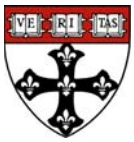

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Demographic Change and Economic Growth in Asia

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Abstract

In 1994 the World Bank called East Asia's strong economic growth performance a "miracle". Trade openness, high savings rates, human capital accumulation, and macroeconomic policy only explained part of this growth performance; the remainder was left unexplained. Research in the ensuing years has shown that when demographic change in East Asia is taken into account, the miracle is explained. These earlier studies used the 1960-1990 sample period, but since 1990 Asia has undergone major economic reforms in response to financial crises and other factors. Moreover, rapid demographic change has continued in East Asia, and in Asia more generally, with fertility rates falling below replacement in many of these countries. In this paper, we re-examine the role of the demographic transition in explaining cross-country differences in economic growth, with a particular focus on East Asia. With the working-age share beginning to decline in many Asian countries, innovation and flexibility in the labor market will be required for them to continue to enjoy the high rates of economic growth they have experienced to date.

1. Introduction

Economic performance throughout the Asian region was among the strongest in the world over the 1960-1990 period (Figure 2). Within Asia, East Asian countries such as Japan, the Republic of Korea, and China experienced some of the highest real growth rates of income per capita in the world. In the ten-year period 1960-1970 Japan experienced a 9 percent annual average income per capita growth rate. In the Republic of Korea economic growth rates averaged 7.4 percent over 1980-1990 period, and in the same ten-year period China experienced average annual growth rates of 8.9 percent.

In the late 1990s, economists turned their attention to the impressive performance of East Asian, and newly industrialized, countries and summarized economic growth throughout the region as the East Asian Miracle. Factors such as expanding trade openness, high savings rates, a focus on education, and effective macroeconomic policy were later identified as key factors driving the East Asian growth miracle (World Bank 1993; Kim and Lau 1994; Krugman 1994; Leipziger and Thomas 1994; Ranis 1995; Stiglitz 1996).

In the last decade, further analysis has shown that economic growth performance of East Asia was no miracle at all, and to a large part was explained by demographic factors. The role of the change in age structure (Bloom and Williamson 1998) has been shown to have had a significant effect on economic growth throughout Asia between 1960 and 1990. A rise in working-age share, brought about by a decline in the fertility rate, increases income per capita as output per worker remains unchanged but the number of youth dependents declines. The rise in the working-age share in Asia created this accounting effect, but it also brought with it behavioral changes. Female labor force participation increased as fertility declined (Bloom, Canning, Fink and Finlay 2007), savings increased as life expectancy increased (Lee, Mason and Miller 2000; Bloom, Canning, Mansfield and Moore 2007), and consequently investment increased.

The literature to date has focused its analysis on the years 1960-1990–the "miracle" period. But since 1990, economic growth throughout Asia has been more rocky and many Asian countries have been hindered by financial crises and slow technological change. But throughout the region demographic change continues: fertility rates continue to fall and are below replacement in many Asian countries, and life expectancy is steadily increasing.

In this paper, we examine the robustness of demographic factors in explaining economic growth throughout Asia, with particular attention to East Asia.

Regression analysis indicates that through 2005, demographic factors continue to explain economic growth performance in East Asia. The demographic transition in South Central Asia lags that in East Asia (see figures in Tables 3), but analysis of our updated sample indicates that demographic factors can also explain part of the economic growth performance in South Central Asia.

This re-examination of the role of demographic factors reaffirms and highlights their vital role in explaining economic growth in East Asia. While the nature of growth between 1960 and 1990 and then 1990 to 2005 appears very different, demographic factors remain key in explaining economic growth in East Asia. In the late 1970s, China began its turn toward market mechanism. Japan continued its post-WWII effort and effective government policies assisted in moving the economy through the two oil shocks of the 1970s. The Republic of Korea was quick to adopt new technologies as it began to restructure and rebuild following its war. From 1990 to 2005, however, the East Asian economies have entered a more mature era. Japan suffered a financial/housing crisis that depressed the economy throughout the 1990s. China stepped into a new era of economic growth enjoying close to 10% annual average growth rates.

The stabilization of the fertility rate at below-replacement levels in East Asian countries (and forecasted for South East Asia and South Asia) will imply a decline in the working-age share in the future and an increase in the old-age share. Questions arise over

the sustainability of economic growth in Asia with this growing fraction of old-age individuals, and particularly in East Asia in the short to medium term. In theory, retirement and reliance on institutional support (viability of health care institutions, social security), imply that old-age individuals are dependent on support from the current, smaller, working-age group.

In this paper we illustrate how the demographic transition is slowing in East Asia, peaking in South East Asia, and is yet to reach its pinnacle in South Asia (see figures in Table 3). We estimate the economic growth effects of demographic characteristics and highlight these effects in East Asia, South East Asia, and South Asia, following work by Bloom, Canning, and Malaney (2000) and Bloom and Canning (2008). Data cover the period 1960-2005; we use income data from the Penn World Tables 6.2 (Heston, Summers and Aten 2006) and demographic data from the World Bank (World Bank 2007). Our analysis of the data shows that a decline in working-age share has a negative effect on economic growth. This result was found for the 1965-1990 period (Bloom, Canning and Malaney 2000), and remains robust to the expansion of the sample period to 2005. However, just as behavior changes came with the increase in the working-age share in the past, behavior changes can be expected to come with the decrease in the working-age share in the future. Factors such as rising female labor force participation, old-age labor supply, and inward migration (if these individuals are predominantly of working age) can offset the negative effects of the forecasted decline in working-age share.

Throughout Asia, however, old-age labor force participation has declined and outward migration has increased. If these trends in old-age participation rates and net migration continue as they have in the past, these effects will compound the negative effect of the decline in the working-age share. In many Asian countries, the normal retirement age is increasing, but changes to this mandate are moving slowly relative to the growth in the 65+ population (and such mandates only affect the subset of individuals in the formal labor force), meaning that old-age participation rates are declining. Moreover, outward migration from Asian countries will reduce the number of individuals in their working age even further.

Female labor force participation has increased, however, and with rates still between 35 percent (Pakistan) and 80 percent (China) there is scope for further increases in many Asian countries. Increased trade openness, improvements in institutional quality, and a greater focus research and development also present opportunities for Asian countries to maintain the economic growth rates of the past 15 years.

The impressive economic growth rates throughout Asia in the past can in part be attributed to the impressive flexibility towards change that is exhibited throughout the region. A keen work ethic and the motivation to advance have meant that many Asian countries have been able to absorb the increasing working-age population into productive labor. In the future, the decline in the working-age share will present new challenges for the Asian region if these countries want to maintain economic growth rates currently enjoyed. Creativity and flexibility of governments, institutions, and individuals throughout the Asian region will be called upon again, as the demographic transition brings these countries into a new era of a growing old-age population shares.

Such flexibility may come in the form of policies to encourage female labor force participation, dismantling retirement incentives to keep people in the workforce beyond the age of 65, and the promotion of inward migration. If Asia can exhibit the same willingness for change over these domains as it has in the past in its actions to spur economic growth, then the negative effects of the decline in the working-age share have the potential to be mitigated.

This paper is organized as follows. In Section 2 we outline the descriptive analysis and illustrate demographic facts and trends through from 1950 and projections out to 2050. In Section 3 we construct a model that demonstrates the relationship between economic growth and age structure. In Section 4 we describe the data sources used, and in Section 5 we estimate the model derived in Section 3. In Section 6 we project the contribution of future shifts in working-age and population growth rates on economic

growth throughout Asia. In Section 7 we discuss the results and highlight the continuing importance of demographic factors in shaping economic performance.

2. Demographic Facts and Trends Throughout Asia

The demographic transition, the shift from high birth and death rates to a situation of low birth and death rates, has been occurring at a varying pace throughout Asia. A high fertility/high mortality environment is representative of an age structure that has a proportionally high number of youth, fewer working-age, and very few old-age individuals in the population. In 1950, all throughout Asia, this age-structure profile was the norm. Subsequent changes in fertility and mortality rates led to heterogeneity in age-structure shifts throughout the region.

In East Asia, the total fertility rate fell from around 5.5 in 1965 to 2.2 in 1985. By 1990, the East Asian regional average total fertility rate was below 2. The rapid decline in the total fertility rate is automatically accompanied by an increase in the working-age share, and in East Asia between 1965 and 1985 the ratio of the working-age population to the non-working-age population increased from 1.3 to 2.1. This rapid increase in working-age share stems from the dominance of the decline in the number of dependents due to the fall in fertility over the increase in the number of dependents due to the rise in life expectancy.

In South East Asia, the fertility rate also declined rapidly between 1960 and 1990 from a regional average of 6.0 in 1960 to 3.0 in 1990. In South Central Asia, the decline was evident but less pronounced: from 6.0 in 1960 to 4.0 in 1990. Throughout Asia the demographic transition has been characterized, as it must be, by a rise in the working-age share.

Using the population projections from World Population Prospects (United Nations 2007) to 2050, we see that the stabilization of the total fertility rate is accompanied by a peaking of the ratio of working-age to non-working-age population. In

East Asia the fertility rate has stabilized below replacement rate, and in South East Asia and South Central Asia the fertility rate is predicted to stabilize 2.1 in 2015 and 2030 respectively. A steady decline in the fertility rate will increase the working-age share as the number of youth dependents falls while the number of working-age individuals increases. Once the fertility rate stabilizes, the number of individuals entering the workforce also stabilizes. Increasing life expectancy, and thus a rise in old-age dependents, will then combine with a stable youth- and working-age population to reduce the working-age to non-working-age population ratio.

Between 1990 and 2005, there have been dramatic shifts in age structure throughout Asia. The demographic transition is well advanced in East Asia, and South East Asia and South Central Asia follow in succession. The series of figures in Table 3 illustrates the advancement of the demographic transition throughout the region. The sharp rise in the working-age share through 1990 has been shown to have been a key explanator of economic growth in East Asia (Bloom, Canning and Malaney 2000). Because demographic shifts throughout Asia will continue to unfold at a rapid pace at least until 2050, Moreover it is valuable to explore whether the relationship between economic growth and demographic factors pertains only to the 1960 to 1990 sample period, or if it remains important in explaining cross-country differences in economic growth.

3. Model

The relationship between working-age share and economic growth has been derived in Bloom and Williamson (1998), and utilized in Bloom, Canning, and Malaney (2000). We adapt the convergence model outlined by Barro and Sala-i-Martin (2004) so that we can observe the role of demographic factors, in particular the working-age share, in an

income per capita growth model. Following the theoretical outline in Bloom, Canning, and Malaney (1999)[1] we consider the Cobb-Douglas production function,

$$Y_{it} = AK_{it}^{\alpha} L_{it}^{1-\alpha} \tag{1}$$

where *Y* is aggregate income, *A* is technological change, *K* is capital stock and *L* is the labor force, proxied by the working-age population. Income, capital, and labor vary across countries, *i*, and over time, *t*. Output per worker can be expressed as,

$$\frac{Y_{it}}{L_{it}} = A\left(\frac{K_{it}}{L_{it}}\right)^{\alpha} \tag{2}$$

Economic growth can be characterized as the speed of convergence towards the steady-state level of income per worker. If we denote $z = \log\left(\frac{Y}{L}\right)$, then growth of GDP per worker is,

$$g_z = \lambda\left(z^* - z_0\right) \tag{3}$$

where z^* is the steady-state level of log income per worker and z_0 is the initial value of log income per worker. The speed of convergence is characterized by λ. Variables that can affect the steady-state level income per worker are denoted by a vector X, and thus $z^* = X\beta$. We also add a random error to the growth of income per worker expression. We can rewrite (3) as,

$$g_z = \lambda\left(X\beta - z_0\right) + \varepsilon \tag{4}$$

As in Bloom, Canning, and Malaney (1999) we use the relationship between income per worker and working-age share to create an identity for income per capita. Income per capita is broken down into income per working-age person multiplied by the working-age population share,

$$\frac{Y_{it}}{P_{it}} = \frac{Y_{it}}{L_{it}}\frac{L_{it}}{P_{it}} \tag{5}$$

where Y is income, P is the population, and L is the working-age population in country i in year t. Taking the logs of both sides of (5) we see that,

[1] Note that the cited work is an earlier draft of the Population and Development Review paper published by the same authors; it is used here as it outlines the theoretical workings in more detail than the final publication.

$$\log\left(\frac{Y}{P}\right) = \log\left(\frac{Y}{L}\right) + \log\left(\frac{L}{P}\right)$$
$$y = z + \log\left(L/P\right) \tag{6}$$
$$z = y - \log\left(L/P\right)$$

Combining (4) and (6), the growth of income per worker can be expressed as,

$$g_z = \lambda\left(X\beta - y_0 + \log\left(L/P\right)_0\right) + \varepsilon \tag{7}$$

Then from the identity in (5), the growth rate of income per capita is the sum of the growth rate of income per worker and the growth of workers per capita (which can be expressed as the growth of workers less the growth of the population),

$$g_y = g_z + g_L - g_P \tag{8}$$

Substituting (7) into (8), we then get a growth equation for income per capita as a function of initial income per capita and demographic factors.

$$g_y = \lambda X\beta - \lambda y_0 + \lambda \log\left(L/P\right)_0 + g_L - g_P + \varepsilon \tag{9}$$

This accounting framework places restrictions on the specification that can be tested. For example, growth of the working-age population and growth of the total population are assumed to have coefficients of 1 and -1 respectively. Any deviation from these values can be attributed to measurement error. In a later section, we estimate the equation derived in (9).

4. Data

For this paper we construct a five-year panel from 1960 to 2005 using country-level data. Income data are drawn from the Penn World Tables 6.2 (Heston, Summers and Aten 2006). As income data are only available up to 2004, we extrapolate to 2005 using the 2001-2004 annual average growth rate. Demographic data for the regression analysis (working-age shares, life expectancy, population growth, and population density) are from World Development Indicators (World Bank 2007). For the descriptive analysis, we use data from World Population Prospects (United Nations 2007). These data include

projections to 2050 and thus are used to illustrate potential future trends in demographic variables.

Other control variables are used in the estimation: geographic variables, education, and institutional quality. Details of the sources of these variables can be found in Table 5. The openness variable is from the Penn World Tables. While it has been common practice in the past to use the (Sachs and Warner 1997) more comprehensive openness measure from Sachs and Warner 1997, in this study we expand the sample period to 2005 and thus opt for the Penn World Tables data, which cover a longer time period than the Sach's openness measure.

Descriptive statistics are given in Table 2. They show that a range of countries from rich to poor are represented in the sample. Moreover with the time element included in the model, high fertility countries include countries that remain with fertility rates around 4 today, and countries that had fertility rates around 4 to 6 in 1965 and now are around replacement rates. The data set captures the diversity in income per capita and demographic change, which is an important feature of the data set as we model the causal relationship between demographic change and economic growth.

5. Estimation

In this section we show the results of the estimation of equation (9) derived in section 3. Results are shown in Table 4. The estimation is similar to that of Bloom, Canning and Malaney (2000) but we conduct the important exercise of expanding the sample period out to 2005.

In column one we show the results for a basic growth model, estimated using ordinary least squares. In our estimation we do no include country fixed effects as their inclusion will lead to a Nickell (1981) bias. Instead, we include a series of country specific, time invariant variables: whether the country is land locked or not and proportion of country in a tropical zone in all of the specifications, and regional dummies

in some of the specifications. While these variables do not cover all of the potential country specific, time invariant, variables they provide partial control without introducing the Nickell bias.

From this basic model in column one, the results indicate that the degree of democracy (Freedom House Polity Index), education, and trade openness are positively correlated with economic growth. In column two we introduce the demographic variables: the significance of schooling drops out. The level of the base year working-age population is a significant correlate of income per capita growth, moreover, while population growth has a negative and signifant correlation with economic growth, growth of the working-age population is a significant positive correlate of economic growth. We assume homogeneity of the two dependent groups, youth-age and old-age. (An assumption we relax in Bloom, Canning and Finlay (2008)).

In column three we estimate the demographic model using instrumental variables. As we may reasonably expect that the growth of the population and the growth of the working-age could affect the growth of income per capita, we control for this potential reverse causality using the lag of the instrumented growth rates, and the base year total fertility rate and the base year infant mortality rate. From the Cragg-Donald F-statistic (74, which is greater than the recommended 10) and the Sargan p-value, statistically, these instruments perform well in this cross-country growth regression analysis.

The results in column three of the demographic model, indicate that even when controlling for potential reverse causality, the growth of the working-age share has a positive and significant effect on economic growth. Moreover, population growth has a negative and significant effect. The level of the working-age share also has a positive and significant effect on economic growth, such that both the size and the growth of the working-age population are estimated to be determinants of economic growth.

In column five we estimate the basic model (as in column one) but permit regional differences in economic growth by including regional dummies. The baseline

case includes all countries not in East Asia, South East Asia, South Central Asia, Latin America, and Sub-Saharan Africa, that is countries in Europe, North America and Oceania. From column five, we see that on average East Asia experienced annual average five year growth rates 2.6 percentage points higher than the baseline group of countries. The significance of the East Asian dummy, indicates that the basic model is not able to explain East Asia's growth performance relative to the rest of the world.

In column 6 we estimate a model similar to that proposed by the World Bank. In that model, to account for demographic change they controlled for population growth. The result in column 6 shows the insignificance of population growth when we do not take account of the elements of population growth. In our approach we correct for this, and include growth and level of the working age share.

In column seven, we include a full set of demographic variables and the regional dummies, and in this result we see that once we account for differences in demographic characteristics across countries, the regional dummy is no longer significant. The insignificance of the regional dummy tells an important story. In the geographic model in column five, the East Asian dummy is significant. This indicates that in a basic model, factors such as education, institutional quality, and trade openness do not explain the premium economic growth rate experienced in East Asia. When we control for demographic variables, namely the level and growth of the working-age share, we see in the results in column (7) that the East Asian dummy is no longer significant. This implies that a model that accounts for differences in working-age share growth and level can explain the superior growth performance of East Asian countries.

These results are consistent with those of Bloom, Canning and Malaney (2000) which was over the 1965-1990 sample period. The important point to highlight is that now we have extended the sample period through to 2005, and we have shown that even with the variability in the nature of economic growth in East Asia, demographic factors still play a key role explaining the growth performance throughout Asia. Given the projected decline in the working-age share in the future, the continuing relevance of

demographic variables in explaining economic growth throughout Asia can provides us with some valuable warnings about future trends in economic growth.

6. Forecasting the Economic Growth Contribution of Demographic Variables

The contribution of the growth of the working-age share and the growth of the population to economic growth in Asia can be calculated using the coefficients from column (7) of Table 4. The coefficient of the working-age share growth rate is 1.74, and the growth of the population coefficient is -1.46. In Table 5, based on these coefficients, we illustrate the contribution of demographic change to economic growth over the period 1965-2005. In the same table we use World Population Prospect forecasts of population levels we calculate the projected growth of the working-age share and growth of the population, and then project the contribution of demographic change on economic growth through 2050 assuming the same relationship between demographic change and economic growth holds into the future. This latter assumption is given greater credibility by the results generated in this paper. We showed in this paper that the demographic model explains much of the unexplained fraction of economic growth in Asia, not only over the high growth period of 1965-1990, but also over the period 1990-2005. Given the continuing validity of the demographic model across these two sample periods, we project the economic growth effects of demographic change with a bit of confidence.

In Table 5 we see that between 1965 and 2005 growth of the working-age population and growth of the population contributed to 9 percent of the economic growth in Japan, 26 percent in China and 29 percent in the Republic of Korea. In South East Asia, the contribution of demographic change on economic growth was even higher at around 40 percent. In South Asia the contribution is high, and starts at around 40 percent. The higher contribution of demographic change to economic growth in South and South East Asia, compared to East Asia, could be attributed to the slow down in working-age share growth in recent years in East Asia.

In the right hand side of Table 5 we show the projected working-age share and population growth rates. Looking down the table, and comparing to the 1965-2005 column, we see that the growth of the working-age share will slow throughout the Asian region and in many cases it will become negative (Japan, Republic of Korea, Thailand, Sri Lanka). The slow down of the growth in the working-age share is seen in Table 3, where working-age share is graphed by region across time. We see that in East Asia working-age share will peak in 2010 and then decline, in South-East Asia the peak will be later, in 2020 and 2040 respectively. Thus, as a country approaches the peak of the working-age share the growth of the working-age share slows, and when the working-age share declines the growth of the working-age share is negative. In the coming years, we see that the working-age share growth will slow in the Asian region.

Given the model that we outlined above, and also the illustration that the demographic model has shown to be relevant across time periods, this slow down in the growth of the working-age share will have a depressing effect on economic growth throughout the region. In the last column of Table 5 will calculate the economic growth effect of the projected working-age share and population growth, and indeed, we see that with the slow down in the growth of the working-age share that growth is set to decline throughout the region.

In Bloom, Canning, Fink and Finlay (2007) we forecast economic growth using demographic variables. In this paper we predicted high growth for China, the Republic of Korea, Philippines, Japan, Thailand and Indonesia. In this paper we predict that growth over the next 50 years will be weaker than throughout Asia in the 1965-2005 period due to a slowing of the growth in the working-age share. Economic growth will be lower for China and the Republic of Korea over the next twenty years, but the slow down in South East Asian countries will not come until a little later as the working-age share is set to decline from 2020. From 2020, economic growth will be depressed by the decline in the working-age share, but until then economic growth will continue to be bolstered by rises in the working-age share.

The projections we make, however, assume that there will be no behavioral response to the demographic change that is occurring. The exact nature of these behavioral responses is not so obvious. For even though the working-age share is forecast to peak and then decline, working-age share of 2.0 in 1990 in East Asia is very different than the working-age share of 2.0 that will come about in 2025. The reason for this is the ratio of old to young will increase significantly so that the dependent population will shift from one that is weighted more by youths to one that is weighted more by the elderly. Fertility will decline and stabilize below replacement, and life expectancy will increase further if current trends continue. We can only hypothesize over the behavioral response as the increase in the elderly share will dominate the dependent population in the future. For example, with the decline in fertility and the rise in the old-age population, behavioral responses such as increase in female labor force participation and increase in old-age labor force participation can act to mitigate the negative economic growth effects of the decline in the working-age share that is projected throughout the Asian region. In the next section, we discuss the nature of these behavioral responses.

7. Discussion

The update of the demographic model from the 1965-1990 period through to 2005 has an important implication for East Asia. The nature of economic growth between the two periods, 1965-1990 and 1990-2005, is very different. Japan experienced a slow down, and the Republic of Korea and China surged on ahead with stronger performance in the second period. But from the regression analysis, it remains clear that demographic factors are a key explanator of economic growth in East Asia.

Armed with the understanding, and having reasonable projections of future age-structure trends in the region, East Asian economies are at the cusp of a weakening of economic growth as a result of the decline in the working-age share.

In the past, East Asian economies have demonstrated remarkable flexibility and creativity in coping with structural change and developing policies targeting economic growth. Within the 1960-1990 sample period, China moved from a communist regime to

a market economy. Its vast population, political leaders, and business leaders, embraced the new opportunities that came with the change in regime. The Republic of Korea was rebuilding following the Korean war which ended in 1953: not only did economic growth accelerate but fertility rates dropped dramatically over that period. The fall in fertility rates freed up women's time and female labor force participation increased. Japan, throughout the 1960s, was still enjoying its post-WWII growth boom. Fertility rates fell much earlier in Japan than in the other East Asian countries. With much of Japan's economy relying on heavy industry it was hard hit by the two oil crises in the 1970s. Economic performance recovered in the 1980s, but then in the early nineties Japan experienced complete meltdown, and despite reform efforts it has been a long road to recovery for this country.

Since 1990, however, the Republic of Korea and China have become more mature markets; opening their borders to international capital flows, and striving for modernity through rising incomes. Fertility rates throughout East Asia reached below replacement by 1990.

Entering a new era of economic growth, and a stabilization of the demographic transition, the role of demographic factors in explaining growth performance is not a given. In this paper, we showed that despite the shift in economic growth, demographic factors remain important in the East Asian region.

This highlights the importance of demographic factors into the future for East Asia. With the stabilization of fertility, it may seem that demographic shifts will be minor and of no consequence for economic performance in the region. But the composition of the age distribution within a country is a function of past variation in birth and death rates and the evolution of cohorts through the age distribution.

In the near future, the World Population Prospects indicate that the working-age share is due to decline in East Asia, and will decline throughout the Asian region over the next 40 years. Just as a growth in the working-age share had a positive effect on

economic growth, we can predict given the on-going importance of demographic factors in explaining economic growth in East Asia, that a decline in the working-age share will have a negative effect on economic performance in the region.

The governments of the Republic of Korea and Japan have had moments of reflection on the low fertility rate, and the consequence for the size of the future workforce. But raising fertility rates is not the only option for government policy, and if we account for the female labor force participation response, then higher fertility could have a damaging effect on economic growth (Bloom, Canning, Fink and Finlay 2007). While we focus on the World Population Prospects predicted decline in the working-age share, the implied concern is over the shrinking labor force. Polices to encourage women into paid work can act to increase the total labor force. Moreover, with the increase in life expectancy we are also experiencing a compression of morbidity: we lead longer lives and also remain healthy for longer. Thus if institutions surrounding retirement age are slow to adjust, normal retirement ages may not reflect the willingness and ability of individuals to work beyond normal retirement age. Increasing the normal retirement age, or relaxing incentives to retire (Bloom, Canning, Fink and Finlay 2007), may encourage labor force participation from the 65+ population. Another policy that may be effective in increasing the labor force is to relax immigration policies. Presently, outward migration from the East Asian countries is an increasing trend, so a major change in policy and in attitudes of employers, will be required to promote inward migration to bolster the working-age population.

In the past the East Asian countries have exhibited remarkable flexibility to change and adapt to embrace new opportunities. With the known influence of demographic factors on economic performance, and the imminent decline in the working-age share, now is not the time for East Asia to rest on its laurels. It is a time for change and required flexibility to adopt policies to maintain the relative size of the labor force to dependents. East Asia has shown in the past that it is able to make such adjustments, and we encourage this determination to continue.

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8. Tables and Figures

Table 1: Country groups with estimation sample

East Asia:	**South East Asia:**	**South Asia:**
China	Indonesia	Bangladesh
Japan	Malaysia	India
Korea, Rep.	Philippines	Iran, Islamic Rep.
	Singapore	Nepal
	Thailand	Pakistan
		Sri Lanka

Figure 1: Change in income per capita and change in working-age share

Figure 2: Growth of income per capita 1965-1990

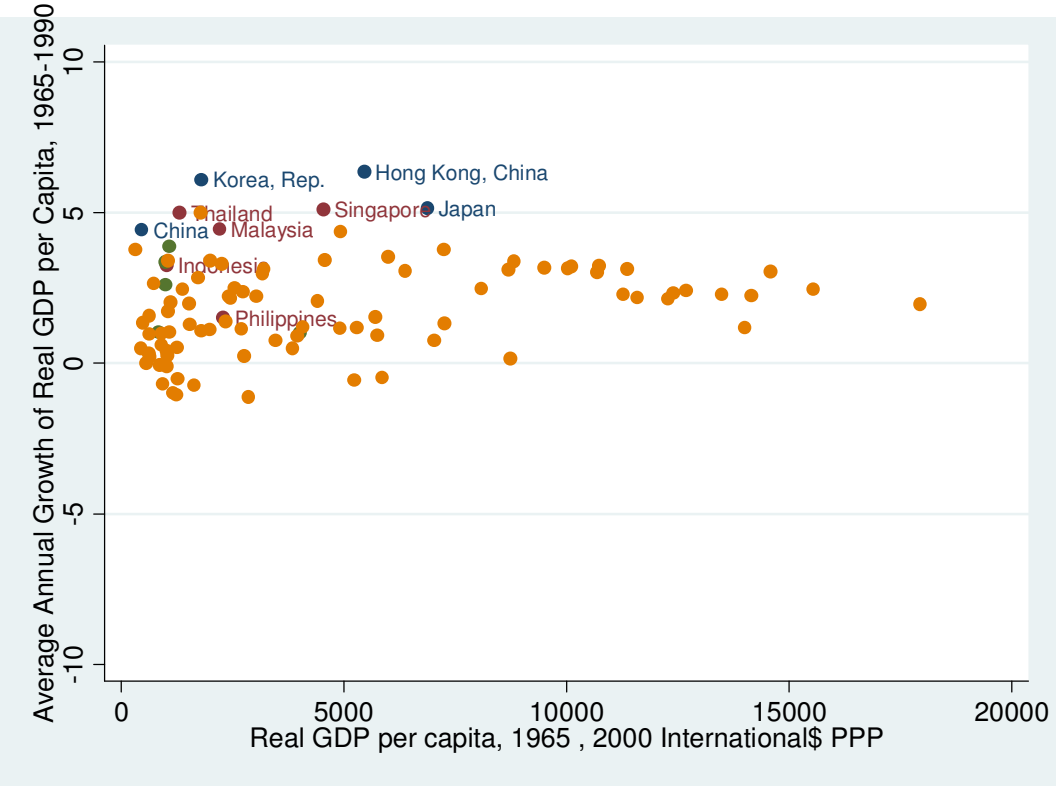


Figure 3: Growth of working-age share 1965-1990

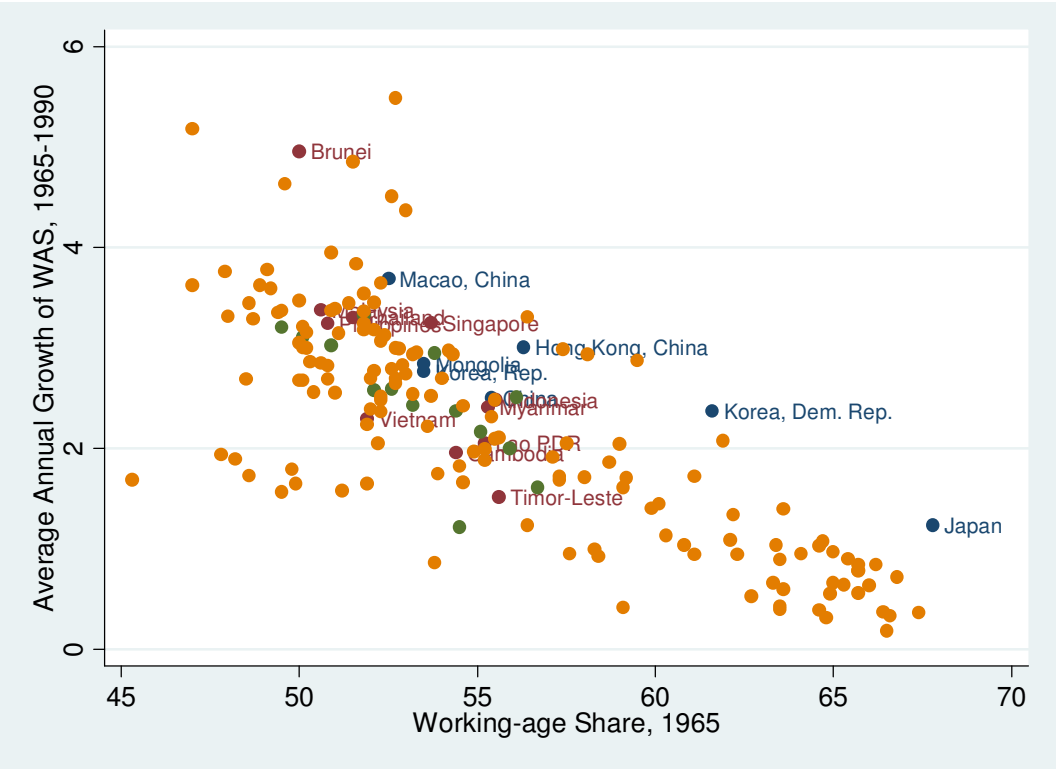


Figure 4: Growth of income per capita 1990-2005

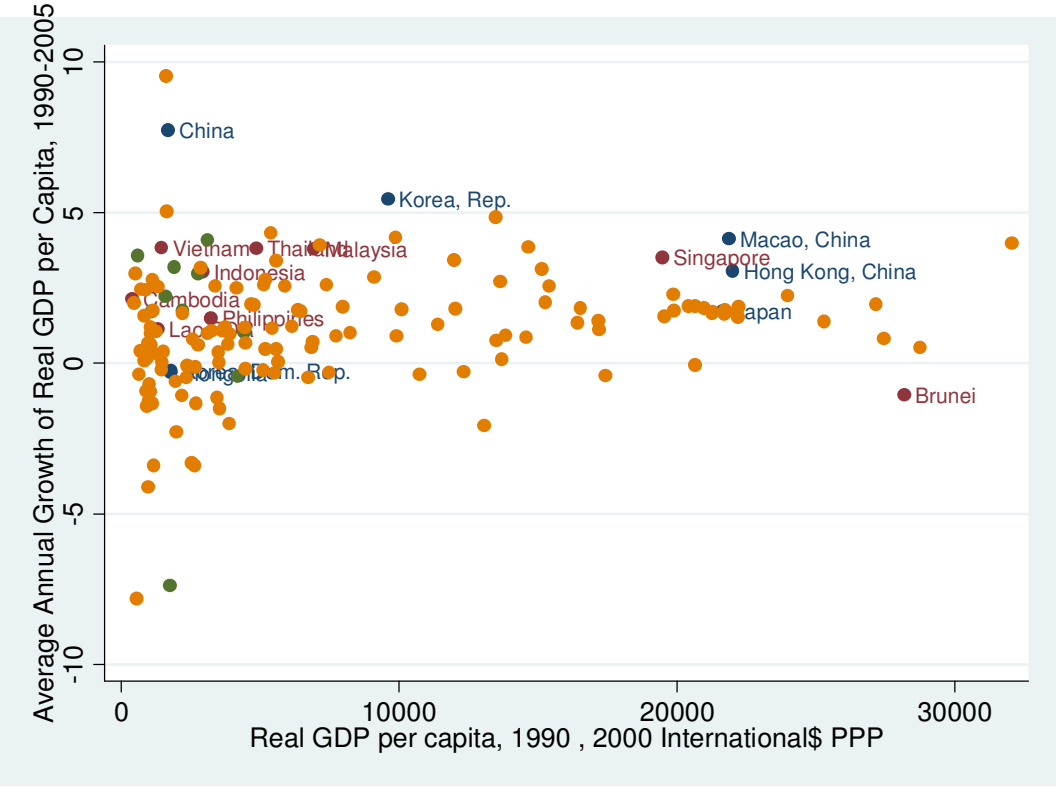


Figure 5: Growth of the working-age share 1990-2005

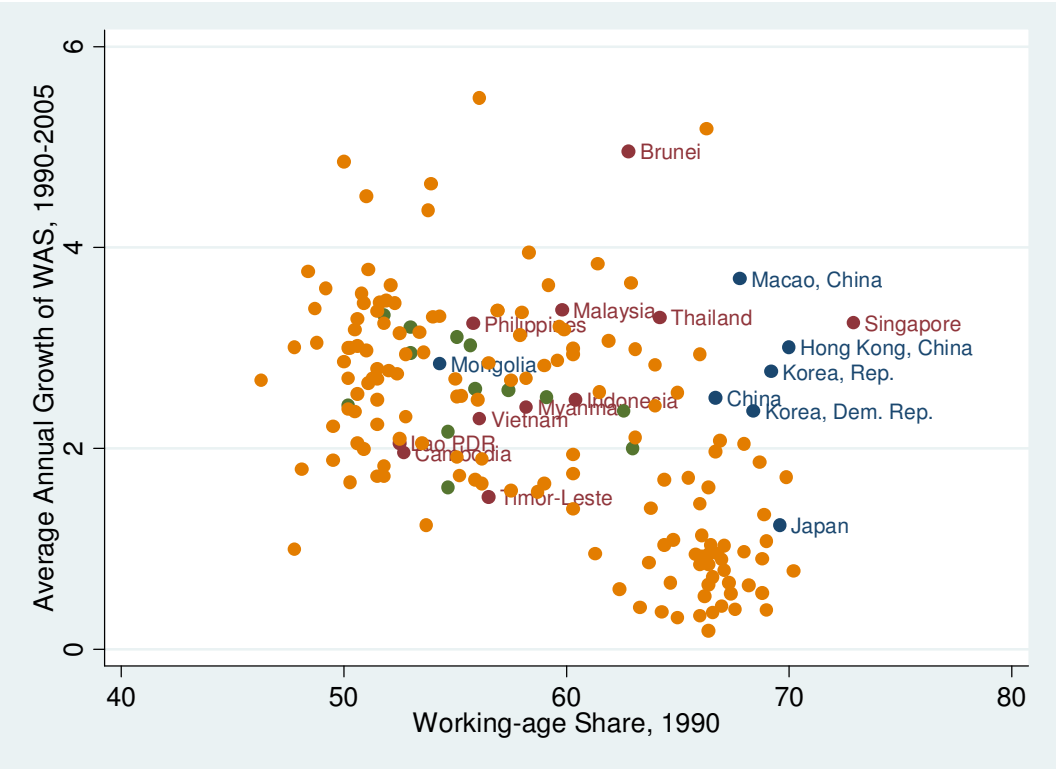
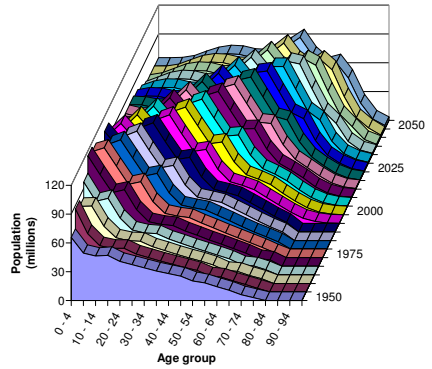
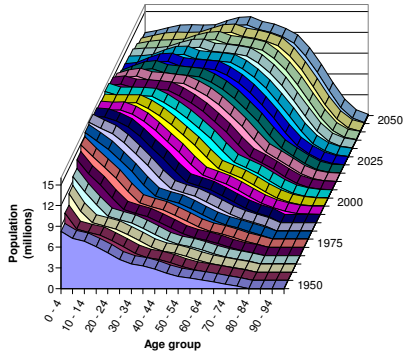
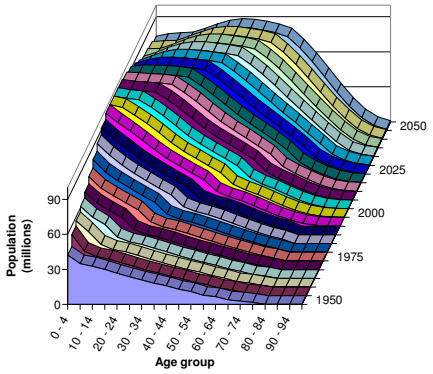
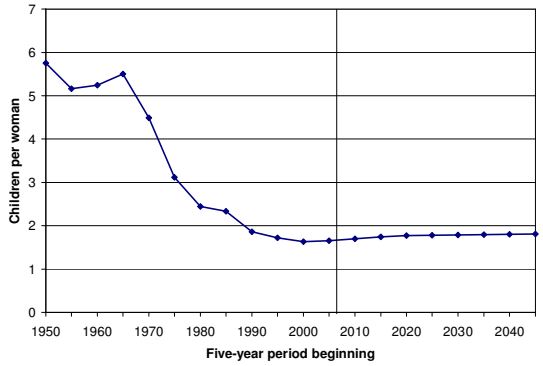
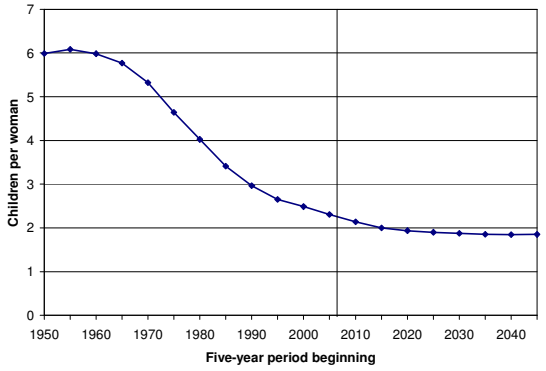
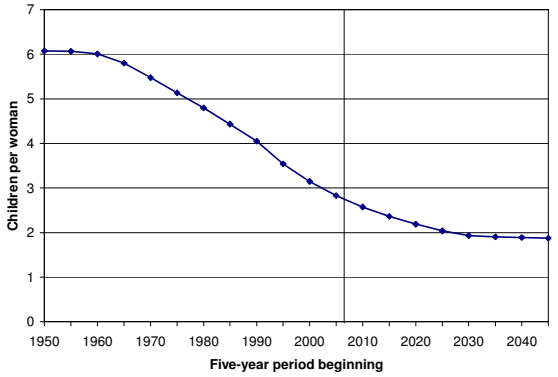


Table 2: Descriptive Statistics

Variable Name	Mean	Std. Dev.	Min	Max
Growth GDP per capita	1.51	3.76	-23.48	29.78
Real GDP per capita	7,782	7,978	171	43,245
Tropical location	0.53	0.48	0	1
Landlocked	0.18	0.38	0	1
Freedom House Polity Index	5.86	3.42	0.19	10.00
Trade openness	62.97	43.53	3.78	377.68
Average years of secondary schooling	1.47	1.14	0.05	5.15
Population growth	2.13	1.68	-4.68	25.91
Working-age population growth	2.47	1.90	-4.68	31.52
Difference in working-age population growth and population growt	0.34	0.58	-1.20	5.61
log working-age population to total population	-0.55	0.11	-0.75	-0.32
Life expectancy at birth	63.11	11.69	31.20	81.10
Population density	143.32	477.33	1.56	6,000

Note: Unbalanced 5 year panel of 562 observations over 98 countries in the 1965-2005 period

Table 3: Demographic transition

East Asia	South East Asia	South Asia
Age Distribution		
		
Total Fertility Rate		
		

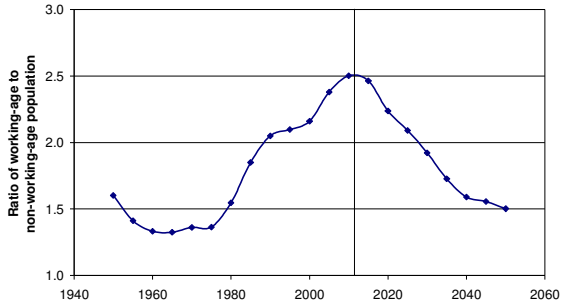
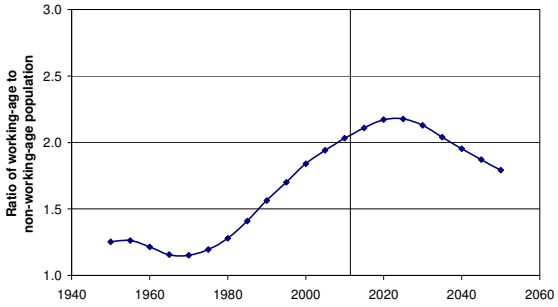
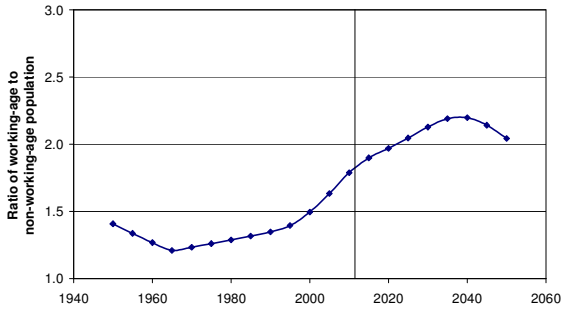
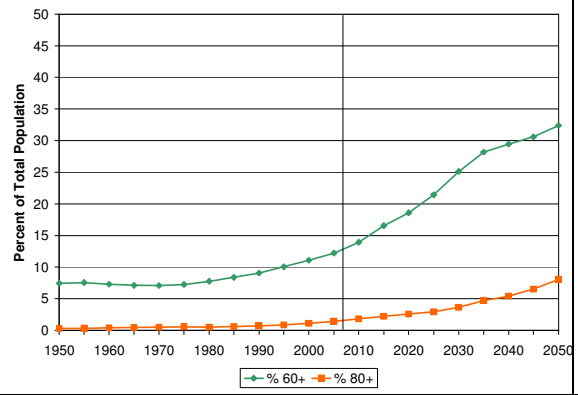
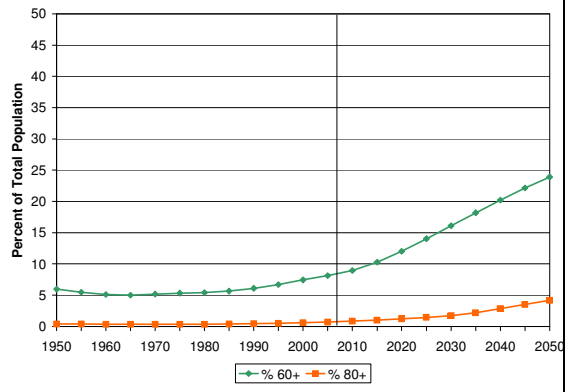
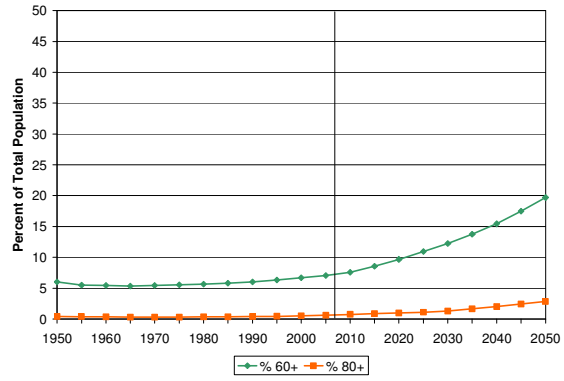
East Asia	South East Asia	South Asia
Working Age Share		
		
Old-Age Shares		
		

Table 4: Estimates of the parameters of a standard conditional convergence economic growth model. Five year annual average economic growth , 1960-2005.

	Basic specification (OLS) (1)	Demographic specification (OLS) (2)	Instrumental variables (IV) (3)	Growth-accounting restriction (IV) (4)	Geographic specification (OLS) (5)	Geographic and population specification (OLS) (6)	Geographic and demographic specification (IV) (7)
Constant	9.158***	-0.584	0.402	-13.24**	11.29***	11.83***	3.186
	(2.27)	(6.44)	(6.60)	(6.56)	(2.65)	(2.49)	(7.46)
Log real GDP per capita in the base year	-1.048***	-2.126***	-2.074***	-1.405***	-1.243***	-1.225***	-1.960***
	(0.29)	(0.28)	(0.28)	(0.29)	(0.32)	(0.28)	(0.31)
Tropical location	-1.195***	-0.991**	-0.968**	-1.809***	-0.929	-1.490***	-0.901
	(0.42)	(0.39)	(0.39)	(0.41)	(0.63)	(0.57)	(0.58)
Landlocked	-0.215	0.922**	0.831**	0.624	0.211	0.448	0.944**
	(0.43)	(0.38)	(0.38)	(0.40)	(0.43)	(0.39)	(0.38)
Freedom House Polity Index	0.194***	0.128**	0.115**	0.197***	0.226***	0.249***	0.133**
	(0.063)	(0.058)	(0.058)	(0.059)	(0.062)	(0.058)	(0.060)
Trade openness	0.0123***	0.00922**	0.0101***	0.00790**	0.00980**	0.0126***	0.0106***
	(0.0037)	(0.0037)	(0.0037)	(0.0038)	(0.0040)	(0.0036)	(0.0039)
Log average years of secondary schooling in base year	1.009***	-0.358	-0.469	-0.275	0.563*	0.204	-0.568*
	(0.29)	(0.29)	(0.30)	(0.31)	(0.30)	(0.26)	(0.30)
Population growth		-1.331***	-1.549***			-0.0942	-1.463***
		(0.32)	(0.43)			(0.10)	(0.43)
Working-age population growth		1.749***	1.842***				1.739***
		(0.27)	(0.38)				(0.38)
Difference in working-age pop growth and pop growth				2.124***			
				(0.47)			
Log working-age popualtion to total population in base year		18.73***	18.60***				17.05***
		(2.37)	(2.57)				(2.75)
Log life expectancy in base year		6.756***	6.461***	6.085***			5.393***
		(1.61)	(1.64)	(1.79)			(1.74)
Population density in base year		0.0000361	-0.0000194	0.000888**			-0.000231
		(0.00039)	(0.00039)	(0.00039)			(0.00041)
Sub-saharan Africa					-1.878**	-1.726***	-0.832
					(0.74)	(0.66)	(0.66)
Latin America Dummy					-0.656	-0.137	-0.158
					(0.62)	(0.55)	(0.55)
East Asia Dummy					2.647***	3.241***	1.188
					(0.94)	(0.86)	(0.86)
South East Asia Dummy					1.753*	2.268***	0.885
					(0.94)	(0.84)	(0.84)
South Central Asia Dummy					-1.562**	-0.446	-0.218
					(0.73)	(0.67)	(0.67)
Observations	570	565	562	562	570	564	562
R-squared	0.13	0.32	0.32	0.23	0.18	0.22	0.33
Cragg-Donald F-stat			74.21	62.30			71.61
Sargan p-value			0.521	0.000000616			0.372
Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1							

Table 5: Growth Accounting: The contribution of demographics to economic growth 1965-2005

	Economic Growth 1965-2005	Growth of the working age share 1965-2005	Population Growth 1965-2005	Contribution to Economic Growth from growth of WAS and population 1965-2005	Percent of growth explained by growth of WAS and population 1965-2005	Growth of the working age share 2005-2050	Population Growth 2005-2050	Contribution to Economic Growth from growth of WAS and population 2005-2050
East Asia								
China	5.52	2.12	1.55	1.41	25.59	0.00	0.21	-0.31
Japan	3.72	0.79	0.70	0.34	9.27	-0.98	-0.42	-1.08
Korea, Rep.	5.51	2.20	1.53	1.60	28.96	-0.72	-0.19	-0.97
South East Asia								
Indonesia	2.91	2.38	2.00	1.21	41.73	0.67	0.69	0.16
Malaysia	4.20	3.21	2.69	1.65	39.35	1.20	1.10	0.48
Philippines	1.46	3.10	2.66	1.51	103.19	1.57	1.27	0.87
Singapore	4.32	2.97	2.28	1.83	42.30	0.00	0.46	-0.67
Thailand	4.23	2.75	2.07	1.74	41.26	-0.05	0.21	-0.41
South Central Asia								
Bangladesh	1.61	2.67	2.40	1.14	70.78	1.52	1.24	0.82
India	2.74	2.40	2.15	1.02	37.09	1.18	0.95	0.67
Iran, Islamic Rep.	1.49	3.38	2.75	1.87	125.03	1.01	0.85	0.51
Nepal	1.26	2.39	2.32	0.76	60.26	2.00	1.57	1.18
Pakistan	2.68	3.06	2.91	1.06	39.56	1.94	1.47	1.22
Sri Lanka	3.55	2.13	1.54	1.45	40.85	-0.15	0.00	-0.27

Table 6: Labor force participation and net migration trends

	Female LFP 25-64			Male LFP 25-64			Female LFP 65+			Male LFP 65+			Net Migration		
	1950	2000	Change	1950	2000	Change	1950	2000	Change	1950	2000	Change	1960*	2000	Change
East Asia															
China	66.58	79.22	12.63	96.26	94.38	-1.88	8.20	9.10	0.90	50.40	28.40	-22.00	-513,940	-1,950,000	-1,436,060
Japan	49.93	62.44	12.51	93.04	94.16	1.12	21.16	14.40	-6.76	48.79	34.10	-14.69	-62,980	280,130	343,110
Korea, Rep.	26.71	56.18	29.46	96.97	88.80	-8.17	9.83	22.80	12.97	79.14	40.60	-38.54	-4,080	-80,000	-75,920
South East Asia															
Indonesia	31.28	57.06	25.77	96.77	95.83	-0.94	28.27	26.10	-2.17	78.79	56.30	-22.49	-10,100	-900,000	-889,900
Malaysia	36.50	49.16	12.65	94.71	94.30	-0.41	10.91	28.30	17.39	64.73	54.20	-10.53	47,320	390,000	342,680
Philippines	49.64	56.13	6.49	95.50	95.68	0.17	18.47	28.90	10.43	68.93	55.70	-13.23	-122,000	-900,000	-778,000
Singapore	23.69	59.42	35.73	97.28	92.45	-4.83	7.09	4.10	-2.99	42.56	18.50	-24.06	85,480	368,000	282,520
Thailand	83.83	77.03	-6.81	96.85	94.94	-1.91	23.59	19.70	-3.89	62.77	44.60	-18.17	0	-87,540	-87,540
South Asia															
Bangladesh	72.25	59.66	-12.59	97.96	96.65	-1.30	37.81	17.40	-20.41	93.09	56.60	-36.49	-10,000	-300,000	-290,000
India	44.37	40.07	-4.30	96.50	94.55	-1.95	19.90	12.00	-7.90	71.24	52.60	-18.64	-4,250	-1,400,000	-1,395,750
Iran, Islamic Rep	20.50	35.29	14.80	95.51	91.24	-4.28	5.93	10.30	4.37	54.53	55.10	0.57	-1,950	-456,000	-454,050
Nepal	43.32	52.16	8.85	96.28	91.87	-4.41	15.07	12.70	-2.37	71.03	39.00	-32.03	-80,230	-99,090	-18,860
Pakistan	25.62	35.13	9.51	96.85	95.17	-1.68	12.40	16.80	4.40	81.08	51.70	-29.38	-16,700	-40,500	-23,800
Sri Lanka	45.41	43.88	-1.53	95.85	90.00	-5.85	56.00	5.70	-50.30	80.62	30.50	-50.12	-31,200	-159,700	-128,500

* 1970 for Philippines and Sri Lanka

Table 7: Data Sources

Variable name	Variable Description	Source Summary
Growth GDP per capita	Annual average change in the log of real GDP per capita over 5 years	PWT 6.2
Real GDP per capita	Real GDP per capita (Constant Prices: Laspeyres)	PWT 6.2
Tropical location	Fraction of tropical area	SIM
Landlocked	Landlocked country dummy	SIM
Freedom House Polity Index	Freedom House Polity Index	Freedom House
Trade openness	Exports plus Imports divided by RGDPL. Constant 2000 prices.	PWT 6.2
Average years of secondary schooling	Average years of secondary schooling of individuals >15 years of age	Barro and Lee
Population growth	Annual average growth of the total population over a 5 year period	WDI 2007
Working-age population growth	Annual average growth of the 15-64 year old population over a 5 year period	WDI 2007
Difference in working-age population growth and population growth	Population growth - working-age population growth	WDI 2007
log working-age population to total population	log(working-age population/population)	WDI 2007
Life expectancy	Life expectancy at birth	WDI 2007
Population density	People per square km.	WDI 2007

Details of Sources

PWT6.2: Penn World Tables 6.2 (Heston et al 2006)
SIM: Sala-i-Martin, Doppelhofer, Miller (2004)
Freedom House: http://www.freedomhouse.org/template.cfm?page=1, degree of democracy less degree of autocracy
Barro and Lee: Barro and Lee (2000)
WDI2007: World Development Indicators 2007 (World Bank, 2007)