East Asian Economic Development: Two Demographic Dividends[1]

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July 21, 2004

Abstract

The important of the demographic dividend to East Asian economic growth is now widely recognized. During the last four decades of the 20th Century the working age populations grew much more rapidly than the dependent populations fueling growth in per capita income. Over the coming decades, however, demographic change is seemingly unfavorable. In the coming decades the working-age populations of many countries will grow more slowly than dependent populations because of rapid growth of the elderly. Thus, the demographic dividend will be undone. The thesis advanced in this presentation, however, is that appropriate economic policy could produce a second demographic dividend – one that is as great or greater than the first dividend and one that may last indefinitely. Contrary to popular wisdom, population aging may prove to be the source of stronger economic growth and greater prosperity in East Asia.

[1] Prepared for Conference on Miracles and Mirages in East Asian Economic Development, Honolulu, HI, May 22, 2004. This paper was written to honor Professor Seiji Naya for his many contributions to the University, to the State of Hawaii, and to understanding economic development in Asia.

Introduction

In the 1960s the populations of East Asia and the rest of the developing world were growing quite rapidly. Many viewed population growth with alarm. The governments of China, South Korea, Taiwan, Singapore, Thailand, and Indonesia pursued policies designed to reduce rates of childbearing and slow population growth in the belief that to do otherwise would seriously impede development efforts. Among the countries of East and Southeast Asia only Malaysia pursued a pro-natalist course.

The view that population growth slows economic growth was greeted by considerable skepticism in academic circles (Kelley 1988). Economists were undoubtedly influenced by the neo-classical growth model which implies that population growth has a relatively modest effect on the level of per capita income during transitions and no effect at all on the steady-state growth path (Solow 1956). Moreover, simple empirical evidence bolstered the view that population growth was of secondary importance. In a bivariate comparison, population growth and growth in per capita income appeared to be entirely independent of one another (Kelley 1988).

Evidence that is now emerging suggests that the policymakers may have had it right and the academics may have had it wrong. Repeating Kelley's simple but provocative exercise, Figure 1 plots growth in per capita income against growth of population for the 1960-2000 period. Assessed over a longer time period there is a clear negative correlation between population growth and economic growth.

Figure 1. Population growth vs economic growth

East Asia's experience is also broadly consistent with the view that population matters (Bloom and Williamson 1998; Mason 2001b). East Asian countries adopted strong family planning programs, fertility rates dropped rapidly, population growth slowed, and economic development accelerated.

Broad characterizations and simple statistical associations will only take us so far, however. The statistical relationship in Figure 1 may be spurious or the causality may go in the other direction. Population growth may have slowed as a consequence of rapid economic growth. Moreover, Figure 1 suggests that slowing population growth explains only a modest portion of East Asian economic success. The East Asian countries lie well above the regression line.

Neo-Malthusian studies of population and development have typically been concerned about the effects of fixed or inflexible resource constraints of one form or another. In contrast, most contemporary studies emphasize the role of age structure. The potential significance of population age structure is immediately apparent from Figure 2, which shows estimates of the age-profiles of labor income and consumption for Taiwan in 1998. The most striking feature of this chart is the extended period of life during which humans consume substantially more than they produce, roughly balanced by an extended period during which humans produce more than they consume. Enormous intergenerational reallocations of economic resources are occurring in Taiwan but also in all other human populations, present and past (Lee 2000).

Figure 2 is important for several reasons. First, it provides important information about income inequality – variation in mean income by age. In Taiwan the profile is very flat. This is remarkable given the extraordinary rate of economic growth in Taiwan over the 40 years preceding 1998. The average lifetime earnings of those who are currently elderly were a small fraction of the lifetime earnings of those who are currently working, yet the elderly are supporting an average consumption nearly as high as are workers. That Taiwan has managed to achieve such an equitable intergenerational distribution of income is reflected in the low overall level of income inequality for which Taiwan is known. Enormous reallocations across age groups and across generations were essential to this outcome.

Second, a direct effect of population age-structure on living standards is readily apparent from Figure 2. A population that is concentrated in the working-ages can support a higher level of consumption than a population that is concentrated at ages where consumption exceeds production.

Less obvious, but of great importance, is the effect of the lifecycle reallocation system on the formation of both human and physical capital. The resources that flow from workers to children include spending on health and education that, in turn, determine the productivity of the next generation of workers. Reallocations from the working years to retirement years are, in part, realized by saving and the accumulation of physical capital. Increases in the expected duration of old-age dependency provides a powerful incentive for increased saving.

Figure 2. Mean Consumption and Labor Income, Taiwan, 1998 (NT$)

In the next section, we describe important and distinctive features of East Asia's demographic transition. The transition is a global phenomenon, but there are important differences across countries and regions, especially in the trends in age structure. In the following sections we discuss the implications for East Asian economic growth. Our thesis is that accelerated growth in the region can be traced to two demographic dividends.

Demographic Transition: East Asian Style

The demographic transition began much later in East Asia than in the West. Even in Japan, life expectancy at birth was stagnant at around 45 years through the first half of the 20th Century. Rapid improvements came immediately following the end of World War II, but in 1960 Japan still had the lowest life expectancy at birth of any OECD country. Mortality conditions in other countries of Asia for which we have data were worse than in Japan. In India, life expectancy was only 24 years in 1891-1911. In China, life expectancy was only 24 years in 1929-30. In contrast life expectancy had reached 56 in Sweden, 50 in the United Kingdom, and 47 in the United States by 1900 (Maddison 2001).

The transition from high to low fertility also began later in Asia than in the West. In Japan, childbearing began to decline in the 1930s. After a short-lived post-World War II baby-boom, the total fertility rate declined rapidly to about 2 births per woman in 1960. Other Asian countries did not experience any significant decline in fertility until 1960 or later. In contrast, fertility decline began in France in the mid-18th Century and in the US in the mid-19th Century. In both countries, the total fertility rate reached two births per woman much earlier than in Asia.

The large differences between fertility and mortality in East and Southeast Asia had important effects on two additional demographic features of the region: population growth and age structure. The baby boom fueled population growth in the West. The annual growth rate for 1950-1973 increased to 0.8 percent per year in the average

Western European country. The US grew much faster at 1.4 percent per year. Population growth in China, Indonesia, and South Korea exceeded 2 percent per year during the same period. In the Philippines, Taiwan, and Thailand the rates exceeded 3 percent per year (Maddison 2001). Among Asian countries only Japan had population growth of close to 1 percent per year at that time.

Although the trends in dependency in Asia and the West were about to diverge, in 1900 there were no apparent differences in the levels of dependency (Figure 3). Based on the available data there were about 0.6 to 0.75 persons in the dependent ages (0-14 or 60+ or 65+ depending on the source) for every person in the working ages (15-59 or 15-64 depending on the source). Dependency was falling in the West, however, and rising in the East. By 1950, dependency ratios had dropped to about 0.5 in the US, Sweden, and other European countries. In Taiwan, Indonesia, the Philippines, and Thailand, the dependency ratio was close to 0.9 in 1950 and still rising (La Croix, Mason et al. 2003).

Figure 3. Age Structure, Selected Countries, 1900-2000.

Beginning between 1960 and 1970 East Asian countries began to experience a precipitous decline in their dependency ratios as a direct consequence of rapid fertility decline. The trend in Japan is somewhat distinctive. It followed the Asian pattern during the early 20^{th} Century but its dependency ratio went into rapid descent over a period of three decades – 1940 to 1970.

By 2000, the dependency ratios in Japan, Thailand, and Taiwan were actually lower than in the US and Sweden. Indonesia's decline has also been quite rapid although its dependency ratio remains somewhat above values found in the West. The decline in the Philippines has been more gradual, reflecting the slower decline in fertility there, and it too has a dependency ratio higher than in the West.

Did Demography Matter in East Asia?

We will use an elaboration of the Neo-Classical Growth model to frame our analysis (Solow 1956; Cutler, Poterba et al. 1990). Defining the effective number of consumer (N) and the effective number of producers (L) as:

$$\begin{aligned} N(t) &= \sum_{a=0}^{100} \mathrm{a}(a)P(a,t) \\ L(t) &= \sum_{a=0}^{100} \mathrm{g}(a)P(a,t) \end{aligned} \tag{1.1}$$

where *P(a,t)* is the population. Output per effective consumer is defined by:

$$\frac{Y(t)}{N(t)} = \frac{L(t)}{N(t)} \times \frac{Y(t)}{L(t)} \tag{1.2}$$

or the product of the support ratio (L/N) and output per effective worker.

Equation (1.2) is expressed in growth terms as:

$$\dot{y}(t) = \dot{L}(t) - \dot{N}(t) + \dot{y}^{l}(t). \tag{1.3}$$

The rate of growth in output per effective consumer ($\dot{y}$) is the rate of growth of the effective labor force ($\dot{L}$), less the rate of growth of the number of effective consumers ($\dot{N}$), plus the rate of growth in output per worker ($\dot{y}^l$). In the original Solow formulation, the population is not distinguished from the labor force. This is an appropriate assumption in steady-state, but during the demographic transition labor force growth and population growth diverge for decades with important implications for growth in per capita income. This phenomenon, known as the *demographic dividend*, is discussed in more detail below.

Output is produced by two factors – capital and augmented labor. Augmented labor is determined in turn as the product of the effective labor force and productivity assumed to grow at a constant rate l . The production function is constant returns to scale (Cobb-Douglas). Growth in output per effective worker is given by:

$$\dot{y}^l = l + b\dot{k} \tag{1.4}$$

where $\dot{k}$ is the rate of growth of capital per augmented worker and b is the elasticity of output with respect to capital. The growth of capital per worker is given by:

$$\dot{k} = sy^l - (\dot{L} + l)k. \tag{1.5}$$

In steady-state equilibrium $\dot{k} = 0$ and $\dot{L} = \dot{N}$.[2] Growth in output per worker and output per effective consumer are determined entirely by technological progress, i.e.,

[2] Given constant fertility and mortality rates and ignoring migration, populations eventually become stable. Under these conditions, all age groups grow at the same rate and the age-distribution of the population is unchanging. Given constant labor force participation rates, the labor force and the population grow at the same rate.

productivity increases. Neither the demographic dividend nor saving rates influence the rate of growth. During transition, however, both the saving rate and the demographic dividend influence growth in per capita income.

An extensive empirical literature on East Asia economic growth demonstrates that the region is far from equilibrium (Young 1992; Bauer 2001). The importance of productivity growth is debated, but the importance of capital deepening is not. Capital per worker grew in excess of 6% per annum in Japan, South Korea, Taiwan and Thailand, for example, between 1965 and 1990 (Mason 2001).

The Solow model identifies two sources of capital deepening – an increase in the rate of saving and a decline in the rate of labor force growth. In many East Asian countries wartime destruction had resulted in a below equilibrium capital-labor ratio and some capital deepening was a matter of recovery to pre-war levels. Saving rates were quite low in the 1950s and early 1960s and to some extent foreign aid contributed to recovery. The key to capital deepening in East Asia, however, has been the extraordinary rise in saving rates throughout the region.

Given the speed of fertility decline one might easily presume that labor force growth slowed contributing further to capital deepening. Labor force growth peaked in the 1970s in Malaysia, the Philippines, Singapore, Thailand, China, and South Korea, but the declines have been relatively modest (World Bank 2003). Several factors account for this. One is that mortality rates were also declining offsetting to some extent the effect of fertility decline on population growth. A second factor is that most of the slowdown in population growth that occurred was due to slower growth in the number of dependents. By and large the number of children stopped growing, but the number of adults continued to grow. Third, there were substantial increases in female labor force participation in many countries in the region.

Based on this brief and highly stylized synopsis of East Asia's economic growth, two issues are important. The first is whether or not there was a substantial divergence between growth in the effective labor force and the effective number of consumers – the first demographic dividend. The second is whether the rapid increase is aggregate saving rates represents a second dividend.

The First Demographic Dividend

The divergence between the effective number of consumers and producers is an inherent part of the demographic transition. The widespread nature of this phenomenon is apparent in Figure 4, which plots the growth of the effective number of consumers against the growth of the effective number of producers for the 1960-2000 period. The values are constructed using UN population estimates for all countries in the UN system (United Nations 2003). Age-specific weights for consumption and production are estimated using the 1998 Family Income and Expenditure Survey for Taiwan (Figure 1).[3]

A few countries lie directly on the 45° line with identical growth rates in the effective labor force and the effective number of consumers. Many African countries and a few Asian countries lie above the 45° line. In these countries, the demographic transition has proceeded slowly and birth rates are relatively high. The effective number

[3] The productivity weights and consumption weights are estimated using standard procedures. The productivity weights are proportional to average earnings classified by age. The consumption weights are based on estimates of the allocation of household consumption among household members using a variant of Engel's method. Within a household child weights are about half of adult weights while the weights of seniors are about 80% of prime age adults. Lai and Maliki (2004) provides details of the estimation methods employed.

of consumers grew more rapidly than the effective number of producers between 1960 and 2000.

Figure 4. Growth in the Dependent and Working Age Populations, 1960-2000

Most countries of the world reaped a demographic dividend between 1960 and 2000. In Asia, Latin America, and the West, the number of effective consumers grew more slowly than the number of effective producers. As a result, output per effective consumer grew more rapidly than output per worker. The estimates of the 1960-2000 dividend are summarized in Table 1. For the world as a whole, the effective labor force grew at an annual rate of 2.0 percent per year while the number of effective consumers grew at an annual rate of 1.8 percent. The difference – 0.2 percent per year – is the annual global demographic dividend for the 1960 to 2000 period. The cumulative effect over the entire period was to increase income per effective consumer by 8.2 percent – a modest positive effect.

Table 1. Demographic Dividend, 1960-2000.

The demographic dividend was slightly greater in the less developed regions than the more developed regions, although the difference is quite small. The least developed countries, mostly African countries, did not benefit at all from changes in age structure. Other major regions of the world experienced a small demographic dividend. The cumulative effect varied from a low of 6.1 percent in Europe to 15.6 percent in Latin America and the Caribbean.

The cumulative effect of the demographic dividend in Asia was to increase output per effective consumer by 12.5 percent between 1960 and 2000. Given the enormous diversity of Asia, however, regional aggregations are not terribly useful. The demographic dividend was substantially larger in the high performing economies of East Asia. In Singapore and South Korea, the demographic dividend increased annual growth in income per effective consumer by about three-quarters of a percentage point over a forty year period. Thailand's growth was higher by two-thirds of a percentage point and China and Hong Kong benefited by one-half of a percentage point. The cumulative effect was to raise output per effective consumer by about 20 percent in China, by 30 percent in Thailand, by 34 percent in South Korea, and 36 percent in Singapore.

Whether the East Asian values are considered small or not depends on the point of reference. As compared with long-term productivity growth in the US, typically estimated at 1-1.5 percent per year, the demographic dividend is quite significant. As compared with the high rates of economic growth achieved in East Asia, the demographic dividend appears to be more modest. Table 2 presents calculations for the four countries with the largest dividends in Table 1. In these four countries, between 1960 and 2000, GDP per effective consumer grew at an annual rate ranging from 4.3% in Thailand to 5.7% in Singapore. The demographic dividend accounted for 9.2% of China's growth up to 15.5% of Thailand's growth. Using a slightly different approach, Mason estimates that the demographic dividend accounted for 19.2% of Taiwan's economic growth between 1965 and 1990 (Mason 2001c).

Table 2. Contribution of Demographic Dividend to East Asian Economic Growth.

A Second Dividend: Demography and Capital Deepening

The existence and potential importance of the demographic dividend has gained relatively wide acceptance in recent years (Bloom, Canning et al. 2002; Mason and Lee 2004). Also widely appreciated is the transitory nature of the demographic dividend. Working age populations are growing much more slowly and beginning to decline in some countries, while the number of pensioners is continuing to grow rapidly. By 2050 the demographic dividend will have essentially disappeared in the West, Japan, Hong Kong, and Singapore. Other Asian countries will follow (Mason and Lee 2004).

The prospect of rapid growth in the numbers of retired elderly – and the accompanying strains on public pension and health care systems – has led to considerable pessimism about economic performance over the coming decades. Rather than being a source of decline, however, population aging may be the source of a second demographic dividend.

The prospects of a longer life and an extended period of retirement represent a powerful saving incentive for those in their working ages. Where familial support systems are especially strong, saving incentives may be undermined. But with fertility decline and increases in life expectancy, familial support systems will experience the same strains widely discussed with respect to public pension systems. The possibility that these systems will erode looms large. Indeed, rapid decline has already begun in several Asian countries.

The combined effects of aging and declining familial support systems has a large effect on lifecycle saving and the demand for wealth. Lee, Mason, and Miller (2003) use a simulation model to trace out the complex effects of demographic change and the decline of familial support systems on saving and wealth based on the experience of Taiwan. They show that the combined effects of increased life expectancy and familial support systems are sufficient to produce a three-fold increase in the capital-output ratio during the first half of the 21st Century. Capital deepening of this magnitude could produce an increase in output per worker by an additional 1.1% per year (Mason and Lee 2004).

The possibility that demographic factors have led to more rapid economic growth because of their effects on aggregate saving rates is broadly consistent with the East Asian experience. As noted above the rise in saving rates in East Asia led to rapid capital deepening and, in conjunction with a variety of other well-known factors, growth in output per worker. Several recent empirical studies have found that the decline in youth dependency had an enormous effect on aggregate saving rates. Macro-econometric studies by Kelley and Schmidt (1996), Higgins and Williamson (1997), and Toh (2001) find large, statistically significant effects of age structure on aggregate saving rates. Over the course of a demographic transition along the lines experienced in East Asia, estimates by Williamson and Higgins and by Toh imply that demographic change would have produced an increase in gross national saving rates by 43 and 45 percentage points, respectively. Analysis by Kelley and Schmidt implies a smaller but still enormous increase of 25 percentage points (Mason 2001a).

Other approaches suggest a more modest though still important effect. Simulation analysis of lifecycle saving suggests that demographic factors could account for no more than an increase in saving rates by 14.5 percentage points (Lee, Mason et al. 2001). Deaton and Paxson (2000) calculate that changes in age structure over the demographic transition could have produced an increase in *household* saving rates of 6.5 percentage points.

Reaching any definitive conclusion about how changes in youth dependency contributed to higher saving rates and capital deepening in East Asia requires some reconciliation of these diverse results. First, the studies use different measures of saving. The macro-based estimates analyze gross national saving, whereas micro-based estimates focus on household saving rates. Thus, macro-based estimates would capture effects on government and saving rates while micro-based estimates would not. Macro-based estimates would also capture effects on private saving not included in household saving rates. Second, the methodology used in the Deaton and Paxson analysis relies on estimating age-profiles of consumption and earning which are then held constant in order to assess the effects of changing age-structure. Such an approach is useful for examining compositional effects, but it excludes from consideration the effects of age structure on the age profiles of consumption and earning. Third, to the extent that changes in childbearing are inducing shifts away from familial transfer systems, the Deaton and Paxson approach would not capture any substitution of saving for family transfers.

At the same time there are many problems with estimates that are based on international aggregate panel data. Two issues seem to be particularly important. First, results are sensitive to model specification and sample selection. Second, endogenity is a constant issue. Under these circumstances, the large estimated effects of youth dependency are likely to be dis-counted by skeptics.

The effect of life expectancy on saving has received relatively little attention in the literature since Yaari's path-breaking work (Yaari 1965). A number of empirical studies have found that an increase in life expectancy leads to higher saving rates (Zilcha and Friedman 1985; Strawczynski 1993; Yakita 2001; Bloom, Canning et al. 2003; Kageyama 2003). Why saving would be influenced by increases in longevity is easily understood in the context of the lifecycle model. If gains in life expectancy lead to an increase in the duration of retirement, lifecycle individuals must increase their saving during the working years so as to finance the greater consumption needed during the retirement years. Early in the demographic transition, most of the gains in life expectancy are achieved through reductions in infant and child mortality with no effect on the duration of retirement. Later in the demographic transition, the gains in life come at later ages increasing the duration of retirement in the face of a constant or declining age at retirement.

Other than the simple lifecycle argument, there are other ways that changes in mortality may influence saving. For example, the age at death has become more compressed and, hence, more predictable. This has led to a decline in uncertainty about the age of death and, perhaps, a decline in the demand for wealth as insurance against longevity risk.[4] Kalemli-Ozcan and Weil (2002) argue that a fall in mortality has an "uncertainty effect" and "horizon effect" on retirement. The uncertainty effect follows from the decline in uncertainty about the age at death which leads individuals to attach greater value to retirement (leisure). Thus, they retire at a younger age and save more while young. The horizon effect leads individuals to delay their retirement in order to finance the additional consumption associated with a later age at death.

[4] Although annuities insure against longevity risk, the market is relatively thin, subject to moral hazard, and expensive even in the US. In Asian countries there is essentially no market, even in Japan. Hence, reliance on annuities as protection against longevity risk is relatively limited.

In a recent study Kinugasa (2004) uses a two-generation OLG model to investigate the effects of improvements in adult mortality on aggregate saving. She shows that in steady-state the aggregate saving rate induced by lifecycle behavior will increase with adult longevity in a growing economy. This is consistent with the standard lifecycle saving model in that changes in the age-profile of consumption have no effect on aggregate saving in a zero growth rate economy (Modigliani and Brumberg 1954). The effect on saving of an increase in the mean age of consumption interacts with the rate of economic growth (Mason 1987; Mason 1988). These features of the steady-state lifecycle saving model are capture by the variable rate-of-growth saving model:

$$s = b_0 + b_1 qg + e \tag{1.6}$$

where q measures adult survival and g is the real rate of growth of total income. The interactive feature of the specification is particularly important to understanding the East Asian experience because changes in survival have a much larger effect in rapidly growing economies such as those found in East Asia.

The important contribution from Kinugasa's analysis is the extension of the OLG model to out-of-steady-state effects. She shows that an increase in the survival rate has a positive effect on saving that is independent of the rate of growth of income. Thus, the effects of improvements in adult survival on saving are captured by:

$$s = b_0 + b_1 qg + b_2 \Delta q + e. \tag{1.7}$$

Under this formulation the speed of the mortality transition matters. A rapid mortality transition results in higher saving rates as adult survival reaches higher levels, but during the transition saving is given an extra boost. Why does this occur? When mortality is improving rapidly, the gap between current wealth and desired wealth is greater. Thus, higher saving is required to achieve the desired level of wealth.

Detailed empirical results are presented in Kinugasa (2004) and only a brief summary is offered here. Table 3 reports OLS and 2SLS estimates of the determinant of the national saving rate, using a sample restricted to Western countries and high-performing East-Asian countries.[5] In other regions of the world, the rate of change in adult survival does not have a statistically significantly positive effect on the national saving rate (Kinugasa 2004).

For the West and high-performing East Asian countries, OLS and 2SLS results confirm the importance of demographic factors and the hypotheses advanced by Kinugasa. The estimated effects of the interaction of adult survival and GDP growth (*qg*) are statistically significantly at 1% level in both the OLS and 2SLS regressions. The effect of an increase in the level of the survival rate on the national saving rate is positive if GDP is growing. The rate of change of the survival rate has a positive and statistically significant effect – at the 5% level in the OLS analysis and the 10% level in the 2SLS analysis.[6]

[5]The Western countries are European countries (Albania, Austria, Belgium, Bulgaria, Switzerland, Denmark, Spain, Finland, France, United Kingdom, Greece, Hungary, Ireland, Italy, Macedonia, Netherlands, Norway, New Zealand, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, Sweden, Turkey), the United States, Australia, and New Zealand. The high-performing East-Asian countries are Japan, Korea, Thailand, and Malaysia. China was excluded because of its tremendous structural change during the period of analysis, Taiwan because of missing data, and Singapore and Hong Kong because they are city-states.

[6] The 2SLS estimates assume that GDP growth is endogenous. The P-value for the Hausman test is 0.000, which implies that GDP growth is endogenous.

<Table 3. Statistical Analysis of Saving Rates>

The estimated effect of youth dependency, interacted with GDP growth, is statistically significant in the OLS analysis, but not in the 2SLS analysis. The rate of growth effect is statistically significant and, at the means of *D1* and *q*, positive. The estimated coefficients of price of investment goods (*PRI*) are positive and statistically significant in both regressions, implying that the substitution effect dominates the wealth effect of increases in interest rates. The estimated coefficient of the dummy variable for East Asian countries is positive and statistically significant implying that the variables in the regression model do not fully account for East Asia's high saving rates.

The importance of changes in the youth dependency ratio and adult survival are most easily assessed using counter-factual analysis. The values presented in Table 4 assess the effect of the demographic variables by holding all other independent variables constant at the mean value for all countries and periods in the sample. The values in column (1) show the combined effect of changes in adult survival and youth dependency, while the separate effects of youth dependency are reported in column (2) and of adult survival in column (3). The effect of adult survival is assessed by allowing both the level of survival and the rate of change of survival to vary in the calculations. All values are based on the OLS estimates.

<Table 4. Counterfactual Analysis using global means.>

The first set of results in Table 4 presents the calculated effects of demographic variables on saving using the global changes in youth dependency and adult survival. The combined effect was to increase saving rates by about 20 percent, with the gains concentrated between 1965 and 1985. Survival and youth dependency had about equal effects.

There are important regional differences because of differences in demographic experiences. In East Asia, the national saving rate increased by 3.7 percentage points due to the decline in child dependency. For the Western countries and for developing countries outside of East Asia, the decline in youth dependency was more modest, leading to an increase in national saving rates of only 1.5 percentage points and 1.2 percentage points, respectively.

Changes in adult survival also had a greater effect in the high-performing East Asian countries than elsewhere. In East Asia, saving rates increased by 2.9 percentage points due to the increase in adult survival. In the West, the increase was 1.9 percentage points and in the rest of the developing world the increase was 1.2 percentage points.

The calculations presented in Table 4 assume that the rate of economic growth for each region was equal to the global average and, thus, do not take into account the interaction between economic growth and demographic variables. Because East Asian economic growth was so high, however, demographic variables had a much larger effect on aggregate saving rates. Table 5 repeats the analysis presented in Table 4 but using regional means rather than global means for the non-demographic variables. Calculated in this manner, aggregate saving rates increased by 13.6 percentage points between 1965 and 1995 due to the decline in child dependency and the rise in adult survival. Again the change in child dependency and adult survival were about equally important. Declining child dependency led to a rise in saving rates by 6.9 percentage points. Improvements in adult survival lead to a rise in saving rates by 6.7 percentage points.

Observed saving rates increased by 14.7 percentage points in East Asia during this period. Hence, demographic change accounted for 92 percent of the increase in East Asian saving rates.

<Table 5. Counterfactual Analysis using regional means.>

The estimated demographic effects on saving, though large, are more modest than those found in other recent empirical studies of age structure based on cross-national regression methods described above. The results presented here are more consistent with micro-based estimates such as Deaton and Paxson's estimate that household saving rates rise by 6.5 percentage points due to changes in age structure (as compared with 6.9 percentage points here). The combined effects of declining child dependency and increasing life expectancy is quite similar to the Lee, Mason, and Miller simulations that the combined effects of East Asian style fertility and mortality change could have led to an increase in saving rates of 14.5 percentage points (as compared with 13.6 percentage points here).

These results clearly point to a second demographic dividend in East Asia. The decline in fertility and the rise in adult mortality, which will lead to rapid population aging, have also led to higher saving rates and rapid accumulation of wealth. Assessing the implications for economic growth would require a simulation analysis that incorporates our saving estimates. We do not undertake such an analysis here, but a recent analysis by Mason and Lee (2004) concludes that per capita income could grow more rapidly – by 1.1 percent per annum over the next fifty years – due to the effects of demographic change on the accumulation of wealth.

Qualifications and Conclusions

Obtaining reliable estimates of the effects of demographic variables on saving is a difficult enterprise. Cross-national panel data can be used to estimate only relatively parsimonious models. Thus, the danger that estimated effects are spurious is a serious problem. Demographic variables tend to change gradually and are highly correlated making it difficult to obtain reliable estimates of the separate effects of mortality and fertility. There are some instances when countries experience demographic shocks that could be explored. Two serious problems would have to be surmounted, however. The first is that the shocks are typically accompanied by (or caused by) other changes with their own implications. The experience of the transition economies comes to mind. The second problem is the interest here is in long-term processes not short-term fluctuations. Incentives to save depend on expectations about the long-term trends in adult survival, not short-term fluctuations in mortality except in so far as they influence expectations in unknown ways. The consistency between the macro-based saving estimates presented here, micro-based estimates, and simulation results is reassuring, but application of the Kinugasa saving model to other developing regions of the world yields estimates that do not support the strong role of demographic factors found for the West and East Asian countries.

One possibility is that changes in fertility and mortality have been so gradual that it is difficult to obtain precise estimates of their effects. But another likely possibility is that the responses in saving are conditioned by the political, economic, and social institutions of the countries experiencing demographic change. Of particular relevance here is the existence and form of support systems for the elderly. State-sponsored unfunded pension systems clearly undermine the incentive effects of fertility and mortality change, as is widely recognized in the literature on public pension reform. Perhaps East Asian saving rates responded more to demographic variables than Latin American saving rates because East Asian countries have relied much less on PAYGO pension systems than Latin American countries.

Uncertainties remain about the contribution of fertility decline and increased longevity to the tremendous increase in saving rates in East Asia. Clearly, the widespread presumption that population aging is bad for economic growth is unwarranted. The rate of economic growth will surely decline with the passing of the first demographic dividend. Countries which are relying excessively on transfer systems to support the needs of the elderly will not benefit from the second dividend. But for countries that encourage capital accumulation as a means of meeting retirement needs, aging can serve as a fundamental force for creating a wealthier and more prosperous society.

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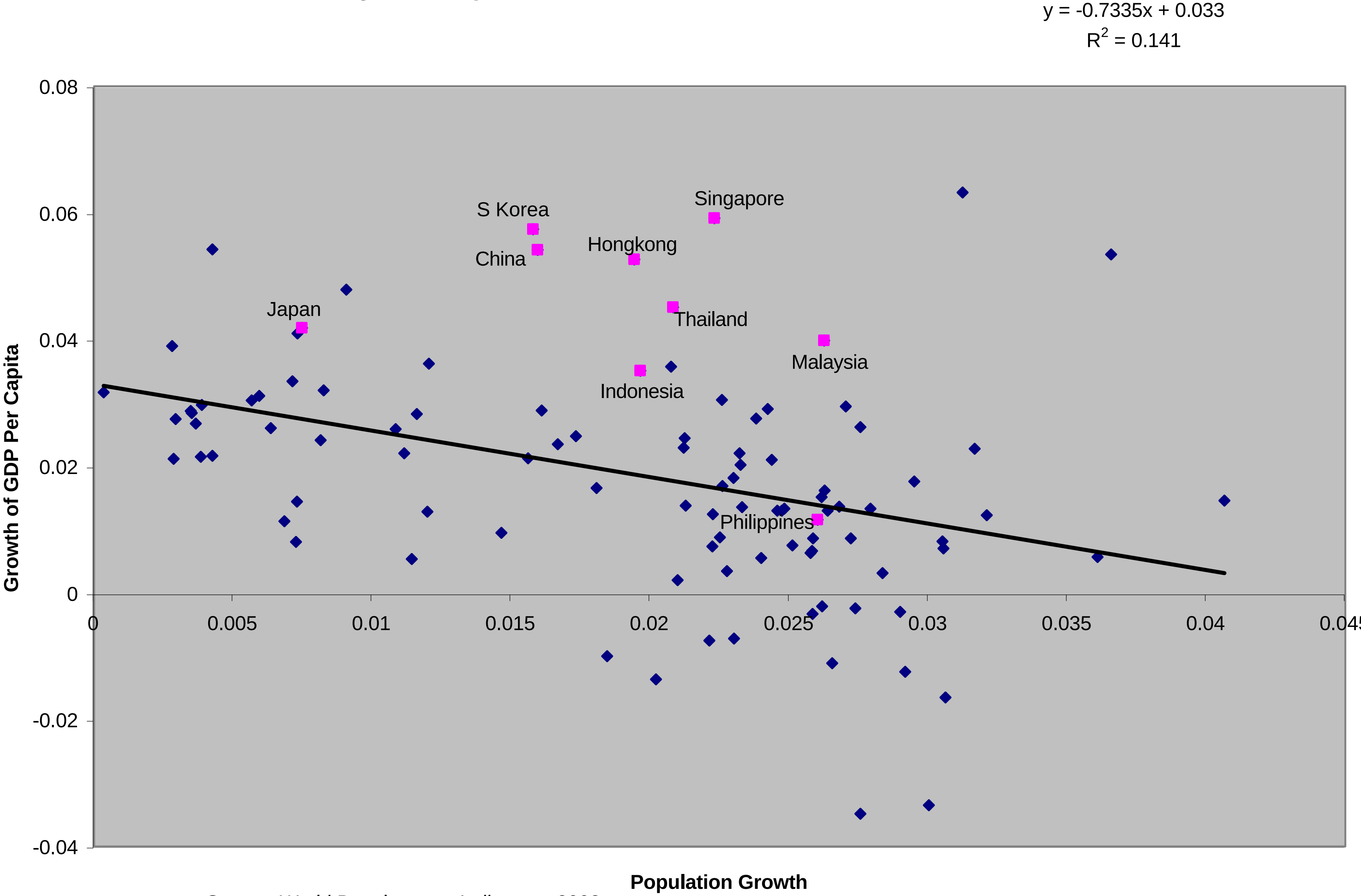
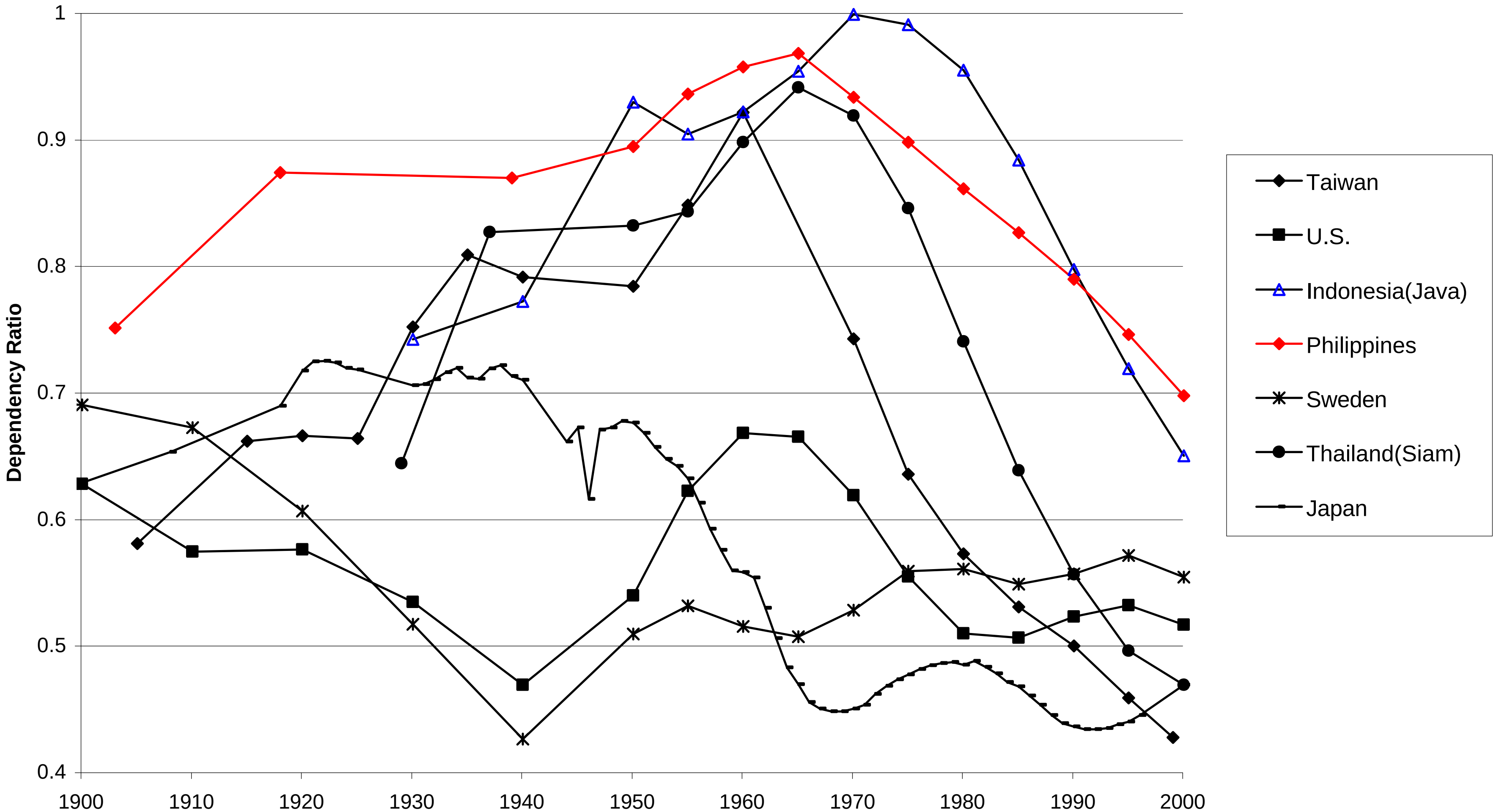
Figure 1. Population Growth and Economic Growth, 1960-2000



Source: World Development Indicators, 2003.

Figure 2. Consumption and Labor Income, Taiwan, 1998 (NT$)

Figure 3. Age Structure, Selected Countries, 1900-2000



Notes. Dependency ratio is young + old population divided by working age population. Young population is 0-14. Definition of old population is 65+ or 60+ depending on data availability. Data for Japan prior to 1920 is for the population with Honseki. Sources available from author.

Figure 4. Changes in age structure East and Southeast Asia, Rest of the World 1960-2000 Source: United Nations 2001.

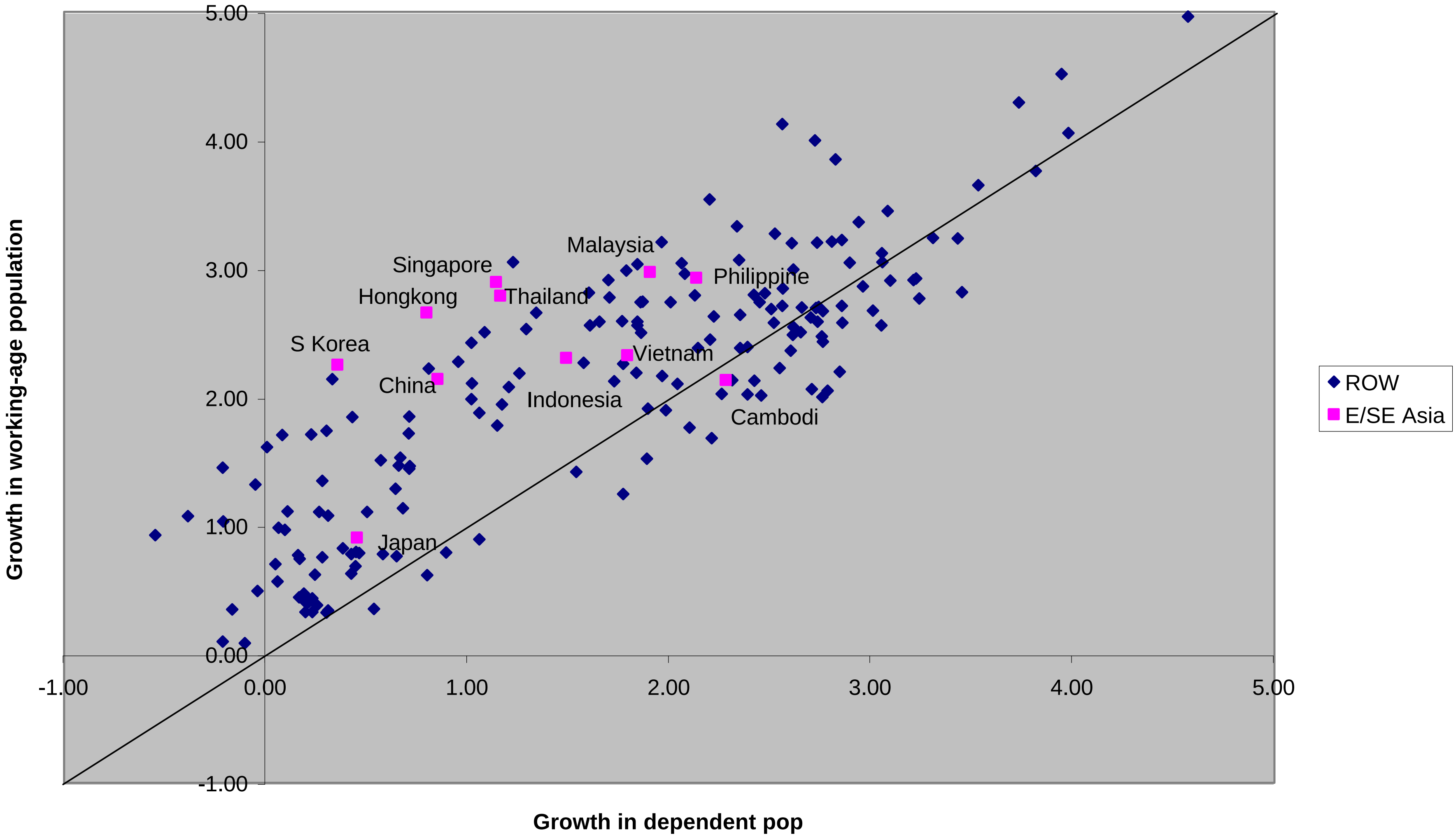


Table 1. Demographic Dividend, 1960-2000. Major Regions of the World, High Performing Countries of East Asia.

	Annual Growth Rate (%), 1960-2000		Annual average dividend (%)	Cumulative effect on output per effective consumer (%)
	Effective labor force	Effective Consumers		
World	2.01	1.81	0.20	8.2
More developed regions	0.92	0.74	0.18	7.6
Less developed regions	2.43	2.18	0.25	10.7
Least developed countries	2.42	2.50	-0.08	-3.0
Africa	2.60	2.64	-0.05	-1.8
Asia	2.32	2.02	0.29	12.5
Europe	0.68	0.53	0.15	6.1
Latin America and Caribbean	2.64	2.28	0.36	15.6
Northern America	1.43	1.17	0.26	10.8
Oceania	1.91	1.73	0.18	7.5
China	2.29	1.81	0.48	21.2
China, Hong Kong SAR	2.70	2.22	0.48	21.3
Japan	1.12	0.87	0.25	10.6
Republic of Korea	2.52	1.79	0.73	33.9
Indonesia	2.38	2.08	0.30	12.7
Malaysia	3.06	2.63	0.43	18.8
Singapore	3.26	2.49	0.77	36.1
Thailand	3.00	2.34	0.66	30.2

Sources: Calculations by author. See text.

Table 2. Contribution of Demographic Dividend to East Asian Economic Growth.

	Growth rate (%)				
	GDP	Effective number of consumers	GDP per effective consumer	Demographic dividend	Dividend as percent of economic growth
China	7.0	1.8	5.2	0.5	9.2
Korea, Rep.	7.3	1.8	5.5	0.7	13.2
Singapore	8.2	2.5	5.7	0.8	13.6
Thailand	6.6	2.3	4.3	0.7	15.5

Notes. GDP growth constructed from World Bank 2003. For other variables see text.

Table 3. Regression estimates of gross national saving rate, Western and East Asian Sample, 1960-2000.

	OLS Estimates			2SLS Estimates		
	Coefficients	Standard errors		Coefficients	Standard errors	
qg	9.531	3.647	***	15.923	3.673	***
?q (5 years)	1.425	0.736	**	1.391	0.834	*
$D1 \cdot g$	-2.738	1.054	***	-1.362	1.140	***
g	-3.753	2.403	***	-7.337	2.472	
PRI	0.037	0.020	*	0.029	0.021	
year70	0.009	0.016		0.010	0.016	
year75	-0.027	0.016	*	-0.024	0.016	
year80	-0.028	0.020		-0.017	0.024	
year85	-0.001	0.017		0.016	0.020	
year90	-0.035	0.017		-0.027	0.019	
year95	-0.004	0.020		0.018	0.023	
Asia	0.111	0.016	*	0.091	0.020	***
Constant	0.164	0.024	***	0.141	0.029	***
Adjusted R^2	0.414			0.384		
N	190			190		
P-value, g	0.000			0.000		
g effect	0.043			0.583		
P-value, year dummies	0.015			0.001		
P-value, Hausman				0.000		

Notes: The dependent variable is the national saving rate.

q: Adult survival index, g: GDP growth rate, $D1$: young dependency rate, $?q$: change in the adult survival rate, *PRI*: price of investment goods, *yrXXXX* are year dummies, N: number of observation. “P-value, g ” is the p-value of F-test of the null hypothesis that the both coefficients of $q \cdot g$ and $D1 \cdot g$ are zero. “Pvalue, year dummies” is the p-value of F-test of the null hypothesis that all the year dummies are zero. “g Effect” is the partial effect of an increase in GDP growth evaluated at the mean of q and D1.

*** denotes significant at 1% level, **denotes significant at 5% level, and * denotes significant at 10% level.

Table 4. Counterfactual analysis given world-wide means for control variables.

	Western and East Asian Sample		
	(1)	(2)	(3)
	Changing q and D1	Changing D1	Changing q
1965	0.2165	0.1996	0.2165
1970	0.2214	0.2011	0.2199
1975	0.2338	0.2049	0.2285
1980	0.2435	0.2091	0.2339
1985	0.2510	0.2134	0.2372
1990	0.2558	0.2163	0.2392
1995	0.2562	0.2186	0.2373

	Western Sample			East Asian Sample			Other Countries		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
	Changing q and D1	Changing D1	Changing q	Changing q and D1	Changing D1	Changing q	Changing q and D1	Changing D1	Changing q
1965	0.2241	0.2101	0.2241	0.1766	0.1443	0.1766	0.1322	0.1082	0.1322
1970	0.2273	0.2111	0.2264	0.1902	0.1483	0.1862	0.1364	0.1087	0.1359
1975	0.2375	0.2141	0.2334	0.2135	0.1555	0.2023	0.1444	0.1103	0.1422
1980	0.2472	0.2176	0.2397	0.2224	0.1634	0.2032	0.1538	0.1133	0.1487
1985	0.2542	0.2214	0.2429	0.2324	0.1700	0.2067	0.1604	0.1152	0.1534
1990	0.2574	0.2234	0.2442	0.2461	0.1774	0.2129	0.1644	0.1179	0.1547
1995	0.2581	0.2252	0.2431	0.2430	0.1817	0.2056	0.1561	0.1201	0.1441

Note: Variables other than q and D1 are set to the world-wide means for the 1960-2000 period.

Table 5. Counterfactual analysis given regional means for control variables.

	Western Sample			East Asian Sample			Other Countries		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
	Changing q and D1	Changing D1	Changing q	Changing q and D1	Changing D1	Changing q	Changing q and D1	Changing D1	Changing q
1965	0.2073	0.1933	0.2073	0.2192	0.1869	0.2192	0.1331	0.1090	0.1322
1970	0.2098	0.1941	0.2090	0.2433	0.1942	0.2360	0.1379	0.1096	0.1359
1975	0.2190	0.1967	0.2155	0.2812	0.2075	0.2606	0.1466	0.1114	0.1422
1980	0.2275	0.1996	0.2212	0.3037	0.2221	0.2685	0.1569	0.1147	0.1487
1985	0.2334	0.2029	0.2237	0.3252	0.2340	0.2780	0.1643	0.1167	0.1534
1990	0.2359	0.2046	0.2245	0.3510	0.2477	0.2902	0.1691	0.1198	0.1547
1995	0.2361	0.2061	0.2233	0.3549	0.2555	0.2863	0.1608	0.1221	0.1441

Note: Variables other than q and D1 are set at the regional means for the 1960-2000 period.