects of population aging for the countries analyzed.

TOPICS AND COUNTRIES

The requirement that the characteristics to be projected by cohort be relatively fixed in early adult life limits but does not fully define the traits available for analysis, as willingness to use auxiliary information can enlarge somewhat the range of usable data. For example, in considering a cohort's current and future marital status, we have projected forward only the proportions never married at ages 40-44, assuming that in most societies first marriages after this age seldom occur. But we have not tried to project forward the proportions that will be married or widowed at older ages as this depends on assumptions about the mortality rates of spouses, remarriage rates and other factors. Although there have been useful projections of future marriage levels (see for example Goldstein and Kenney, 2001; Zeng et al., 2004), the parameters needed for a detailed analysis are not known with sufficient specificity across the countries of interest to permit a more in-depth view. Considerations such as these led us to restrict our projections to the following characteristics and age groups:

Marital Status: proportions of males and females who have never married starting at age 40 in 2000.

Children Ever Born: average number of children ever born to ever married women starting at ages 30-34 in 2000.

Education: educational attainment distribution for age sex cohorts starting at age 20 in 2000.

Further details on the nature of these projections and any necessary adjustments will be provided below when each topic is discussed.

Collectively these three characteristics point to important dimensions of well-being of the future elderly, as well as help to define the challenges that policymakers will face in developing appropriate programs. Education in relation to the economic, health, and emotional well-being of the elderly has been closely studied and is a potent influence, speaking to the knowledge and resources older people have to provide for themselves, their capacity to adjust to changing conditions, their preferences as to living arrangements, and the nature of their relationships with children and other kin. The strong relationship of education to disability (Grundy and Glaser, 2000; Zimmer and House, 2003; Zimmer et al., 1998) provides insight to the health challenges a society will face as its population ages. More educated societies with the same age composition as less educated ones may face lower over-all health costs (though the higher level of health of the more educated is likely to be accompanied by higher levels of healthcare utilization and demands for advanced technology), and the more educated societies should also have shown greater economic development, providing more resources for the programs that are needed.

Marital status and the number of children ever born speak to the nature and size of the networks older individuals will have as they age. The rapid decline in rates of marriage in many countries means that significant proportions of older people in coming years will not have a spouse or children to assist them, creating a need for new sources of emotional and physical support. The number of children likewise speaks to the size of the network couples will have at older ages. Those with small numbers of births will likely have relatively small numbers of children available to them when one takes into account possible mobility of the children (a factor we cannot examine directly). In addition, for those who survive to very old ages (85 or older), the mortality of their children may be a factor as well (as shown in Preston, 1992), and where numbers of surviving children are available in the census figures and/or reasonable life table parameters exist, we illustrate this effect as well.

The thirteen countries selected for analysis were chosen from each of the world's developing country regions and represent a mix of cultures, size, and demographic and economic levels. Listed alphabetically they are: Brazil, China, Egypt, India, Indonesia, Korea (Rep.), Mexico, Philippines, Singapore, South Africa, Taiwan, Thailand, Vietnam. Five of the countries (Korea, Philippines, Singapore, Taiwan, and Thailand) were the subject of earlier projections based on 1980 census data and are included preparatory to appraising the robustness of the earlier analyses, though this is not pursued here (Hermalin and Christenson, 1992; Christenson and Hermalin, 1991). The other countries included are, for the most part, large populations and important economies in their respective regions. Altogether, the 13 countries analyzed here account for two-thirds of the world's developing regions population as of 2000, and over 70 percent of the population aged 65 or older.

Tables 1 and 2 present several socio-demographic characteristics of each country, and selected characteristics of their older populations, respectively. Key findings from these tables are summarized here.

First, as shown in Table 1, population sizes vary from a low of 4 million for the city state of Singapore to over one billion for the two most populous countries, China and India. Between 1980 and 2000, all the countries had average annual growth rates of 1 percent or more and several approached or exceeded 2 percent. Between 2000 and 2050, however, growth rates will slow appreciably. Only Egypt and the Philippines are projected to maintain a growth rate of 1 percent or more, while South Africa, China, Korea, Taiwan, and Singapore will show little change in population size.

Table 1: Socio-Demographic Characteristics by Country

Characteristic:	Africa		East Asia			Southeast Asia					South Asia	Latin America	
	Egypt	South Africa	China	Korea	Taiwan	Indonesia	Philippines	Singapore	Thailand	Vietnam	India	Brazil	Mexico
Population, 2000 (in millions)	67.8	44.0	1,275.2	46.8	22.2	211.6	75.7	4.0	60.9	78.1	1,016.90	171.8	98.9
Avg. Growth Rate (%):													
1980-2000	2.2	2.1	1.2	1.0	1.1	1.7	2.3	2.5	1.4	1.9	1.9	1.7	1.9
2000 - 2050	1.3	-0.2	0.2	0.0	0.1	0.7	1.0	0.2	0.5	0.8	0.8	0.6	0.7
Dependency Ratios:													
Young; Old 1975	74; 8	79; 6	70; 8	64; 6	58; 6	75; 6	84; 6	52; 7	79; 6	83; 9	71; 7	72; 7	94; 8
Young; Old 2000	61; 8	55; 6	36; 10	29; 10	30; 12	48; 8	64; 6	31; 10	39; 8	54; 9	56; 8	45; 8	55; 8
Young; Old 2050	29; 19	33; 14	26; 37	25; 55	24; 51	28; 26	28; 21	22; 54	27; 35	28; 28	28; 22	28; 31	27; 32
Total Fertility Rate 2000-2005	3.3	2.6	1.8	1.4	1.4[a]	2.4	3.2	1.4	1.9	2.3	3.0	2.2	2.5
Life Expectancy 2000-2005													
Male	66.7	45.1	68.9	71.8	72.7	64.8	68.0	75.9	65.3	66.9	63.2	64.0	70.4
Female	71.0	50.7	73.3	79.3	78.4	68.8	72.0	80.3	73.5	71.6	64.6	72.6	76.4
Percent Urban, 2000	45	55	32	82	55[b]	41	59	100	22	24	28	81	74
Net Migration Rate 2000-2005	-0.4	0.2	-0.3	-0.3	0.3[c]	-0.8	-2.3	11.9	-0.1	-0.2	-0.2	-0.1	-2.9
GDP per capita, 2000	3635	9401	3976	17380	16600	3043	3971	23356	6402	1996	2358	7625	9023
TV's per 1000 pop, 2000	189	127	293	364	298	149	144	304	284	185	78	343	283
Adult Literacy, 2000	55.3	85.3	84.1	97.8	95.6	86.9	95.3	92.3	95.5	93.4	57.2	85.2	91.4
% in Sec. School, 2000	79	57	50[d]	91	92	48[d]	53	92	55[d]	62	39[d]	71	60
Health Spending as % of GDP, 2000	3.8	8.8	5.3	6.0	5.4	2.7	3.4	3.5	3.7	5.2	4.9	8.3	5.4

Table1 continued

(a) represents average of TFR values, 2000-2003

(b) % in aggregations of 150,000 or more
(c) for year 2000
(d) represents data circa 1998

Sources:
Central Intelligence Agency, 2002; Republic of China, Department of Health, 2001; Republic of China, Directorate-General of the Budget, Accounting and Statistics, 2004; Republic of China, Ministry of Interior, 2001; Singapore Ministry of Education, 2005; United Nations, 2003; United Nations Development Programme, 2002; The World Bank, 2002; The World Bank, 2003; U.S. Census Bureau International Program Center;
Republic of China, Ministry of Interior website.

Notes:

The youth dependency ratio is the ratio of those under age 15 to those age 15-64, multiplied by 100.

The old age dependency ratio is the ratio of those 65 and older to those aged 15-64, multiplied by 100.

The sum of the youth and old age dependency ratios is the total dependency ratio.

GDP per capita is based on purchasing power parity calculations, utilizing standardized, international price weights, so that $1000 will buy about the same market basket of good in each country.

% in secondary school is the net enrollment rate, measured as the percent of those of secondary school age that are enrolled in secondary school.

The health spending percent includes public and private health expectations.

The human development index is a composite measure which reflects weighted values of life expectancy, literacy and school enrollment, and GDP per capita.

The youth and old age dependency ratios reveal currents of population change over the last several decades that have important implications for social and economic development. Due to the declines in fertility experienced between 1975 and 2000, the youth dependency ratios--the ratio of those 15 or older to those aged 15-64--declined substantially in all 13 countries, while the old age dependency ratios--the ratio of those 65 or older to those aged 15 to 64--advanced very little, so that the over-all dependency ratio (the sum of the two) declined in all countries. This served to reduce the pressure for new schools and several other social services over the period. For the period 2000-2050, the pattern is more complex. While the youth dependency ratios will continue to decline in all the countries, in some, the decreases will be small and offset by the rapid rise in the older age dependency ratios. For these countries-China, Korea, Taiwan, Thailand, Singapore and Brazil-the over-all ratios will advance. For the other countries, there will be little change over-all or continued decreases, as the continued declines in the youth dependency ratios offset the projected increases at the older ages.

Dependency ratios of course are only one broad demographic indicator of the pressures on the labor force to support the non-working population and of pressures on governments for social welfare programs. Many other factors come into play. For example the rapid decline in the youth dependency ratios between 1975 and 2000 also signals that large numbers of children have moved into young adulthood, bringing along demands for rapid job creation, enhanced educational opportunities, and in some cases new housing and other elements associated with those ages (Lloyd, 2005). These shifts remind us that growing numbers and proportions of older populations and their particular profiles are only one among a number of socio-demographic changes that policymakers will be facing in the coming years, and programs oriented toward the elderly will be competing with other socio-economic goals.

By early this century, all but three of the countries--Egypt, Philippines, and India--had total fertility rates below 3, and five of the countries had rates below 2. The timing of the onset of fertility decline and the rapidity of decline will be prime determinants of future age structure. Once fertility has reached low levels, the levels of mortality will further influence the age structure, particularly in terms of the distribution of people at the older ages. As the life expectancy data indicate, in all but three of the countries, female expectation of life at birth exceeded 70 years by 2000-2005, and was at or near 80 years in Singapore, Korea and Taiwan. Life expectancy was noticeably lower in South Africa than the other countries, partly because of deaths due to HIV/AIDS, and the levels were slightly lower in Indonesia and India.

Urbanization tends to be high in Latin America as reflected in the proportions urban for Brazil and Mexico. For the African countries shown, about half the population lives in urban areas, and in Asia there is considerable variation, with the city state of Singapore, and Taiwan, Korea and the Philippines at the upper end; the remaining countries showing more modest levels. It would be of interest to be able to project the proportion urban among the future elderly, but uncertainties about the internal migration rates that future cohorts will generate, as well as co-residence patterns, make that impractical. In some literature there is concern about abandoned older people in rural areas as children migrate to cities, but there is also recognition that older people may prefer to remain in familiar surroundings, and that they face serious adjustment problems if they move to cities late in life. In addition, from a policy and program standpoint, considerations about the cost of providing services to the elderly in a denser urban environment vs. a more rural setting need to be considered. It was noted that high in- or out-migration rates for cohorts as they age may distort the projections made on the assumptions of stability. Of the countries under analysis, Mexico and the Philippines have quite high out-migration rates and Singapore has a high in-migration rate, so the projections for these countries should be considered more tentative.

The countries examined in this paper vary widely in their per capita income, with Singapore, Korea and Taiwan at the high end, Mexico, South Africa, Brazil and Thailand intermediate, and the remaining countries quite a bit lower. Despite these variations, most of the countries have achieved quite high levels of adult literacy, with only Egypt and India noticeably lower than the others. More variation exists among the countries in terms of their secondary school enrollment rates. Although these rates must be interpreted with some caution due to variations in school reporting practices and the like, they do point to the current levels of investment in secondary schools and to the level of education of adults in the coming years. The three countries with the highest per capita income do show the highest enrollment rates, but beyond these the relationship between income and school enrollment is quite weak. Egypt, with low current adult literacy and a relatively low level of GDP per capita, has the highest enrollment rate among the remaining ten countries, while South Africa with a moderate level of income has one of the lower secondary enrollment rates. Differences in education among the current elderly will be presented below. Another major arena of policy is health expenditures, and Table 1 indicates that the percentage of total health spending (public and private) also varies considerably across countries. The increasing numbers and proportions of elderly in the coming years will increase demands for more health expenditures, so the starting levels and the existing infrastructures are important factors.

Table 2 focuses on the current and future elderly populations of the countries and describes in some detail the general patterns indicated earlier. In every country there will be a substantial increase in the number of those 65 and older between 2000 and 2050, more than doubling in South Africa and increasing six fold in the Philippines. The rapid growth of this population will place great burdens on these countries for the provision of health care and other services in the coming years. Every country will also see the proportion of the elderly rise sharply. In Singapore, Korea and Taiwan, this age group will represent about 30 percent of the population by 2050, and around 20 percent in China, Thailand, Vietnam, Brazil and Mexico. The older population will itself be aging: by 2050 the proportion of those 65 and older who are over 75 years of age will advance markedly from 2000, and in several of the countries will constitute 50 percent or more of the 65+ age group. Given the heavier medical expenses at older ages, this will add to the pressures on government health programs. Table 2 also confirms that due to the differential in life expectancy between men and women, the sex ratio becomes increasingly female at the older ages, so that at ages 75 and older, there will be less than 60 males for every 100 females in several of the countries.

Labor force participation rates depend in part on definitions of economic activity and tend to be influenced by the level of agriculture. For the countries analyzed here the rates of activity for males vary from over 50 percent down to about 10 percent, with almost half the countries in the 20 to 30 percent range. Females in all countries show lower labor force rates than males, but in several Southeast Asian countries about a quarter of the women 65 and older were in the labor force in 2000. A major policy issue for many countries with aging populations is the degree to which the older population can and will remain economically active, as this has great influence on the cost and viability of pension programs and a number of other aspects of economic support.

Figures compiled for the 1990s from various sources by the UN and others (United Nations, 2005) show that, in the developing countries analyzed, relatively few of those at older ages were living alone, more were living with a spouse only (particularly among men relative to women), and the majority were residing with one or more children. The situation is quite different in the industrialized countries where co-residence with a child or grandchild is in the range of 4 to 40 percent, with the higher percentages mainly in Southern and Eastern Europe. Also in several countries in Asia where time series are available there has been a noticeable decline in

Table 2: Characteristics of the Older Population by Country

Characteristic:	Africa		East Asia			Southeast Asia					South Asia	Latin America	
	Egypt	South Africa	China	Korea	Taiwan	Indonesia	Philippines	Singapore	Thailand	Vietnam	India	Brazil	Mexico
Population, 2000													
Number 65+ (in thousands)	3018	1626	87,295	3338	1893	10242	2670	287	3319	4178	50,036	8875	4736
Percent 65+	4.5	3.7	6.8	7.1	8.5	4.8	3.5	7.2	5.4	5.3	4.9	5.2	4.8
Percent 75+ to 65+	27.8	29.0	31.1	31.6	34.7	26.8	30.2	34.1	28.4	34.6	29.4	32.9	37.1
Population 2050													
Number 65+ (in thousands)	16,644	3826	319,262	14,154	6809	49706	17836	1383	16590	21173	221,266	46161	28070
Percent 65+	13.1	9.5	22.9	30.5	29.3	16.9	14.0	30.5	21.5	18.0	14.4	19.8	20.0
Percent 75+ to 65+	35.4	43.5	53.2	53.4	53.1	38.9	38.6	61.9	46.2	42.3	40.9	45.7	46.8
Sex Ratio (M/F) 75+	59	54	66	57	72	68	65	72	59	72	78	57	63
Life Expectancy at 65													
Male	12.3	10.8	12.8	13.8	15.1	12.7	13.1	16.1	13.5	14.5	13	13.7	16.1
Female	13.7	14.6	16.1	18.1	17.5	14.2	14.7	19.3	15.6	15.7	14.4	16.0	18.1
% in Labor Force													
65+, Male	24.6	23.5	27.5	32.4	10.9	48.5	54.5	16.3	40.1	43.7	52.7	30.1	51.1
65+, Female	8.0	4.6	7.6	16.0	3.4	24.1	26.2	4.3	19.3	26.1	13.5	5.0	12.4
Living Arrangements													
Men 60+													
Alone	3.9	8.0	7.8	1.3	11.1	2.3	4.0	3.2	1.8	2.7[b]	1.8	5.3	5.8
Couple Only	14.6	18	28.5	17.8	17.2	21.7	13.0	8.1	8.5	14.9[b]	10.0	22.7	14.4
with Children	78.6	52.5	62.2	75.6[a]	67.3	65.4	68.2	81.5	78.8[a]	74.5[b]	81.8	60.8	66.2[a]
Women 60+													
Alone	13.1	8.2	9.2	3.0	6.6	11.9	6.4	3.3	5.7	7.9[b]	5.0	11.7	8.8
Couple Only	9.4	7.4	21.7	9.0	15	12.5	8.1	3.8	4.0	9.2[b]	6.1	14.8	10.6
with Children	68.5	55.1	68.2	83.8[a]	72.6	60.4	73.5	87.9	76.7[a]	76.5[b]	80.9	55.7	59.1[a]

Table 2 continued

(a) Includes those living with grandchildren only.
(b) Refers to adult children only.

Sources:
Friedman et al., 2003; Republic of China, Ministry of Interior, 2001; Republic of China, Directorate-General of the Budget, Accounting and Statistics, 2001; Anonymous, 2002; United Nations, 2003; United Nations, 2004; U.S. Census Bureau International Program Center, International Database;
Republic of China, Ministry of Interior website; Special tabulations from surveys of older populations in Philippines, Singapore and Taiwan;
Tabulations from UN population database.

levels of co-residence (Hermalin, 2001). How this pattern may change in the future when older people have fewer children, they and their children have more education, and other social and economic changes have taken place is a major question which will impinge on the well-being of the future elderly. Although future living and support arrangements cannot be foreseen with any accuracy, the changing characteristics associated with these key influences can be anticipated and we turn to several of these.

MARITAL STATUS AND CHILDREN EVER BORN

As noted above, the marital status of the older population and the number of children they have speak to the size and nature of their social support network. In all societies, family members are a major source of emotional support, and in developing countries they are the prime source of needed material and physical assistance. In many cultures, the tradition is for the older parent (or parents) to live with a married child and, although the parents often contribute to the household in tangible ways, they are often the recipients of financial and material support (Biddlecom et al., 2002; Glaser et al., in press). By the same token, an older couple will share material resources and provide emotional support and needed physical assistance to each other. In several countries, housing, tax, and other incentives have been developed to encourage children to co-reside with or otherwise support parents as a way of reducing demands on community services and social welfare programs. (For a description of the programs in effect in several Asian countries see Ofstedal et al., 2002; Hermalin et al., 2002; Phillips, 2000.) Socio-economic changes that weaken the ability of informal support networks to perform their functions can increase the social welfare burdens of developing economies with modest income levels which are struggling to accomplish a number of social and economic goals.

Projections of Marital Status

The ability to project forward the marital status distributions of future older cohorts and the number of children potentially available to them is limited both by the timing of such events over the life course, as well as by available data. In the case of marital status, men and women can marry over a wide spectrum of ages, marry more than once, and undergo periods of non-marriage as a result of divorce and widowhood. To capture the process for current younger cohorts would require detailed knowledge of future rates of marriage, marital dissolution, and remarriage or appropriately robust models and simulations of these events. But some limited insight can be achieved from the knowledge that the rates of first marriage tend to decrease sharply with age and, up to the present, relatively few men and women marry for the first time after age 40. Consequently we use this pattern to project forward the percent never married among the five year age-sex cohorts who are 40 years or older as of 2000, in order to generate estimates of the proportions 65 and older and 75 and older who will never have married through the year 2025.

Table 3 presents the marital status distribution for those aged 65 or older in 2000.[1] The proportion never married is a very small component of the marital status distribution of the elderly. A much higher percentage of both men and women age 65 or older are without a spouse because of widowhood, and in a few countries the proportion divorced or separated approaches or exceeds the proportion never married. Rising expectation of life at age 65 will affect the probability that a married woman becomes widowed and the length of time in widowhood. But changing marriage patterns at younger ages suggest that future levels of never married may increase substantially, meriting an attempt to project this parameter. In addition, although those widowed as well as those divorced and separated may well have children with whom they are in contact and serve as a potential source of support, this is much less true of the never married, making them a particularly vulnerable group.

Table 3. Percent Distribution of Marital Status for Men and Women Age 65 or Older in 2000

Region	Men				Women			
Country	Married	Widowed	Divorced/Separated	Never married	Married	Widowed	Divorced/Separated	Never married
Africa								
Egypt	83.9	15.0	0.7	0.4	21.5	75.7	1.3	1.4
South Africa	74.5	15.2	3.2	7.1	32.6	55.1	3.0	9.2
East Asia								
China	73.0	23.3	0.9	2.7	48.9	50.5	0.3	0.2
Korea	85.4	13.5	0.8	0.3	31.3	67.6	0.7	0.3
Taiwan	74.7	15.6	2.4	7.2	50.3	47.4	1.3	1.0
Southeast Asia								
Indonesia	81.5	13.7	1.3	3.4	34.4	58.4	2.8	4.3
Philippines	76.6	19.3	1.0	3.1	41.9	50.1	1.0	7.0
Singapore	80.6	13.8	1.7	4.0	40.3	55.1	1.9	2.7
Thailand	77.7	19.4	1.3	1.6	45.9	49.3	1.8	3.0
Vietnam	81.3	17.4	0.8	0.5	37.5	60.4	1.0	1.1
South Asia								
India	78.9	17.9	0.3	2.9	41.2	56.6	0.4	1.7
Latin America								
Brazil	73.7	15.4	4.0	6.9	36.2	47.6	3.2	13.0
Mexico	73.6	17.9	3.9	4.6	38.9	48.8	5.5	6.8

Figure 1 shows the proportion of females 65 and older who are projected to be never married between 2000 and 2025. For three of the countries, more than 10 percent of the women over 65 are estimated to be never married by 2025, with South Africa reaching about 20 percent. For South Africa and Singapore, these represent sharp increases from the levels observed in 2000, but for Brazil there is little change over the 25 years. Of the remaining countries, four show a significant upward trend--Mexico, Taiwan, Thailand and Vietnam--so that the percent never married by 2025 is in the range of 5 to 8 percent, while the Philippines remains rather steady at 6 to 7 percent. Focusing on those 75 and older allows extension of the data to 2035, but the levels and trends are largely as those shown in Figure 1, and are not presented here.

The pattern for males age 65 years and older is shown in Figure 2, and resembles that for females. The highest percentages never married in 2025 are expected for South Africa, Singapore and Brazil, ranging from 9 to 16 percent, with each showing an upward trend from 2000. At a somewhat lower level, in the 6 to 7 percent range, are Taiwan, Mexico, Philippines, and Thailand. For each of these countries, this represents an increase from 2000, except for Taiwan, where the phasing out of the large contingent of never married Mainlanders who arrived in 1949 leads at first to a decline in the proportion never married, before a slight increase sets in. For the other countries the percent never married is below 5 percent, though for a few of these their projected 2025 levels are much higher than the very low levels of 2000. As for the females, the pattern for those 75 years and older between 2010 and 2035, looks very similar to those 10 years younger and is not shown separately.

A recent report by Jones confirms that marriage patterns are changing throughout much of Asia (Jones, 2004). As of 2000, he finds relatively high percentages of never married women, age 30-34, in Korea, Vietnam, Philippines, Thailand, and Singapore, as well as in major cities elsewhere. A sharp gradient by education is often evident. For example, among women in Singapore aged 40-44 in 2000, about 20 percent with more than a secondary education were single, compared to 9 percent with less than a secondary education.

Marriage rates and the proportions married at young adult ages have become much more volatile around the world. For many industrialized countries there have been noticeable declines in period marriage rates so that the median age at marriage has advanced sharply and the proportions married by age 35 or 40 have declined (Goldstein and Kenney, 2001; Lesthaeghe, 1995). A key question, as Goldstein and Kenney note in reference to the United States, is whether women will "compensate for their delayed marriage by marrying at higher rates at older ages" (p. 508).[2] In contrast to the pattern that may be emerging in Singapore, Goldstein and Kenny report that the trend in the United States among more recent cohorts of women is for the more educated to ever marry at higher rates than the less educated. Nevertheless, if these sharp downturns in the proportion married among 30 year-olds carry forward into old age they would mark a dramatic break with past trends, and add a new dimension to the challenges faced by individuals and governments in providing for well-being at older ages.

In projecting forward the proportion never married we had hoped to capture some of these emerging changes, but since much of this is still occurring at ages before 40, it could not be incorporated into the methodology we have used here without very strong and possibly misleading assumptions.

Note should also be taken of the rising levels of divorce in some developing countries. Strong upward trends have been noted in Korea (Byun, 2004), Taiwan (Republic of China, Ministry of Interior, 2003), and China (Zeng and Wu, 2000). An analysis by Raymo et al. (2004) for Japan also indicates an upsurge in that country which is marked by a clear social status differential, whereby the less educated are more likely to divorce than the more educated. The pattern in China however appears more complex, as the differentials by status appear to be shifting toward higher divorce rates in more modernized areas or by individual measures of social status (Zeng et al., 2002).

Figure 1. Projection of Proportion of Females Age 65+ Who Are Never Married

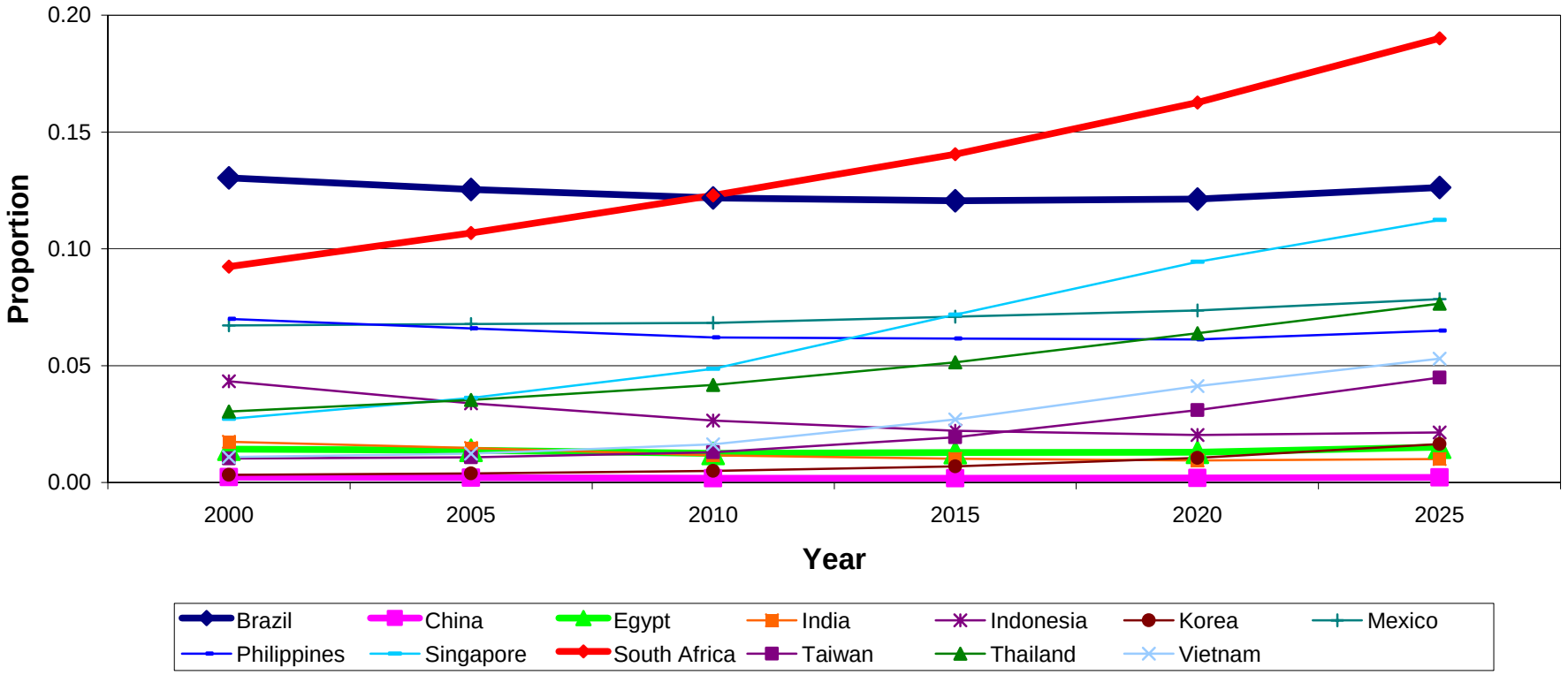
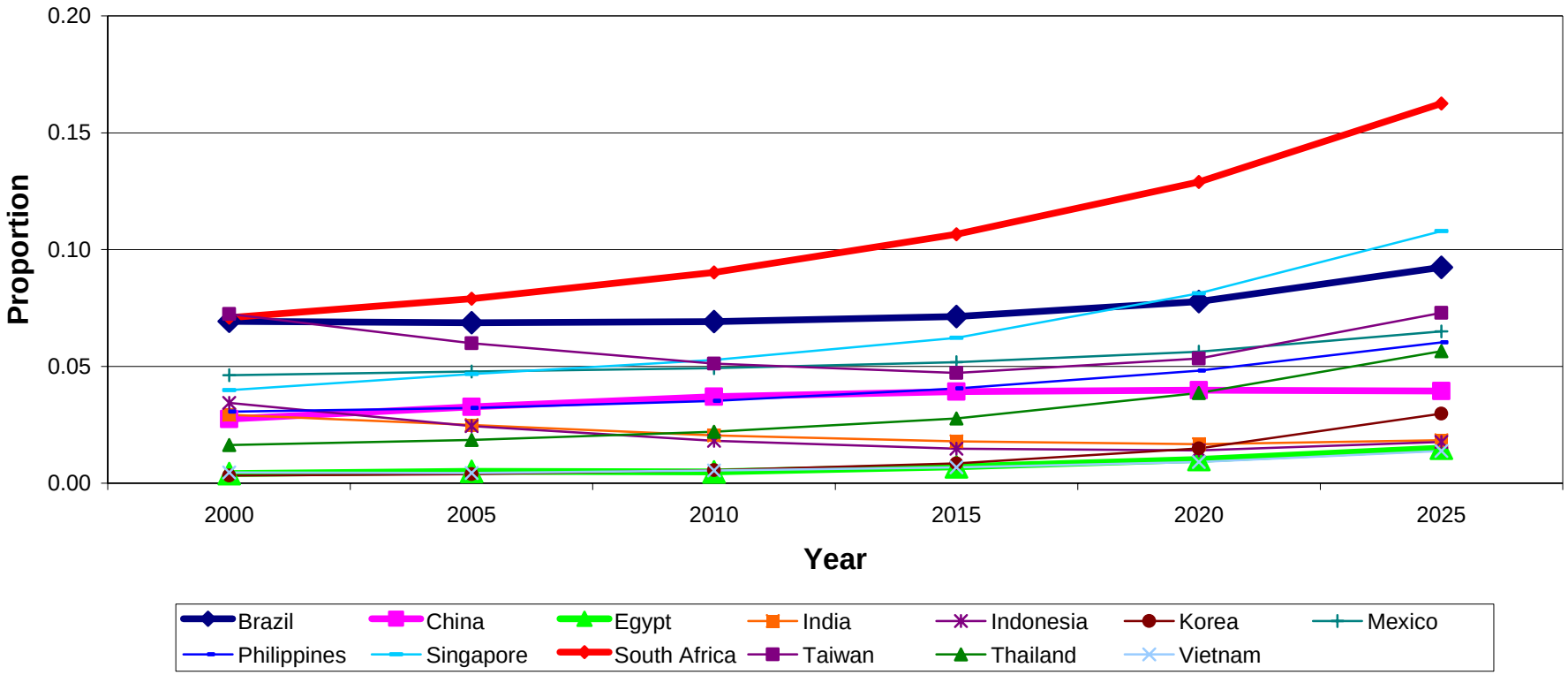


Figure 2. Projection of Proportion of Males Age 65+ Who Are Never Married



Projections of Children Ever Born

A direct indicator of potential familial support is provided by estimates of the number of offspring that future cohorts of older women will have at various dates in the future. For these projections, we have used census reports from each country of the number of children ever born (CEB) to ever married women. For women 45 and older we have assumed there was no further childbearing. At ages 30 to 45, we have used data on current fertility rates to estimate the completed fertility of these cohorts. At present these rates are quite low, so that any errors in the estimates of added childbearing will have little over-all effect. In addition, where necessary, adjustments were made to convert CEB reported for all women to those representing ever married women only. When data on CEB were not available from the census, reports from the Demographic and Health Surveys (www.measuredhs.com) or other large scale surveys were substituted. For many of these countries, the requisite data are reported only up to ages 45-49, limiting the projections.[3] For the eight countries for which CEB is available for a full range of ages for 2000, those 65 and older display the following levels, ranked from highest to lowest: Mexico, 6.8; Brazil, 6.1; Singapore, 4.9; Indonesia, 4.9; Taiwan, 4.8; Thailand, 4.6; Korea, 4.5; India, 4.3. Thus all of these countries and the others for which precise estimates are not available, start this century with CEB levels for older women well above four, and with some exceeding six children.

As shown in figure 3, all the countries show substantial decreases in CEB over the next 35 years, although the starting point and rates of decline differ sharply. By 2035 the last year for which we can estimate the 65 and older age group, there appear to be three distinct clusters of countries by CEB; at the lower end, are the three East Asia countries--China, Korea, and Taiwan--plus Thailand and Singapore in Southeast Asia. Each of these countries will decline by two or more children over the period of observation, and by 2035 women 65 and older in these countries will have CEB levels between two and two and a half. China's rate and magnitude of decline are particularly steep, with a decrease of 2.6 children between 2010 and 2035, a reflection of course of the one child policy and related programs. At the next level, with between three and a quarter and three and a half children ever born as of 2035 are Brazil, India, Indonesia, South Africa and Vietnam. Of these, the amount and rate of decline of Brazil stands out, while for the other countries, the pace of decline is more moderate. (Vietnam's decline can only be observed between 2025 and 2035, and for this period the decline is almost one child.) At the high end are Egypt, Philippines, and Mexico, where women will continue to have well over four children.

To provide more detail, Table 4 presents amounts and rates of change for women age 75 or over in each country, according to rank in 2045, over two periods, 2010-2030 (where available) and 2030-2045. The five countries at the low end in 2045 have around two CEB, with China the only country achieving a level below two children. These countries had large declines in magnitude and rates of change between 2010 and 2030, and then continued declining substantially between 2030 and 2045, despite the relatively low levels they had achieved by 2030. The next cluster of countries range from 3 to 3.5 CEB in 2045; Vietnam, due to its sharp rate of decline, is at the low end of this group along with Brazil, while India and South Africa at nearly 3.5 CEB show a pattern of small absolute and relative declines. Indonesia is intermediate in CEB and in its absolute and relative declines. The top tier of three countries is projected to have 4 to 4.5 children and also represents diverse trends. Mexico and Egypt, which started at very high levels of CEB, show quite substantial absolute and relative declines, while the Philippines shows relatively little change in CEB over the period, although its initial position is lower than the other two countries. These differences of course reflect the differences in levels of fertility among these countries at earlier dates and the magnitude and pace of the fertility transition that they have experienced in the last quarter of the 20th century.

Figure 3. Average Number of Children Ever Born to Ever-Married Women Age 65+

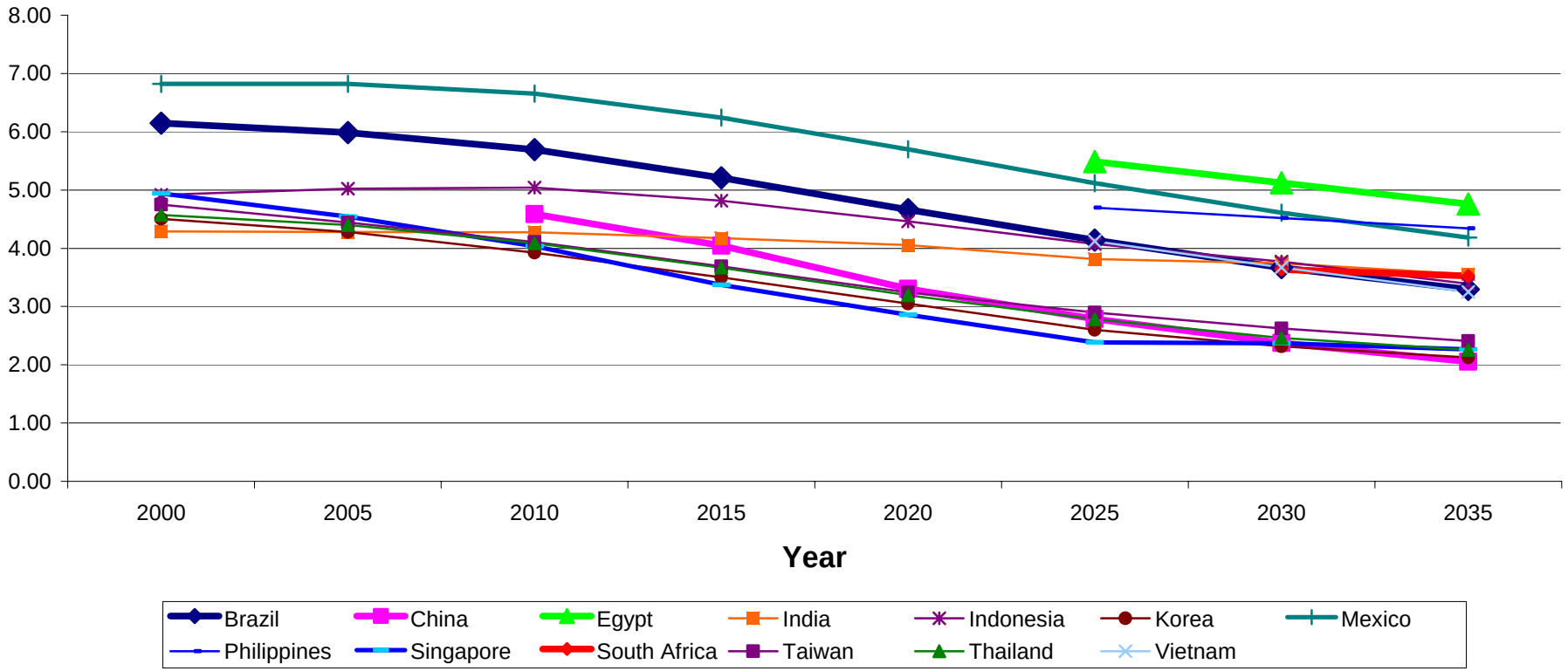


Table 4: Children Ever Born for Those 75 and Older in 2010, 2030, and 2045, and Changes Per Period

				Amount of Change		% Decrease	
	2010	2030	2045	2010-2030	2030-2045	2010-2030	2030-2045
Egypt	----	5.75	4.55	----	1.20	----	20.9
Philippines	----	4.77	4.26	----	0.51	----	10.7
Mexico	6.82	5.45	3.94	1.37	1.51	20.1	27.7
South Africa	----	3.74	3.45	----	0.29	----	7.8
India	4.32	4.00	3.45	0.32	0.55	7.4	13.8
Indonesia	5.00	4.29	3.24	0.71	1.05	14.2	24.5
Brazil	6.12	4.41	3.07	1.71	1.34	27.9	30.4
Vietnam	----	4.39	3.06	----	1.33	----	30.3
Taiwan	4.75	3.06	2.30	1.69	0.76	35.6	24.8
Singapore	4.92	2.61	2.20	2.31	0.41	47.0	15.7
Thailand	4.57	2.96	2.13	1.61	0.83	35.2	28.0
Korea	4.46	2.79	2.00	1.67	0.79	37.4	28.3
China	5.04	2.98	1.92	2.06	1.06	40.9	35.5

Even with improved life expectancy, the average numbers of children alive when parents reach advanced ages will fall short of the estimated numbers of CEB. This can be illustrated in two ways. For countries that report both numbers of children ever born and numbers of children living, one can observe the magnitude of the difference at older ages for the current elderly. Table 5 illustrates this for several countries at different ages and time periods.

For older women (65 and over) who had approximately 5 children ever born, deaths were in the order of one-half to three-quarters of a child.[4] These differences result from the operation of past mortality rates – those in operation over the reproductive lives of the women and subsequently. The differentials shown for women 45-49 circa 2000 for women in Egypt, India, and South Africa indicate that the current differences between CEB and number surviving are not trivial even at younger ages, and that when these women reach older ages they will have significantly fewer children surviving than their CEB levels suggest.

Preston provides a different illustration for the United States by first projecting the distribution of CEB for women aged 85 to 89 through 2015, and then using cohort mortality rates for the children as they age to determine what percentage of women would have no surviving children, one child, or more (Preston, 1992). The results indicate that, through the year 2000, about half of the women at that advanced age would have no or only one surviving child, and even in 2015 almost a third would be in that situation.

Table 5: Average Numbers of Children Ever Born and Surviving Children

Country, Date & Ages	Average CEB	Average Number Living
Egypt		
1995, 45 - 49	6.23	4.80
2000, 45 - 49	5.70	4.74
India		
1998/99, 45 - 49	4.79	3.94
Korea		
1990		
45 - 49	3.44	3.35
55 - 59	4.56	4.29
65 - 69	5.11	4.51
70 - 74	5.09	4.34
South Africa		
1998, 45 - 49	4.34	3.89
Taiwan		
1980		
45 - 49	4.49	4.25
55 - 59	5.22	4.75
65 - 69	5.26	4.56
75 and older	5.08	4.12
Thailand		
2000		
45 - 49	2.59	2.47
55 - 59	3.59	3.30
65 - 69	4.57	4.04
70 and older	4.77	4.06

A simple illustration of the effects of mortality is provided below which shows the expected configuration of surviving sons and daughters to women at age 80 who had three births (2 sons and 1 daughter), assumed to occur to her when she was aged 30, under a mortality table with life expectancy of 67.5 years for females and 63.6 for males (the model West life table no. 20, Coale and Demeny, 1966):

One son or fewer survives	33.6%
Two sons survive	66.4
Daughter dies	14.9
Daughter survives	84.9

Although the expectation of life currently is higher that that assumed here (see Table 1), the survival rates chosen are probably a fair representation of the average mortality that children born say 20 years ago, to women now 50 years of age, were facing and will face as they grow up in many of the countries under analysis.

The number of children is only a rough indicator of the potential support that might flow from children to parents. Support can come in many forms and many considerations besides the demographic intervene in determining the form and magnitude of assistance. Co-residing with a parent or living nearby is necessary for the provision of physical assistance and with the activities of daily living, and it facilitates the provision of material and emotional support. But remittances may be made at a distance, technology increasingly facilitates contact by phone and other means, and services can be purchased from third parties.

In addition, whether services are provided and their mode of provision will depend to a large extent on the constraints and preferences of both children and parents (Casterline et al., 1991; DaVanzo and Chan, 1994). In many cultures support from children is structured along gender lines (Ofstedal et al., 1999) so that small numbers of children born and surviving may greatly curtail the availability of a child of a preferred gender. On the other hand, a more educated older population may prefer more privacy and need less support; and the growing education of the children and changing job locations may constrain the personal provision of services while enhancing the ability to purchase any needed services. In short, having surviving children at older ages is a necessary but not sufficient condition for co-residing or for receiving certain types of assistance.

EDUCATIONAL ATTAINMENT

The third and final characteristic that we project is educational attainment. As noted previously, education plays a key role in various aspects of elderly well-being. Education influences employment opportunities in early life and perhaps throughout life, and this, in turn, impacts financial status in the form of income and accrued wealth. Education has also been linked to physical, cognitive and emotional health, as well as mortality, such that those with higher education experience more favorable outcomes on a range of measures. Education also influences the values people hold, the types of living arrangements they prefer when they get older, and the extent and nature of their interpersonal relationships (Hermalin and Yang, 2004).

Projections of Educational Attainment

For the education projections we have used Census or DHS data on completed education for the age 20+ population in each country. The data for the Philippines do not allow us to differentiate between the two highest categories (upper secondary and tertiary), and the data for South Africa do not allow us to differentiate between primary and lower secondary. Thus, the upper secondary category represents completed upper secondary or higher education for the Philippines, and the primary category for South Africa includes everything between completed primary through attended (but did not complete) upper secondary.

At present, the elderly in all countries examined here have quite low levels of completed education, as indicated in Table 6. With the exception of Korean males, a large majority of elderly in all countries have a primary or lower level of completed education. The modal category in most countries is less than primary. This is true for both men and women, although the levels for women tend to be lower than those for men, and in some cases the gender gap is substantial. When primary education is combined with less than primary, the figures range from 80 to 90 percent with primary or lower education for most countries. For men, countries showing the highest levels of education in 2000 are Korea, Taiwan and the Philippines, for which the percent with higher than primary education ranges from 30 to 50 percent. For women, the percentages with higher than primary education are much lower than those for men and show less variation across countries, ranging from about 3 percent in Vietnam to 22 percent in the Philippines.

Table 6. Percent Distribution of Completed Level of Education for Men and Women Age 65 or Older in 2000

Region / Country	Men					Women				
	< Primary	Primary	Lower Secondary	Upper Secondary	Some Tertiary	< Primary	Primary	Lower Secondary	Upper Secondary	Some Tertiary
Africa										
Egypt	66.6	20.5	2.2	4.9	5.8	85.1	11.8	0.8	1.5	0.8
South Africa	58.8	24.0	n.a.	10.3	6.9	66.5	22.2	n.a.	7.5	3.7
East Asia										
China	34.1	45.7	12.8	5.0	2.5	73.7	21.6	2.8	1.3	0.6
Korea	14.5	35.8	15.3	18.6	15.7	45.0	39.7	7.5	6.1	1.8
Taiwan	23.8	41.0	12.1	11.4	11.6	56.6	31.6	5.5	4.1	2.2
Southeast Asia										
Indonesia	66.7	23.9	4.1	4.3	0.9	87.1	9.0	2.5	1.0	0.4
Philippines	50.9	19.2	16.0	13.9	n.a.	57.1	21.0	11.4	10.5	n.a.
Singapore	54.9	26.0	10.9	3.5	4.6	81.2	11.7	4.4	1.3	1.3
Thailand	25.5	64.6	5.5	1.8	2.7	44.9	51.7	1.7	0.6	1.1
Vietnam	52.4	27.9	13.6	3.6	2.5	86.0	11.6	1.9	0.4	0.1
South Asia										
India	66.7	9.0	12.1	6.4	5.7	89.5	4.0	4.3	1.2	1.0
Latin America										
Brazil	58.0	24.5	5.6	5.7	6.1	59.7	25.0	5.7	6.1	3.4
Mexico	71.2	15.9	4.6	2.3	6.2	73.3	15.6	5.0	2.6	3.5

It is interesting to note that the levels of education do not necessarily correspond with levels of economic development. For example, Singapore has the highest GDP of all countries examined here, but the level of education among current Singaporean elderly is lower than that of several countries. In contrast, the Philippines has a relatively low GDP, but Filipino elderly are among the highest educated. As will be discussed in more detail shortly, the gender gap in education for the current elderly is large in China, Korea, Taiwan, Singapore and Vietnam; and much smaller in the Philippines, Brazil and Mexico. Finally, very few of the current elderly have any tertiary education, except for Korean males, for which 16 percent had completed at least some tertiary schooling.

The educational profiles of the elderly population will change markedly between 2000 and 2045, as shown in the next set of figures. Figure 4 shows the percentage of males aged 65+ who will have completed an upper secondary or higher level of education. With the exceptions of Korea and Taiwan, which start out relatively high (34 and 23 percent, respectively), all of the countries start at a similar level ranging from 5 percent in Thailand to 17 percent for South Africa. All of the countries will experience an increase in the percent with upper secondary or higher education, with Korea, Taiwan, Egypt and Singapore experiencing the largest increases. By 2045 over 90% of the male elderly in Korea will have completed at least an upper secondary level of education. The next highest countries are Taiwan (67 percent), Egypt (57 percent) and Singapore (50 percent). The result of these changes is that there will be much more variation in educational attainment across these countries by 2045. A similar pattern is projected to occur for elderly women (Figure 5), although the increases for most countries will be less pronounced than those for men. Here again Korea and Taiwan stand out. Although education for current elderly women (as of 2000) in these countries is comparable to that of the other countries, the percent of women age 65+ with an upper secondary or higher education will increase more than ten-fold in both countries by 2045. The resulting levels of 86 percent in Korea and 70 percent in Taiwan are substantially higher than those for any of the other countries.

Figures 6 and 7 show what will happen at the lower end of the educational distribution for elderly men and women, respectively. The proportion that will have a primary or lower level of completed education will decline between 2000 and 2045. For men (Figure 6), there is some variation in the starting levels, ranging from 50 percent for Korea to about 90 percent for Indonesia and Thailand. The differing rates of decline across countries will result in a much larger spread in the percent with low education by 2045. Korea, Taiwan, China, Singapore and Egypt will experience the most pronounced declines, and South Africa the most modest.[5] Again, the general pattern for females (Figure 7) is similar, although the starting levels are much more concentrated. In contrast to men, the Philippines is among the countries showing the sharpest decline in low education for women, and the decline in Egypt is more modest. For most countries, primary education will no longer be the modal category for either men or women in 2045.

The educational projections allow us to examine three questions about the educational changes of the older population in the coming years: how rapidly will their educational attainment be changing; how will the educational changes of older men compare to those of older women; how will the educational attainment of the older population compare to those of younger adults at different time points.

Figure 4. Projection of Proportion of Males Age 65+ with Upper Secondary or Higher Education

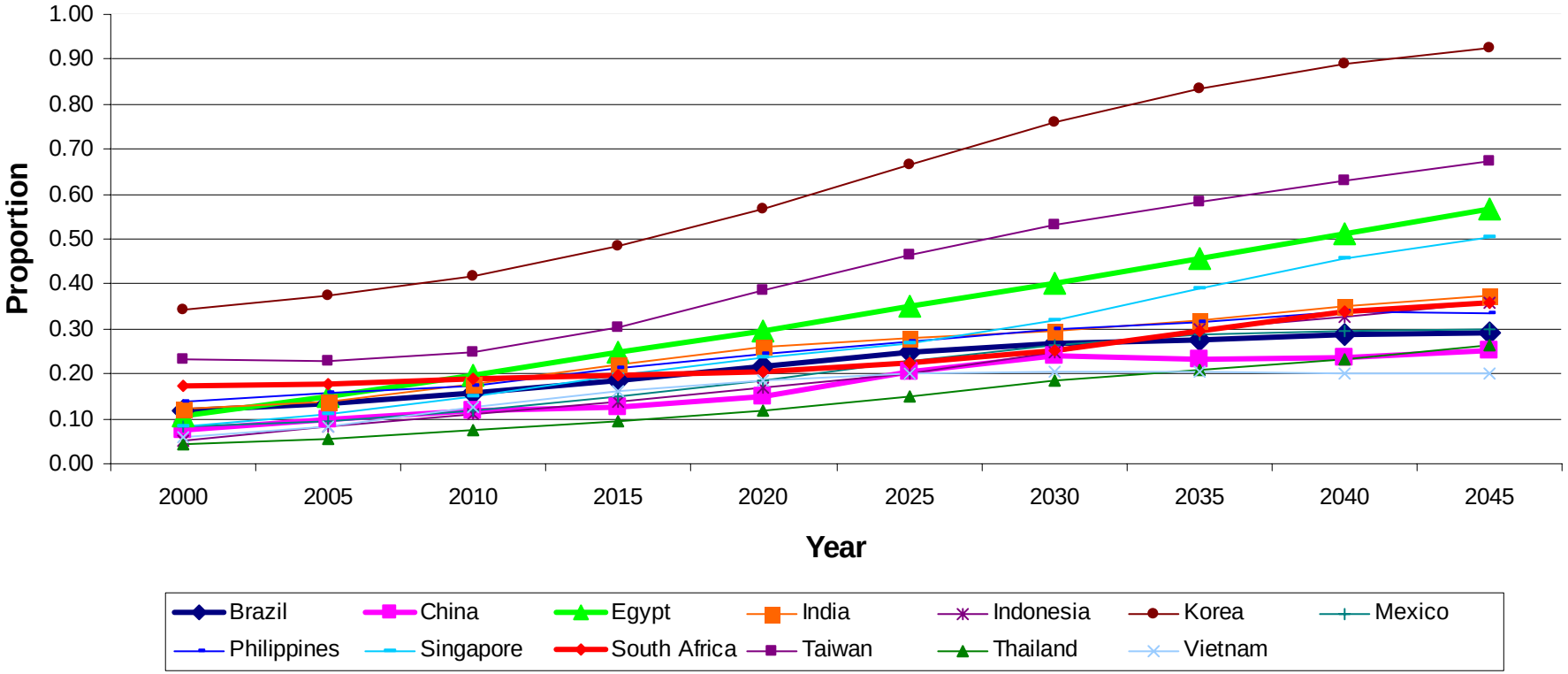


Figure 5. Projection of Proportion of Females Age 65+ with Upper Secondary or Higher Education

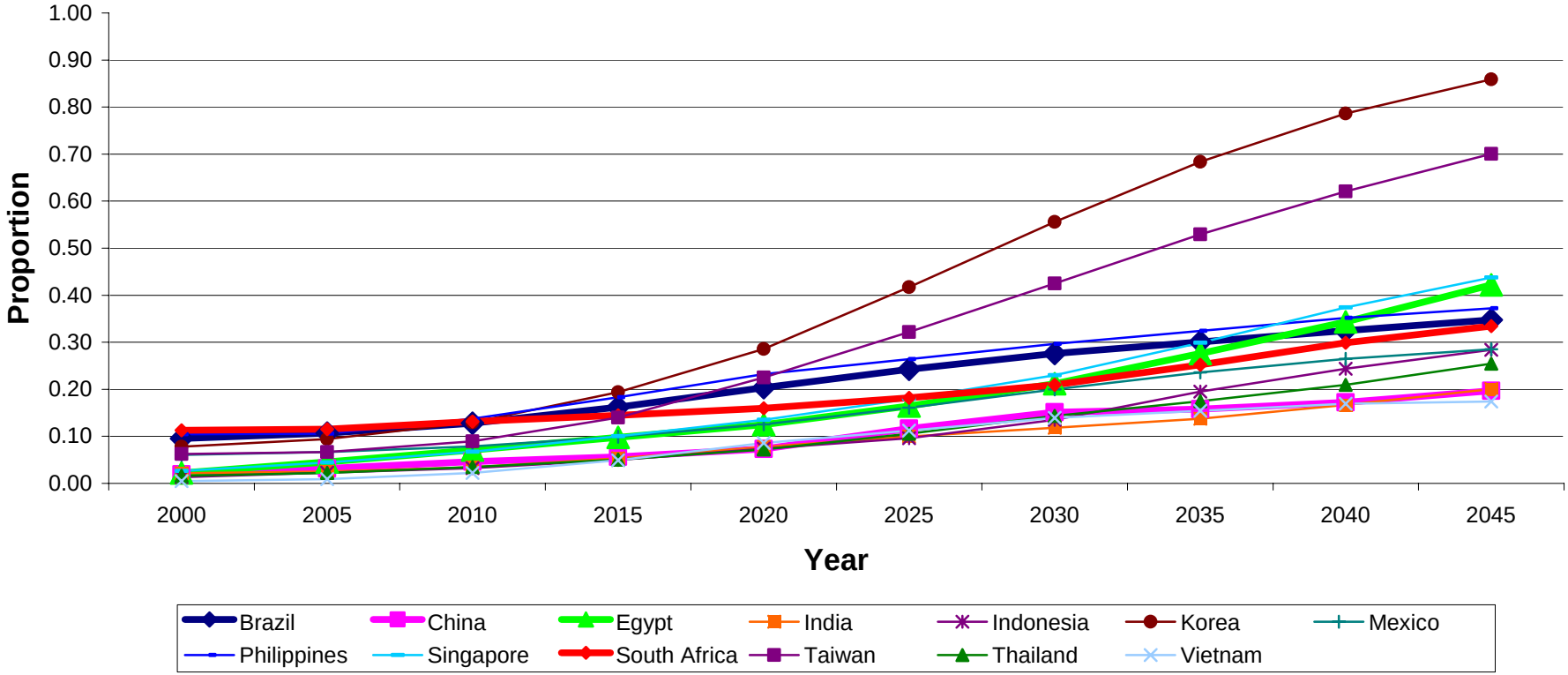


Figure 6. Projection of Proportion of Males Age 65+ with Primary or Lower Education

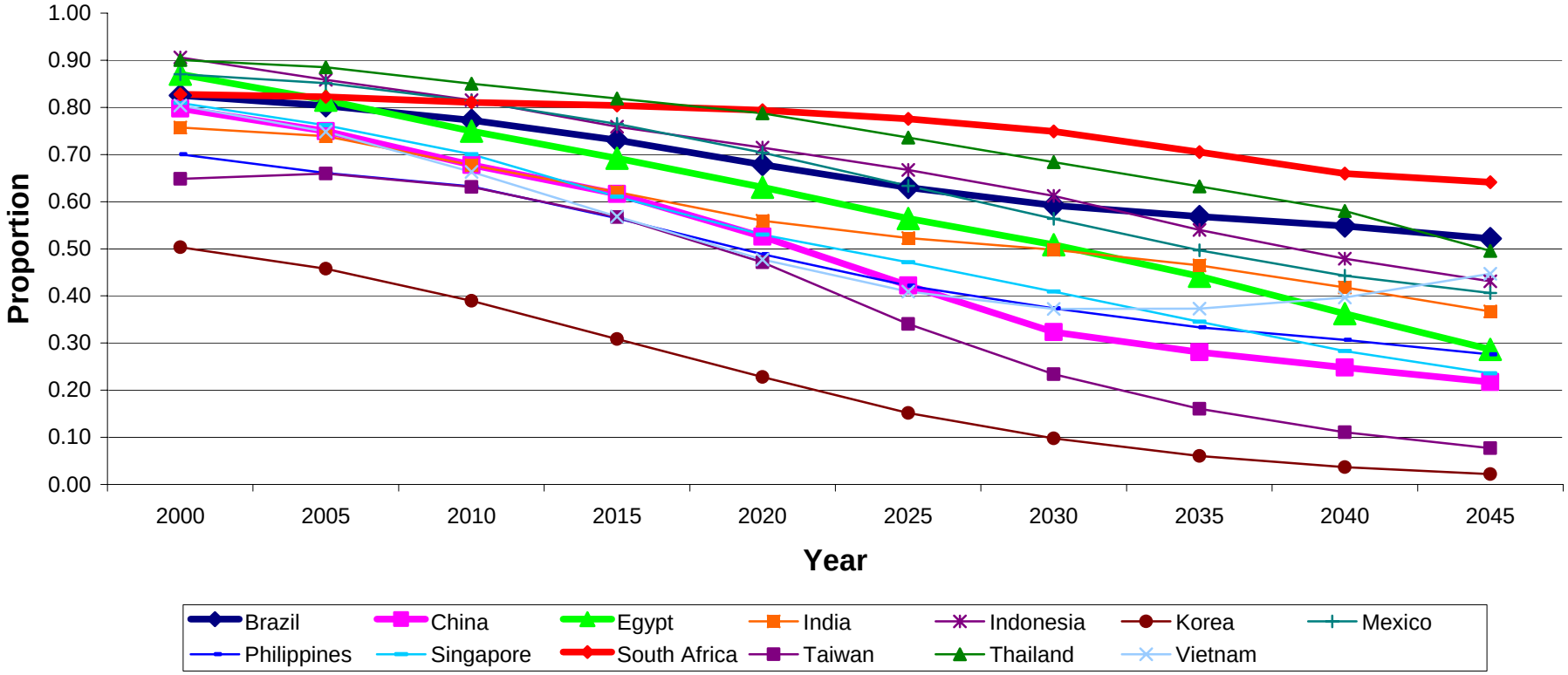


Figure 7. Projection of Proportion of Females Age 65+ with Primary or Lower Education

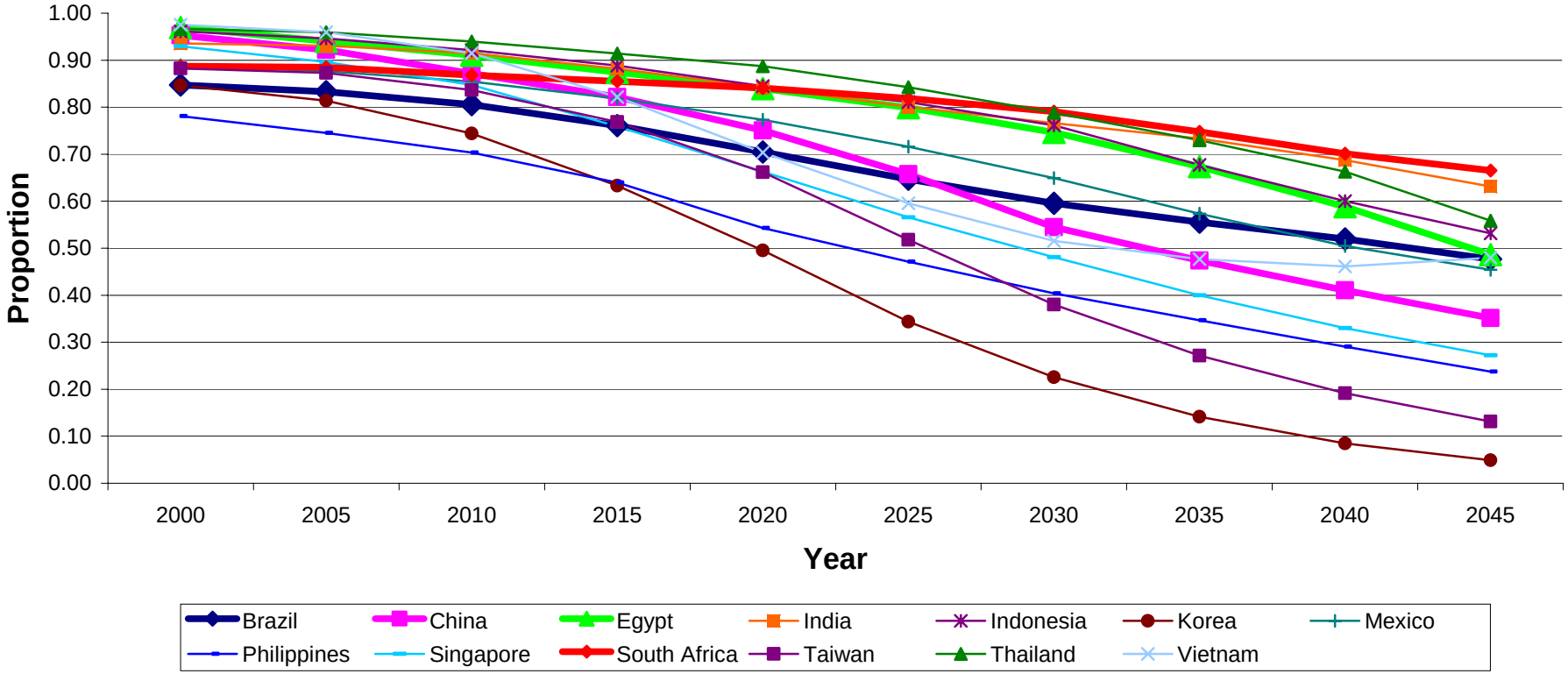


Figure 8 provides some insights into the first question. Making use of the full educational distributions projected for 2040, we calculate the index of dissimilarity between 2000 and 2040 for men and women in each country. The index of dissimilarity (D) is calculated as half of the sum of absolute differences in proportions in each level of educational attainment. The index equals zero if two groups are identically distributed over the categories and it attains its maximum value of one with no overlap, i.e., if no one category contains persons from both groups. The numerical value equals the minimum proportion of either group that would have to be shifted to achieve a D of zero. To calculate D, we used the five category education distribution shown in Table 6 from two different years: 2000 and 2040. Separate indices were calculated for men and women in each country.

On balance, the countries that will experience the greatest degree of change in the educational attainment of elderly men and women between 2000 and 2040 are Korea, China, Taiwan and Indonesia. Egyptian and Mexican men will also see substantial change, as will Singaporean and Vietnamese women. Interestingly, the educational level at the start of the interval is not closely tied to the index of dissimilarity. Taiwan and Korea both started with relatively high levels of education, at least for men, yet they exhibit among the highest degree of change. In contrast, Indonesia started at a relatively low level and China at a moderate level, and both of these countries also exhibit a high degree of change between 2000 and 2040.

Figures 9a-9d presents indices of dissimilarity for gender differences in educational attainment over time. In this case, D is calculated as one-half the sum of absolute differences in the education distributions for males and females in a given country in each of the specified years. A first point worth noting is that none of the indices are extremely large, with the largest being .40 for China in 2000. Most countries will experience a narrowing of the gender gap in education during the period.

There are four general patterns that emerge across the countries. The first is one in which gender differences in education start out fairly high, but decline substantially over the period. This pattern is found in China, Korea, Taiwan, Vietnam, and Singapore (Figure 9a). The second pattern is found in Indonesia and Thailand, for which gender differences start at a more moderate level and show a modest decline by 2045 (Figure 9b). Interestingly, in Indonesia, the gender differences actually increase slightly between 2000 and 2015, before they begin to decline. A third pattern is one in which the gender differences start out low and remain low, and this occurs in Brazil, Mexico, the Philippines, and South Africa (Figure 9c). And a fourth pattern is found in Egypt and India, for which the index is moderate at the start and increases slightly during the period (Figure 9d). Taken together, in most countries examined here, the gender difference in educational attainment, where it existed to begin with, will diminish by 2045. Thus, on balance, elderly men and women in the countries under study will have more comparable levels of education in 2045 than was the case in 2000.

The third question focuses on the degree of generational differences in education that will occur with the emergence of new cohorts of elderly and their children in the coming years. Families often pool resources so that the well-being of older persons may be greatly influenced by the educational levels of their children, as well as their own attainments. Children with more education will often have more material resources, as well as more knowledge about health matters and health care that can directly benefit their parents (Zimmer et al., 2002). On the other hand, educational differentials within a family can work to an older person's disadvantage. Children who gain more education may be more likely to pursue new jobs in new locations, and even when children remain at home, differentials in education may heighten cultural divisions between sons and parents or daughters-in-law and mothers-in-law about appropriate styles of child rearing and related issues. Newspaper stories in developing countries where there have been noticeable gains in educational attainment in recent years, often play up these generational clashes, and there is also evidence of this in the focus group discussions in the four countries which were part of the aging in Asia project (Knodel, 1995; Hermalin, 2002).

Figure 8. Index of Dissimilarity for Educational Distributions between 2000 and 2040 for Persons Age 65+, by Sex

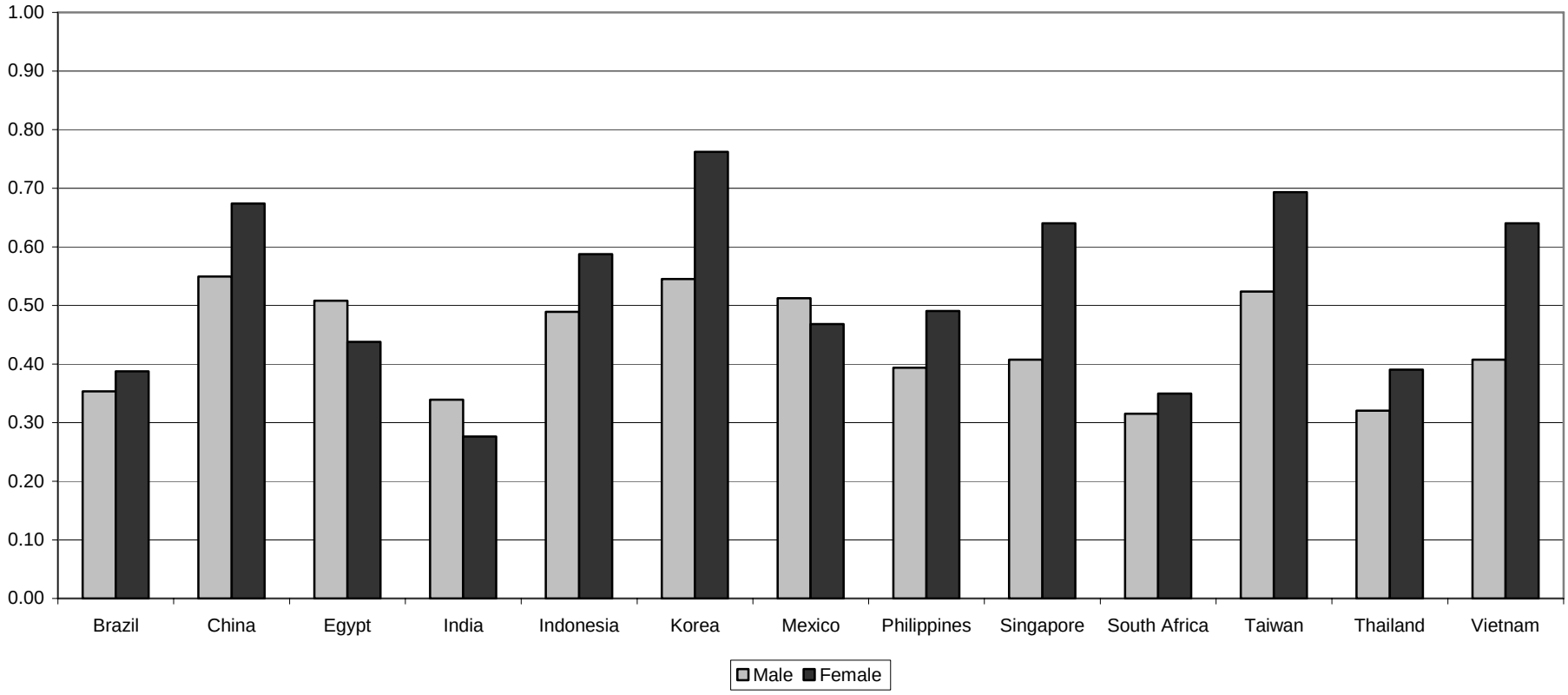


Figure 9. Index of Dissimilarity for Educational Distributions between Men and Women Age 65+

Figure 9a

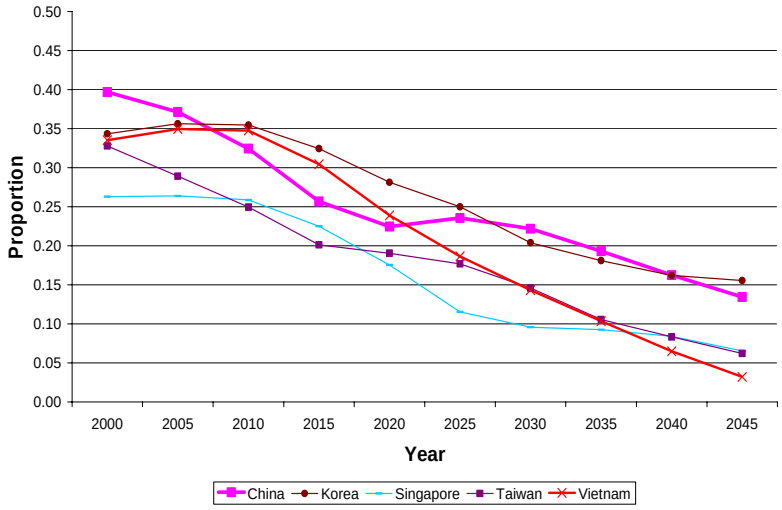


Figure 9b

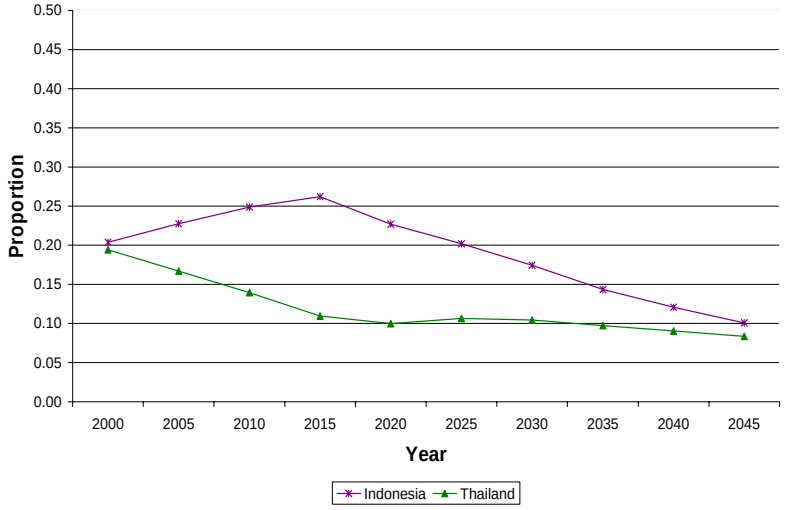


Figure 9c

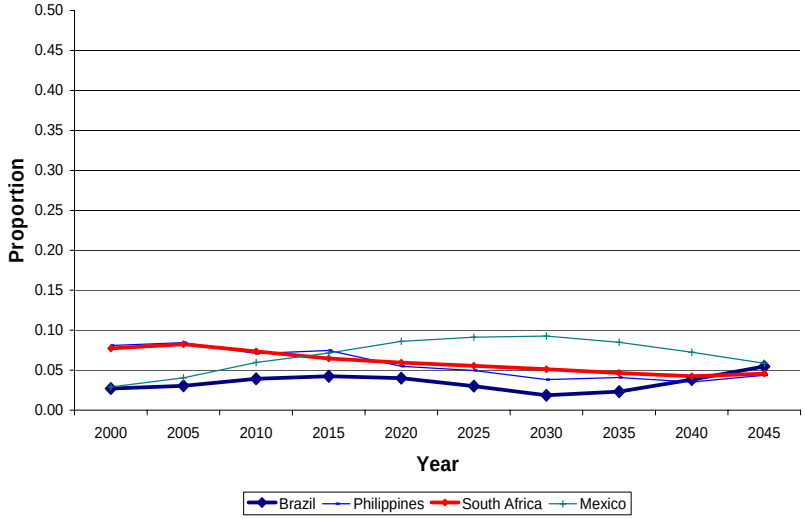


Figure 9d

To assess the extent to which this may occur, Table 7 shows the joint distribution of probabilities of having a secondary school education or higher for hypothetical pairs of 45-49 year olds and those 65 or older, separately for males and females, for each of the 13 countries at two points in time. The probabilities are derived from the educational distributions of the younger and older age groups at each date, and assume that a random person selected from one age group is paired with a random person for the other age group. It should be stressed that educational pairings within a family are not random, and that the educational level of the parent often influences that of the child. But the distribution of probabilities shown should serve to demonstrate in broad terms the generational gaps in education and how they will evolve in the coming years across the 13 countries.

Comparing older and younger males in 2000 (top left panel of Table 7), the probability that neither would have a secondary or higher education was nearly 60 percent or more in 11 of the 13 countries, demonstrating the recency of the growth in educational attainment. Only Korea and Taiwan differ from this pattern, with probabilities of 22 and 39 percent, respectively, that neither the middle aged "son" nor the "father" would have a secondary or higher education. If anyone in the pairing has achieved secondary education, it is most frequently the "son." For Taiwan and Korea, this occurs about 40 percent of the time; between 20 and 30 percent of the time in Brazil, India, the Philippines, and Singapore; and less than 20 percent of the time in the remaining six countries, with the Mexican probability sharply lower than the others.

By 2025 the educational profile improves, but considerable variation remains. In eight countries, the probability that neither the younger nor older male has secondary or higher education is still quite high, at close to 50 percent or more, while in Korea and Taiwan, this probability drops to 1 and 11 percent respectively. Major changes are observed for Egypt and Singapore, where the high probabilities of 2000 drop to 25 and 30 percent respectively in 2025. Concomitant with these shifts, the probability that both the "father" and "son" will have a secondary or higher education becomes noticeable in several countries, reaching 64 percent in Korea, 37 percent in Taiwan, 22 percent in Egypt, 16 percent in Singapore, and 12 percent in India. But it remains below 10 percent in the remaining eight countries

The joint probability distribution for younger and older females, shown in the bottom panel of Table 7, generally resembles the pattern for males in each country, but the implied levels of education are lower. As of 2000, neither the older nor younger women would be expected to have a secondary or higher education more than 60 percent of the time in all but one country, and the gains between 2000 and 2025 are less pronounced for women compared to men in most of the countries.

POSITIONING COUNTRIES AND COHORTS BY MULTIPLE OUTCOMES

To this point we have focused on individual indicators without taking into account the potential interrelationships between them. We now examine how a country's ranking on one of the projected characteristics coincides with its ranking on another socio-demographic outcome. One would expect some of the ongoing changes to be interrelated. For example, both social and economic changes and family planning efforts have been important factors in fertility decline in many developing countries. Often early success in economic development has been accompanied by increased access to schooling and by early declines in fertility, but the periods of onset and the trajectories of change vary across countries.

These variations are reflected in Table 8, which locates the countries according to their level of CEB and their educational attainment for women age 65+ in 2035. One would expect to find countries in the lower left cell (low CEB, signaling rapid fertility decline, and high educational attainment) and in the upper right cell (high CEB, reflecting slower fertility change, and modest gains in education). Taiwan and Korea are examples of the former pattern and Mexico, the latter. But somewhat surprisingly, there is considerable variation among the

other countries. China and Thailand have achieved very rapid declines in fertility through their population programs and/or policies, but their educational attainment did not advance at a level commensurate with those changes. At the other extreme is Egypt, which has been making rapid gains in educational attainment with only modest declines in fertility. The Philippines is a country where their relatively high initial educational attainment (circa 2000) has changed little, nor have they decreased their fertility as much as the other Asian countries. The other countries in the table tend to show more moderate changes in both education and fertility. Although the data are not shown here, if the CEB of women is contrasted with men's education in 2035, the configuration would be similar, but India and Indonesia would both move from the low to moderate education level. It is not surprising that no countries appear in the lower right cells-high educational attainment and high CEB. A high level of fertility is likely to strain a country's educational resources and limit its ability to expand access.

Table 7. Actual and Projected Probabilities of Completing Secondary School or Higher for Randomly Selected Pairs of Older and Younger Men and Women: 2000 and 2025

	2000				2025			
	Males 45 - 49 and Males 65 or older							
	Younger Only	Older Only	Both	Neither	Younger Only	Older Only	Both	Neither
Brazil	0.228	0.088	0.030	0.654	0.227	0.173	0.074	0.562
China	0.157	0.062	0.130	0.768	0.234	0.144	0.060	0.560
Egypt	0.305	0.070	0.036	0.588	0.402	0.133	0.219	0.246
India	0.266	0.085	0.037	0.612	0.295	0.166	0.115	0.424
Indonesia	0.187	0.041	0.010	0.761	0.309	0.123	0.078	0.490
Korea	0.440	0.114	0.230	0.216	0.321	0.023	0.644	0.012
Mexico	0.080	0.022	0.002	0.896	0.156	0.068	0.014	0.762
Philippines	0.242	0.100	0.039	0.619	0.230	0.187	0.086	0.497
Signapore	0.252	0.059	0.023	0.666	0.428	0.112	0.157	0.303
South Africa	0.179	0.135	0.037	0.649	0.283	0.142	0.082	0.493
Taiwan	0.379	0.117	0.113	0.391	0.427	0.094	0.368	0.110
Thailand	0.138	0.038	0.006	0.817	0.257	0.105	0.046	0.592
Vietnam	0.189	0.048	0.012	0.751	0.158	0.161	0.039	0.642
	2000				2025			
	Females 45 - 49 and Females 65 or older							
	Younger Only	Older Only	Both	Neither	Younger Only	Older Only	Both	Neither
Brazil	0.240	0.070	0.025	0.665	0.293	0.149	0.094	0.464
China	0.091	0.017	0.002	0.890	0.236	0.086	0.031	0.647
Egypt	0.150	0.019	0.003	0.828	0.447	0.076	0.088	0.389
India	0.108	0.020	0.002	0.870	0.233	0.074	0.026	0.667
Indonesia	0.101	0.012	0.001	0.886	0.305	0.063	0.032	0.599
Korea	0.416	0.043	0.035	0.506	0.568	0.010	0.407	0.015
Mexico	0.088	0.024	0.002	0.885	0.167	0.069	0.016	0.748
Philippines	0.257	0.075	0.030	0.638	0.294	0.159	0.105	0.442
Signapore	0.175	0.022	0.005	0.798	0.512	0.068	0.112	0.308
South Africa	0.161	0.092	0.020	0.726	0.326	0.110	0.072	0.492
Taiwan	0.330	0.041	0.022	0.607	0.579	0.048	0.273	0.100
Thailand	0.099	0.014	0.002	0.885	0.308	0.070	0.036	0.586
Vietnam	0.127	0.004	0.001	0.868	0.155	0.092	0.020	0.733

The positioning of countries on two dimensions in Table 8 suggests that a highly useful expansion of the cohort projection technique employed here is possible when one can cross-tabulate characteristics of interest by cohort and project these forward. As example, cross-tabulations of education by children ever born for women over 40 years of age are likely to reveal that the future availability of children will vary considerably by educational level, given the generally strong association of education and fertility. The necessary data for such projections are occasionally published in census reports, but they are more likely to be available through micro-data census samples or appropriate public use surveys.

Table 8: Cross-classification of CEB and Education Levels for Women Age 65+ in 2035

	CEB level		
Education level	Low	Moderate	High
Low	China, Thailand	India, Indonesia, Vietnam	Mexico
Moderate	Singapore	Brazil, South Africa	Egypt, Philippines
High	Taiwan, Korea		

The potential for this type of projection and its value in reflecting differences in fertility by education is illustrated by the data for Taiwan as of 2000 in Table 9. The figures show a sharp gradient in fertility by education and projecting these data forward would add nuance to the prior projections. Although older people in the future will have fewer children, the very low numbers of offspring are likely to be among the most educated elders who, presumably, will have better financial and other resources for obtaining the support they require. The use of such cross-tabulations will not only enrich the analysis, but the groups defined in greater detail will be more homogeneous than in the univariate distributions, reducing the risk that differential mortality will distort the projections.

Table 9: Taiwan - Average Number of CEB by Age and Select Education Levels for Ever Married Women

Age	Primary School	Senior high	Jr. College or higher
40 - 44	2.76	2.28	1.95
45 - 49	2.95	2.30	1.99
50 - 64	3.46	2.58	2.33

Recent attention has been directed to the “second demographic transition,” which refers to the rapid changes in levels of marriage, cohabitation, divorce, and fertility as well as the timing of key events observed in many industrialized countries (Lesthaeghe, 1995; Van de Kaa, 1987). McLanahan (2004) has noted that many of these changes appear to be highly differentiated by social status, and the earlier discussion of marriage and divorce trends in Asia indicates that a number of these features are appearing in the developing world. If these trends continue, they will give rise to future older cohorts who vary considerably along both demographic and socioeconomic dimensions.

DISCUSSION

The projections of several characteristics of the future elderly in 13 developing and recently industrialized countries show that they will be quite different in a number of ways, 30 to 40 years hence, from those currently at advanced ages. Educational attainment will be higher, and the number of offspring lower in all of the countries.

The nature of our projections limits our view of marital status to 2025, and at this date our estimates show only a modest increase in the proportions never married in several of the countries. But given the relatively high proportions of women now in their 30s who have never married, we are likely to see substantial increases in this characteristic among the older population by 2040.

Although changes are underway in all the countries examined, considerable variation in the characteristics of the future elderly will remain. In terms of education, over 90 percent of older Korean men can expect to have an upper secondary or higher level of attainment in 2045, whereas this will be true of less than 20 percent of the older men in Mexico. Similarly, the numbers of children ever born, though reduced in all countries, will vary among women aged 75 or older from less than 2 children in China to 4.5 children in Egypt in 2045. The six countries with the lowest numbers of CEB in 2045 among women aged 75 or older are all in East or Southeast Asia; however, another Southeast Asian country--the Philippines--is among the highest on this measure.

The differences between current and expected levels of education for men versus women illustrate that countries can change policies and allocations to reduce gender differences while widening opportunities. Korea and Taiwan display the most rapid gains in men's education but the gains for women are even more pronounced in these countries so that the index of dissimilarity by gender decreases sharply between 2000 and 2045. In Egypt, the rapid gains for men in secondary and higher education outstrip those for women sufficiently, so that the index increases moderately over the period. In terms of economic development, it is worth stressing that the educational levels we observe for the older population in 2045 are only the arithmetic reflection of current educational levels. Those countries that have been able to advance educational opportunities over the last 25 years have the benefit not only of a more educated young work force today but these gains persist throughout the life cycle so that their future older populations are likely to be healthier and more self sufficient on several dimensions than countries where educational gains have been delayed.

The interrelationships among the socio-demographic characteristics of interest, like fertility and education, and the potentially rapid changes underway in marriage, divorce and childbearing levels, often referred to as the second demographic transition, should alert policymakers that they will be need to be attentive not only to average levels of key traits among the elderly, but to the needs of special groups that may arise in significant numbers, like the divorced elderly with few children available, or those who have never married. In addition there may be important variation among the elderly by region or ethnicity, characteristics that could not be explored here.

The socio-demographic changes in the characteristics of the older population provide policymakers with useful information as they fashion programs and policies for the future. But there is no one-to-one correspondence between the projected changes and the policies to be adopted. As example, although the educational level of the future elderly may be anticipated with a fair degree of accuracy, the *meaning* of these changes depends on other factors. To what extent will those with higher levels of education in the coming years be able to secure jobs commensurate with their education, so that they can accumulate the resources and knowledge that will stand them in good stead when they are older. Likewise, as noted earlier, smaller numbers of children may not in itself be an impediment for effective contact and support with older parents, given the

ability to be in frequent contact and to arrange for services at a distance. Much will depend on the preferences and constraints of each generation as well as the effectiveness of policies in place that encourage family interactions while recognizing the nature of ongoing social changes.

As often noted, "demography is not destiny," but it is a significant component of the challenges and opportunities facing a society as it attempts to advance its welfare. Ascertaining the characteristics of the older population in the years ahead does not provide a detailed blueprint for future action, but observing the levels and interrelationships of key socio-demographic measures does provide valuable clues to policymakers on how best to position evolving policies and programs that impinge on their aging populations.

SOURCES

The basic data consisted of published or online census tables for the year 2000 (or an adjoining year) for education, marital status, and children ever born. In some cases, tabulations were obtained from micro-census data if the needed table was not published. When census data were not available (often the case for children ever born) we relied on the Demographic and Health Surveys (both published and raw data) to generate the needed inputs. For all countries except Taiwan, the census and DHS data were supplemented by the population projections from the United Nations, available as downloadable EXCEL files.

APPENDIX

Preston's focus is on the changing educational distributions and on the number of offspring of cohorts of the oldest old (those aged 85 to 89) in the United States. Using the relatively large differentials in mortality by education for women observed by Kitagawa and Hauser (1973), Preston demonstrates that differential mortality would result in an increase in mean schooling of 0.3 years for the U.S. cohort of women aged 50 -54 in 1980 as they advance to ages 85-89 in 2015. But it should be noted that the differences in educational distribution with and without an assumption of differential mortality are quite small in relation to the sharp gain in education observed using either distribution, between this cohort and those aged 85-89 in 1980. This is shown in the data in the table below taken from Preston (1992).

The index of dissimilarity between the two distributions projected to 2015 is only .044, while the indexes between the actual educational distribution in 1980 and the projected distributions are .389 based on no mortality differential and 41.0 based on differential mortality. This demonstrates the considerable change observed using either projection and, in contrast, the small amount of difference between the two projections.

Years of Schooling	Actual 1980	1980, 50-54 years old Cohort Projected to 2015:	
		No Differential Mortality	With Differential Mortality
0-8	54.7%	15.8%	13.7%
H.S. 1-3	13.8	20.0	19.2
H.S. 4	17.6	41.2	39.7
College 1-3	8.5	13.1	15.6
College 4	3.8	5.6	6.7
College 5+	1.6	4.3	5.1
Total	100.0%	100.0%	100.0%

Christenson and Hermalin (1991) make use of differential life tables by level of urbanization in Taiwan to simulate likely differences in mortality by education, which were not available. They show that for the 1980 life tables, the cumulative proportion of men surviving in the five largest cities (the higher education areas) does not exceed that of the townships (the low education areas) by more than five percentage points for any age group during the adult life span. In addition, they simulate the educational projections assuming an even sharper educational differential than that actually observed, and as with the Preston distributions shown above, they find very little difference in the projected educational levels, with and without a differential mortality assumption. The data below show the actual and projected proportion of older men (age 60+) at two educational levels, with and without differential mortality assumptions:

Education Level	Actual 1980	Projected to 2015	
		No Differential Mortality	With Differential Mortality
Less than primary	.525	.100	.089
Upper secondary or more	.135	.341	.371

NOTES

[1] For four of the countries examined in this paper – South Africa, the Philippines, Brazil and Mexico – Census or other data sources differentiated consensual unions and/or cohabitation as a marital status. It was not possible to make this differentiation in the other countries. Since our focus is on women and men age 65+ (Table 3) or age 40+ (Figures 1-2), it is plausible that the cohabitation reflects either a long-term union or an arrangement following the dissolution of a prior marriage. For this reason, consensual unions and cohabitation were combined with the category of "married" in Table 3, and were excluded from the never-married category for projections in Figures 1 and 2.

[2] Goldstein and Kenny's (2001) projections of the proportions ever married for the female cohorts born from 1946 through 1965 (based on detailed marriage histories collected in 1995) show only a slight decline for the younger cohorts as against the older cohorts and in comparison with the observed trends for cohorts born prior to 1946. This trend is also confirmed by Schoen and Standish (2001); whether these projections hold up remains to be seen. Recent reports for the United States show a continued downturn. For example, for women 35 to 44 in 2003, 13 percent were never married as against 5 percent for this age group in 1970; likewise, for those 30 to 34, the corresponding figures are 23 percent vs. 6 percent (Fields, 2004).

[3] This limitation also produces the curious situation that one can obtain estimates of CEB for those 65 or older in the future, but cannot observe this characteristic for those currently at older ages, limiting insights into the changes that will be occurring. We encourage those who have input into the selection of census items to include a question on children ever born for women of all ages (not just those who are currently of childbearing age), as it is a valuable tool for studying various aspects of population aging, as well as dimensions of fertility.

[4] Given any tendency to underreport children who died shortly after birth, the differences may even be larger. See Weinstein et al. (2002) on the accuracy of CEB reporting in censuses.

[5] The more modest decline for South Africa may be attributable to the fact that we are unable to differentiate primary from lower secondary education. Thus, if there is an upward shift in the educational distribution between primary and lower secondary education over this period, our projections do not capture this.

REFERENCES

BIDDLECOM, A., CHAYOVAN, N. & OFSTEDAL, M.B. (2002) Intergenerational support and transfers, in Hermalin, A.I. (ed.) *The Well-Being of the Elderly in Asia: A Four Country Comparative Study*, University of Michigan Press, Ann Arbor, pp. 185-229.

BYUN, W.-S. (2004) Marital status, in Kim, D.-S. & Kim, C.-S. (eds.) *The Population of Korea*, Korea National Statistical Office, Daejeon, Korea.

CASTERLINE, J.B., WILLIAMS, L., HERMALIN, A.I., CHANG, M.-C., CHAYOVAN, N., CHEUNG, P., DOMINGO, L., KNODEL, J. & OFSTEDAL, M.B. (1991) 'Differences in the living arrangements of the elderly in four Asian countries: The interplay of constraints and preferences', *Comparative Study of the Elderly in Asia Report* No. 91-10, Population Studies Center, University of Michigan, Ann Arbor.

CENTRAL INTELLIGENCE AGENCY (2002) *The World Factbook*, Central Intelligence Agency, Washington D.C.

CHRISTENSON, B.A. & HERMALIN, A.I. (1991) 'Comparative analysis of the changing educational composition of the elderly population in five Asian countries: A preliminary report', *Comparative Study of the Elderly in Asia Report* No. 91-11, Population Studies Center, University of Michigan, Ann Arbor.

COALE, A.J. & DEMENY, P. (1966) *Regional Model Life Tables and Stable Population*, Princeton University Press, Princeton, New Jersey.

DAVANZO, J. & CHAN, A. (1994) 'Living arrangements of older Malaysians: Who coresides with their adult children', *Demography,* vol. 31 no. 1, pp. 95-113.

FIELDS, J. (2004) 'America's families and living arrangements: 2003', *Current Population Reports, Population Characteristics',* US Census Bureau, Washington D.C. , pp. 20-553.

FRIEDMAN, J., KNODEL, J., CUONG, B.-T., & ANH, S. (2003) 'Gender dimensions of support for elderly in Vietnam', *Research on Aging,* vol. 25 no. 6, pp. 587-630.

GLASER, K.F., AGREE, E.A., COSTENBADER, E., CAMARGO, A. & TRENCH, B. (In press) 'The effects of fertility decline on family structure', *Journal of Aging and Health.*

GOLDSTEIN, J.R. & KENNEY, C.T. (2001) 'Marriage delayed or marriage forgone? New cohort forecasts of first marriage for U.S. women', *American Sociological Review,* vol. 66 no. 4, pp. 506-519.

GRUNDY, E. & GLASER, K. (2000) 'Socio-demographic differences in the onset and progression of disability in early old age: A longitudinal study', *Age and Ageing,* vol. 29, pp. 149-157.

HERMALIN, A.I. (2001) 'Ageing in Asia: Facing the crossroads', *Hallym International Journal of Aging,* vol. 3 no. 2, pp. 133-167.

HERMALIN, A.I. (2002) Making the choices: Policies and research for the coming years, in Hermalin, A.I. (ed.) *The Well-Being of the Elderly in Asia: A Four Country Comparative Study*, University of Michigan Press, Ann Arbor, pp. 543-581.

HERMALIN, A.I. & CHRISTENSON, B.A. (1992) 'Census-based approaches for studying aggregate changes in characteristics of the elderly', *Asian and Pacific Population Forum,* vol. 6 no. 2, pp. 35-67.

HERMALIN, A.I., OFSTEDAL, M.B. & MEHTA, K. (2002) The vulnerable and their potential disadvantages, in Hermalin, A.I. (ed.) *The Well-Being of the Elderly in Asia: A Four Country Comparative Study*, University of Michigan Press, Ann Arbor, pp. 461-518.

HERMALIN, A. & YANG, L.-S. (2004) 'Levels of support from children in Taiwan: Expectations versus reality, 1965-99', *Population and Development Review*, vol. 30 no. 3, pp. 417-448.

JONES, G.W. (2004) Not 'When to marry' but 'Whether to marry': The changing context of marriage decisions in east and southeast Asia, in Jones, G.W. & Ramdas, R.K., (eds.) *(Un)tying the knot, ideal and reality in Asian marriage,* Asia Research Institute, Singapore.

KITAGAWA, E.M. & HAUSER, P.M. (1973) *Differential Mortality in the United States: A Study in Socioeconomic Epidemiology*, Harvard University Press, Cambridge, MA.

KNODEL, J. (ed.) (1995) 'Focus group research on the living arrangements of elderly in Asia', *Journal of Cross-Cultural Gerontology,* vol. 10 no. 1-2.

LESTHAEGHE, R. (1995) The second demographic transition in western countries: An interpretation, in Mason, K.O. & Jensen, A.-M., (eds.) *Gender and Family Change in Industrialized Countries,* Clarendon Press, Oxford.

LLOYD, C.B. (2005) Growing up global: The changing transitions to adulthood in developing countries, in *A Report of the National Research Council Panel on Transitions to Adulthood in Developing Countries*, National Academies Press, Washington D.C.

MCLANAHAN, S. (2004) 'Diverging destinies: How children are faring under the second demographic transition', *Demography,* vol. 41 no. 4, pp. 607-628.

OFSTEDAL, M.B., CHAN. ANGELIQUE , CHAYOVAN, N., CHUANG, Y.-L., PEREZ, A., MEHTA, K. & HERMALIN, A.I. (2002) Policies and programs in place and under development, in Hermalin, A.I. (ed.) *The Well-Being of the Elderly in Asia: A Four Country Comparative Study*, University of Michigan Press, Ann Arbor, pp. 65-99.

OFSTEDAL, M.B., KNODEL, J. & CHAYOVAN, N. (1999) 'Intergenerational support and gender: A comparison of four Asian countries', *Southeast Asian Journal of Social Sciences,* vol. 27, pp. 21-42.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVEOPMENT (1998) *Maintaining Prosperity in an Ageing Society*, OECD, Paris.

PHILLIPS, D.R. (ed.) (2000) *Ageing in the Asia-Pacific Region: Issues, Policies and Future Trends*, Routledge, London.

PRESTON, S.H. (1992) Cohort succession and the future of the oldest old, in Suzman, R., Willis, D.P. & Manton, K.G., (eds.) *The Oldest Old*, Oxford Press, New York.

RAYMO, J.M., IWASAWA, M. & BUMPASS, L. (2004) 'Marital dissolution in Japan: Recent trends and patterns', *Demographic Research,* vol. 11, pp. 395-419.

REPUBLIC OF CHINA, DEPARTMENT OF HEALTH (2001) *2000 Republic of China Health and Vital Statistics, Volume I,* Department of Health, Taipei.

REPUBLIC OF CHINA, DIRECTORATE-GENERAL OF THE BUDGET, ACCOUNTING AND STATISTICS (2001) *Report on the Manpower Utilization Survey in Taiwan Area, Republic of China, 2001*, Directorate-General of the Budget, Accounting and Statistics, Executive Yuan, Taipei.

REPUBLIC OF CHINA, DIRECTORATE-GENERAL OF THE BUDGET, ACCOUNTING AND STATISTICS (2004) *Statistical Yearbook of the Republic of China 2004*, Directorate-General of the Budget, Accounting and Statistics, Executive Yuan, Taipei.

REPUBLIC OF CHINA, MINISTRY OF INTERIOR, Ministry of Interior website.

REPUBLIC OF CHINA, MINISTRY OF INTERIOR (2001) *2000 Taiwan-Fukien Demographic Fact Book*, Ministry of the Interior, Taipei.

REPUBLIC OF CHINA, MINISTRY OF INTERIOR (2003) *2002 Taiwan-Fukien Demographic Fact Book*, Ministry of Interior, Taipei.

SCHOEN, R. & STANDISH, N. (2001) 'The retrenchment of marriage: Results from marital status life tables for the United States, 1995', *Population and Development Review,* vol. 27 no. 3, pp. 553-563.

SINGAPORE MINISTRY OF EDUCATION (2005) *Education Statistics Digest, 2004*, Ministry of Education, Singapore.

UNITED NATIONS (2002) *World Population Ageing 1950 - 2050*, ST/ESA/SERA/207, United Nations, New York.

UNITED NATIONS (2003) *World Population Prospects: The 2002 Revision*, ST/ESA/SERA/222, United Nations, New York.

UNITED NATIONS (2004) 'Policy responses to population decline and ageing', *Population Bulletin of the United Nations.*

UNITED NATIONS (2005) *Living arrangements of older persons around the world*, ST/ESA/SER.A/240, United Nations, New York.

UNITED NATIONS DEVELOPMENT PROGRAMME (2002) 'Deepening democracy in a fragmented world', *Human Development Report 2002*, Oxford University Press, New York.

U.S. CENSUS BUREAU INTERNATIONAL PROGRAM CENTER, International Data Base.

VAN DE KAA, D. (1987) 'Europe's second demographic transition', *Population Bulletin,* vol. 42 no. 1.

WEINSTEIN, M., HERMALIN, A., CHANG, M.-C. & GREENFIELD, D. (2002) 'Census/survey consistency of reports of childbearing: The case of Taiwan', *Genus,* vol. LVI no. 1-2, pp. 259-280.

THE WORLD BANK (1994) *Averting the Old Age Crisis*, Oxford University Press, New York.

THE WORLD BANK (2002) *World Development Indicators*, The World Bank, Washington D.C.

THE WORLD BANK (2003) *World Development Indicators,* The World Bank, Washington D.C.

ZENG, Y., SCHULTZ, T.P., DEMING, W. & DANAN, G. (2002) 'Association of divorce with socio-economic covariates in China', *Demographic Research*, vol. 7 no. 11, pp. 407-432.

ZENG, Y., STALLARD, E. & WANG, Z. (2004) 'Computing time-varying sex-age-specific rates of marriage/union formation and dissolution in family household projection or simulation', *Demographic Research*, vol. 11 no. 10, pp. 264-299.

ZENG, Y. & WU, D. (2000) 'Regional analysis of divorce in China since 1980', *Demography,* vol. 37 no. 2, pp. 215-219.

ZIMMER, Z., HERMALIN, A.I. & LIN, H.-S. (2002) 'Whose education counts? The added impact of adult-child education on physical functioning of older Taiwanese', *Journal of Gerontology: Social Sciences*, vol. 57B no. 1, pp. S23 - S32.

ZIMMER, Z. & HOUSE, J.S. (2003) 'Education, income, and functional limitation transitions among American adults: Contrasting onset and progression', *International Journal of Epidemiology,* vol. 32, pp. 1089-1097.

ZIMMER, Z., LIU, X., HERMALIN, A. & CHUANG, Y.L. (1998) 'Educational attainment and transitions in functional status among older Taiwanese', *Demography*, vol. 35, pp. 361-375.

Comparative Study of the Elderly in Asia

This series of research reports deals with the status of the elderly in several Asian countries. The series was initiated in 1989 under a broad project sponsored by the U.S. National Institute on Aging (Grant No. AG07637) and directed by Albert I. Hermalin. This particular report presents research that was conducted under a parallel R01 grant from the National Institute on Aging, A Comparative Study of Aging and Health in Asia (AG20063-01 and AG20072-01). This is a multi-country collaborative study whose overall goal is to describe and analyze health transitions and health care utilization patterns in four Asian countries undergoing rapid population aging and social and economic change.

The project uses existing longitudinal survey data from five Asian settings: Taiwan, the Philippines, Singapore, Indonesia, and China. Organizations collaborating in this research include the Population Council, New York; the Population Institute, University of the Philippines; the Department of Sociology, National University of Singapore; the Bureau of Health Promotion, Department of Health, Taichung, Taiwan; the Beijing Geriatric Clinical and Research Center, Beijing, China; and the Nihon University Population Research Institute, Tokyo, Japan.

For additional information on this research project, please visit the project website: http://aha.psc.isr.umich.edu or contact the Principal Investigator: Mary Beth Ofstedal, Population Studies Center, University of Michigan, PO Box 1248, Ann Arbor, MI 48106-1248, USA.

Copyright