

AGE STRUCTURE AND DEVELOPMENT IN ASEAN AND JAPAN: 1950-2015, A PRELIMINARY REPORT

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1. Introduction

Although population changes have been given increasing attention in both theoretical and empirical explanations of growth, the age composition of population changes remains a relatively neglected factor. Recently, especially in the work of Richard Easterlin and Michael Wachter, this neglect has been questioned and theoretical and preliminary empirical evidence (mostly for the US) advanced to suggest that changes in age structure may have a pervasive effect on economic, social, and political outcomes.¹ Unlike earlier empirical studies including my own on demographic changes and long-swings in residential construction,² Easterlin and Wachter emphasize the effect of changes in age structure on various age specific rates (e.g., fertility rates).

Since the effects of age structure changes have been generally neglected, perhaps even more so in studies of growth in developing countries than elsewhere, this preliminary paper is designed to accomplish three tasks. First, the major *possible* influences of shifts

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1. See Easterlin, R. (1978), Easterlin R. and Wachter, M.L. and S.M. (1978), Wachter, M.L. (1975, 1976), and Wachter, M.L. and S.M. (1980).

2. Campbell, B. (1966).

in age structure, both given age-specific rates and through feedbacks from induced changes in age-specific rates, will be set out. Then, since if age composition does not change it makes no difference what the effects of changes would be, the extent of past and likely future age structure changes in the ASEAN countries and in their major trading partner, Japan, will be investigated at this stage in relative broad terms. Finally, given the assumed relations between different economic, demographic, and social variables and changes in age structure, some of the past and likely future effects of changes in age structure for the ASEAN countries and for Japan will be assessed. If the possible impact of shifts in age composition turns out to be important, this should encourage research to test the hypothesized relations — the major goal of this study.

Putting population changes in a growth context can most easily be accomplished through the long-swing growth pattern that characterized economic development in the US and industrial Europe from the early nineteenth to the mid-twentieth century and possibly beyond.³ From the 1830s to the 1930s, until the 1924 Immigration Act ended the process, the expansion phase of the long-swing in the US put upward pressure on real wages in the US which encouraged immigration and hence growth in the labor supply. The responsiveness of the supply of labor to growth in demand kept the expansion going longer than otherwise would have occurred, raising the capital stock, the quality of the capital stock and per capita incomes above levels that otherwise would have been achieved. Slowing growth, as the longswing peak was passed, at a time when children born to the last wave of immigrants were entering the labor force, then created labor market conditions leading to reduced immigration.

The resulting long-waves in population growth and in the age structure of the population gave rise to the residential building cycle that led the way into the depressions that terminated each long-swing from the end of the Civil War through the 1930s. Over this period, partly because the ebb and flow of immigration tended to stabilize the relative income of the young, age-specific rates, at least headship

3. See Abramovitz, M. (1961) for the standard description of the long-swing process and Easterlin, R. (1968) for an analysis of the contribution of demographic factors to this process. Oshima, H. (1980) contains an application of the long-swing concept to the growth experience in East Asia, one of the few applications to developing economies.

rates, remained remarkably constant.⁴ Then, after the 1930s, population change was no longer dominated by swings in immigration. When the long-swing expansion during and after World War II raised the demand for labor at a time when the entering labor force was growing relatively slowly, the absolute and relative incomes of the young could increase sharply without inducing an offsetting flood of immigrants but bringing about, however, increased rural-urban migration. One outcome was a large increase in household formation rates among the young, partly responsible for the period's housing boom and the continued role of residential construction in the long-swing. Another, according to Easterlin, was a large increase in fertility rates, which more than offset the effects of the contemporary change in age structure and raised crude birth rates.

By the early 1960s the increase in births began to be reflected in rapid increases in the entering labor force, both absolutely and relative to the established or basic labor force. This change in the age composition of the labor force reduced the relative incomes and increased the rate of unemployment of the young and so, among other effects, reduced fertility rates. The resulting waves in population change and in age composition will continue to influence the prospects for economic growth as well as for such diverse outcomes as divorce, suicide, and political alienation rates in the US far into the future.⁵

In most developing countries immigration is ruled out and, with some important exceptions, emigration is not encouraged.⁶ Thus, the most recent US experience is more relevant than that based on the pre-World War II waves of immigration. Most changes in the labor force base and in age structure in developing countries are the result of past swings in births and of the aging of the indigenous

4. The response of immigration to labor market conditions also tended to stabilize the absolute real wages of unskilled and semi-skilled labor near the trend growth rate, but below it, in productivity. Present immigration in the US from Latin America may partly have this effect but it seems based more on the large existing inter-country differentials in real wages and so may prove less responsive to long-swings in labor demand.

5. The analysis in the text is based on my University of Hawaii lecture notes (available in mimeographed form) covering the 1967 to 1981 period and on Easterlin (1968, 1978).

6. Exceptions in the ASEAN region in the period covered include the effects of emigration, permanent and otherwise, from the Philippines and immigration from Malaysia to Singapore in the late 1960s and early 1970s.

population. Thus, the size and skill composition of the labor force and the relative income and labor market experience of the young, with all the feedbacks and effects suggested by Easterlin-Wachter, will depend on the current age composition of the population and hence on past, not present, economic conditions.

However, for much of the world, until quite recently, the age structure of the population probably did not vary widely. Population growth was slow, despite high birth rates, because of high infant mortality, pestilence and war. And, because productivity was low and growing very slowly, if these brakes on population expansion temporarily disappeared, the Malthusian constraint of starvation would take their place. With all surviving the high initial mortality rates equally affected by these limiting forces there was little scope for wide swings, at least as a continual experience, in age composition. The whole population increased or decreased with the cycles of pestilence and war, leaving the age composition relatively unchanged. Then in the twentieth century, mostly for developing countries since World War II, a combination of medical, economic, and political changes removed the major past constraints on population growth.

With a much higher percentage of children born surviving the first dangerous years, with increased incomes allowing improved sanitation, better nutrition for ever larger numbers, mass preventive inoculations, and better medical care when illness does arise, the result was population explosion. Accompanying this explosion was a sharp twist in the age structure, with the very young accounting for a much greater proportion of the total population. One result, since the very young add little to output, was the dilution of hard won increases in total output even among more rapidly increasing populations, keeping per capita growth rates at very low levels or even reducing them. Once this population wave reached the age of first employment the spectre of social and economic malaise and of still further increases in births led to a sense of emergency that gave rise to numerous national efforts to control birth rates. These efforts, through the auspices of the UN and others, became world-wide, the goal being to control birth rates before Malthusian limits again come into play, this time involving the earth's environment and life-supporting resource limits! This effort or, more likely, the effect of the increased entering population on the relative and often absolute incomes and job market experiences of the young had the desired effect in many countries. Thus, fertility rates fell, giving rise to

swings in the age structure and in population growth rates that will affect economic activity in these countries through the year 2000 and beyond. In the present context, the key point is that the ASEAN countries are among those experiencing these waves.

If per capita rates of economic, demographic or social variables differ between age classes, then the swings in age composition just described can affect all these variables directly. For example, to mention only a few important possibilities, household formation or headship rates, savings rates, work experience and up-to-dateness of education, kinds of goods and services demanded, labor force participation rates, school attendance, adaptability to changed conditions, are all known to vary between age classes. Thus, if age-specific rates are relatively constant and the age composition of the population changes, the above variables will also change and with them the economic and other activities they help determine, including activities that may influence births and thus future population and age structure swings.

In addition, swings in age composition can affect the relative incomes of different age groups, if they are not perfect substitutes in production, and their relative labor market experiences (e.g. unemployment or underemployment rates, income expectations). In turn, changes in relative income, in income expectations, and labor market experience can alter the pattern of age-specific rates. In fact, the change in age-specific rates may overwhelm the opposite effect, if present, of changes in age composition, given age-specific rates. This clearly happened in the US just after World War II when a change in headship rates at early life-cycle stages turned a prospective decrease in household formations, at given headship rates, into a large increase.

2. The Relative Income Effects of Changes in Age Structure

With some differences, the following analysis is based on the Easterlin-Wachter approach. Essentially, this approach divides the working population into two age groups. The argument is that the relative income of the first or entering labor force group, defined as the 15-29 age class, varies inversely with the ratio, hereafter called the key ratio, of this age class to the second or basic labor force group, defined as the 30-64 age class. This inverse variation is based

on the assumption that workers in the two age classes are not close substitutes. A simple argument in support of this assumption, from the viewpoint of employers, would be that the greater experience and the greater stability of the services of the 30-64 age class make the expected productivity of the average member of this class considerably higher than for the 15-29 age class. Thus an increase in the relative numbers in the 15-29 class will have the effect of lowering the relative wages of this age class.⁷

Actually, the relative productivity and degree of substitutability between these broad age classes would be expected to vary with the stage of development. Four stages may be usefully recognized in this context. The earliest stage, involving a predominantly agricultural economy, would exhibit relatively minor differences in relative productivity between age classes and gives little importance to the effect of shifts in age composition on the economy via shifts in relative income. Only the effect on economic, demographic, and social aggregates of changes in age composition given age-specific rates would remain.

Then in stage two, when labor intensive industrialization based on relatively unskilled labor is underway, output tends to grow at a pace constrained, with a lag, by the growth of the entering population. The established population partly substitutes for the entering population in labor intensive industries and partly complements this age class in management and service roles. The established population also provides an increasing share of agricultural labor. At this stage, swings in the key ratio begin to affect the relative incomes of the two age classes, both because experience begins to count in production and because shifts in the key ratio will give rise to excess supply or demand for older workers in their roles that complement the entering labor force.

As trade and industrial production grow in importance and in

7. There is some product mix, some growth in the mix of capital specialized to different labor characteristics, some adaptations of the skilled/unskilled mix in producing different products that together or individually could keep the relative demands for the two age classes in line with their relative numbers at existing relative wages. It is assumed that changes in relative numbers alone cannot, i.e., via changes in the composition of demand or in expected labor constraints at different skill levels, bring about the shifts described. Therefore relative excess supplies or demands will appear and relative wages will be changed.

complexity, the learned skills required also become more complex and a premium is placed on the expected stability of the labor supply. These characteristics of stage three indicate that the degree of substitution between younger, less skilled and less stable workers and more experienced, more settled workers declines and relative incomes tend to shift more widely with the same change in the key ratio. Education is an important input, but the basic ideas tend to serve for an entire working life. At this stage, the younger population tends to complement the basic population and their jobs tend to be tied to the employment of the basic population, via pipeline and apprentice relations. Substitution takes place through changes in the mix of products requiring different input skills and occurs in response to the relative wage changes brought about by changes in the key ratio.

Finally, as up-to-date education becomes more valuable, because of rapid technological change in a "high tech" economy, the relative productivity of the younger population will increase, increasing substitutability and reducing again the relative income effect of key ratio changes. At some point, the productivity of the entering population may even surpass that of the basic population, reducing substitutability once again. In this fourth stage, probably not yet attained by any country, the average product per worker will move directly with rather than inversely to the key ratio.

With the exception of Indonesia and possibly Thailand, Japan and the ASEAN countries were at or beyond stage two by the beginning of the 1960s. With the exception of Indonesia, all were almost into or into stage three by the beginning of the 1970s. So, in general, the conditions were present for the expected relation between the key ratio and relative incomes to hold in the ASEAN countries and Japan over the postwar period. Although some countries may move into stage four (e.g. Japan and Singapore) by the time the period to be covered ends (2015), the analysis will proceed on the assumption that all will be in stage three through this period.

For changes in relative income to have the effects postulated, the impact of changes in the relative income of the 15-29 age class must not be outweighed by the effects of opposite changes in absolute income. For example, if the 15-29 age class grows more rapidly than the 30-64 age class but there is a large excess demand for both age classes, it is doubtful that the fact income increases 25 percent for the entering age class while increasing 35 percent for the 30-64 age

class will reduce fertility or headship rates. They may not increase as much as they otherwise would have, but that is all. Thus, arguing that relative income varies inversely with the key ratio is not sufficient; something must be said about the total supply and demand for labor as well.

If, as in growth stage three, the demand for labor varies with the 30-64 population, then, of course, the market for this age group would always be in balance at the existing wage and increases or decreases in the key ratio would signal excess supply or demand for the 15-29 age class.⁸ Thus, relative real income would fall and unemployment would increase in the entering age class if the key ratio increased. What would then happen to absolute real income would depend on what is happening to labor productivity. All that can be said is that the 15-29 age groups share of increased real output per unit of labor input would tend to fall. Of course, unless productivity changes are really large, the young will be more impressed by the decline in their relative position than by any increase in the purchasing power of their nominal income, especially if consumption standards are based on the now relatively higher real incomes of the 30-64 age class. Even with higher incomes it may seem more difficult than before for the 15-29 age class to attain the desired consumption standard.

A relatively simple model that would give the relation just described, is that over five year periods (the time period used in the empirical work that follows) with the growth in the basic labor force, the 30-64 population, plus the rate of increase in output per unit of labor input, determining the rate of growth in GNP. In other words, over such periods the economy adjusts to the basic supply of labor. There is no deficiency of demand and the capital stock adjusts to keep the 30-64 labor force employed at the same average product, net of increases in labor productivity. If the latter are assumed to proceed at a relatively constant rate over time, then the GNP growth rate and the growth rate in the basic population will vary together. If it is additionally postulated that the demand for the entering

8. If, alternatively, labor demand grows with the total population or with the growth in the 15-29 population as, with a lag, might happen in stage two, the relative income effects of changes in the key ratio would be the same as described for stage three. However, the unemployment and absolute income effects would tend to differ and so the net effect of relative income changes might also differ, a possibility ignored in the following analysis.

population is some function of the rate of change in the basic population, given relative wages, then the fortunes of the entering population would clearly vary inversely with the key ratio.⁹ Direct reasons for such a relation could involve modern variants of an apprentice or helper system or a fixed proportion of unskilled to skilled intensive outputs all related to the 30-64 age class labor constraint.

To sum, in this supply determined model the total demand for labor varies proportionately with the rate of growth of the basic population. Thus, excess supply or demand for labor is restricted to the entering population. The unemployment rate and the relative income of this age group will vary with the excess supply or demand and, unless labor productivity changes are large, so will absolute income. The extent of the variation will depend on how the product mix responds to the changes in relative income. However, the absolute income relation will be asymmetrical. Since the trend in labor productivity generally has been positive, the real income of the entering population will increase if the labor market is in equilibrium (i.e., if the key ratio is unchanged from one period to the next). This productivity effect must be added to excess demand and subtracted from excess supply situations to get the net effect of these differing circumstances on wages.

If, in fact, the growth in the 30-64 population is not in line with the growth in labor demand, then the outcomes become ambiguous. In this case, if there is an excess supply of basic labor, the relative income of the entering population can be expected to fall (in stage three) even if the key ratio is constant and may, up to a point, drop even if the key ratio drops. With an aggregate excess supply, more experienced workers will be substituted for less experienced ones, workers representing a bigger investment to employers will be kept at the expense of new entrants, etc. On the other side, if there is a basic excess demand, entering workers will be upgraded to fill the gap and

9. However, if for example, excess supply of the entering age group appears and relative incomes fall, some substitution of entering for basic workers will occur, either directly, by assumption very limited, or by changes in the product mix as the relative prices of goods and services using relatively more unskilled labor and, usually, relatively less capital per unit of output tend to fall. The more significant this indirect substitution effect between age classes, the more important will be the composition effect compared to the relative income effect of key ratio changes.

their relative income may increase even if the key ratio is unchanged. Certainly their absolute income and so, presumably, their behavior will change under these circumstances. However, in the following discussion these ambiguities will be ignored.

The economic implications of the model presented will be discussed in the next section. An important qualification must be introduced first. Breaking the labor force into two age groups ignores possible variation within the age groups selected. Optimally, the variation within should be nil and the variation between the age groups selected should be considerable. In fact, if only two broad age classes are used, the best that can be expected is that variation between the age classes be greater than variations within. In that case the age classes selected should be the ones that maximize the ratio of inter to intra-class variation. For present purposes it is sufficient to assume that this is the case and to ignore the effect of variation within the age classes involved, even though this is large for several variables to be discussed, e.g., headship rates. However, in any subsequent study the ideal of selecting age classes to exclude any significant variation within the age classes should be pursued.

3. Compositional and Relative Income Effects of Changes in the Key Ratio

Given that various economic, social, and political activities vary relative to the population in each age class, changes in age structure have a role in determining changes in the level and in the rate and direction of change of the activities involved. Since changes in age structure, at least of the labor force and household formation population bases, can be readily forecasted (net of immigration or emigration), they provide an important input in making base-line (i.e., given age-specific rates) forecasts of labor market conditions, housing needs, education demands, GNP growth rates, etc. In the following, the effect of changes in the age structure of the population, as measured with age-specific rates held constant, is called, directly enough, the *composition effect* or the CE for short.

Changes in age structure affect the relative supplies of labor in different age classes and, in the manner described above, the changes in relative supplies affect the relative incomes of the different age classes. Changes in relative incomes and, perhaps more importantly, the unemployment rates and lifetime expectations that move with

relative incomes, will affect the age-specific rates for economic, social and political variables. In the following this effect is labeled the *relative income effect* or simply RE. This effect, if the age-specific rate concerned is a ratio to income (e.g., the propensity to consume), will be the net of a "pure" RE or "keeping up with the Joneses" effect and of the fact that changes in relative income alter the aggregate income weights attached to the different age-specific activity rates. Where these two effects pull in opposite directions the net result may not be predictable on *a priori* grounds (see the discussion of the propensity to save below).

If the neoclassical assumptions discussed roughly hold, the key ratio or some variant is probably not too bad a measure of the relative income effect. For this to be so, it is necessary that increases in the ratio do not always match with large aggregate excess demand for labor and decreases with large aggregate excess supply. However, it is much less satisfactory as a measure of the composition effect. For many activities, e.g., household formations, saving rates, there is no way the population between 15 and 64 years of age can be split into two groups without there remaining much intra-class variation in one or both of the groups. Nor, if the full range of the composition effect on the economy is of interest, is it possible to cover this range if the population outside the 15-64 age class is ignored. A more complete study would have to look carefully at the gains in explanatory and predictive power attainable with the further disaggregation possible on the basis of available data.

Given these qualifications, the expected relations between an increase in the key ratio and a long but incomplete list of dependent variables, based on the net impact of the CE and RE, are given in Table 1. For some variables, these two effects complement one another and pull in the same direction when the key ratio changes. For example, an increase in the key ratio will tend to reduce the households to population ratio both because headship rates are lower at early than at late life-cycle stages and because the induced fall in the relative income of the 15 to 29 age class will reduce the age-specific headship rates in this age class much more than the increase in relative income of the basic population will raise headship rates at later life-cycle stages.¹⁰ Essentially, the age of leaving home,

10. When relative incomes change, the response of age-specific rates can be expected to differ between the age classes included in the key ratio. For

Table 1 — Net Relative Income and Composition Effects of Changes in Age Structure: Selected Variables

I. Variables Reduced By An Increase In The Key Ratio¹

1. Income Equality^a (0, -)
2. Fertility Rate^b (0+, -)
3. Immigration Rate (0, -)
4. Average Headship Rate (-, -)^c
5. Skill Intensify Of Output (-, -)^d
6. Average Product of Labor And Per Capita Income (-, -)

II. Variables Increased By An Increase In The Key Ratio

1. Unemployment (Underemployment) Rates (+, 0-)
2. Female Labor Force Participation Rates (0+, +)
3. Emigration Rates (+, +)
4. Age of First Marriage, Age of Leaving Home (0, +)
5. Suicide, Divorce, Alienation Rates (+, +)
6. Responsiveness To Change (+, +)
7. Demand For Loanable Funds (+, +)

III. Variables With A Priori Uncertain Responses To An Increase In The Key Ratio

1. Savings Rate (-, ?)
2. Aggregate Demand (?, ?)
3. Goods Demanded By Young/Goods Demanded By Basic (+, -)
4. Demand For Higher Education (+, ?)
5. Velocity Of Money (+, -)
6. Crude Birth Rate (+, -)
7. Male Labor Force Participation Rates (-, ?)
8. Internal Migration Rate (+, -)

a. Range of average incomes across quintiles and skill distribution.

b. For females 15-34.

c. Also reduced are the ratio of owners to renters and the average quality of housing demanded.

d. Capital intensity is often related to skill intensity and an increase in the relative cost of unskilled workers would likely increase capital intensity.

1. The first sign in parentheses after each variable is the expected direction of the composition effect and the second sign in the expected direction of the relative income effect.

the age of first marriage, and the size of non-normal households all depend on job market experience and the headship rates of the young vary with these factors.¹¹ In fact, all the per capita expenditure, running from demand for appliances to the services of various utilities, related to the average headship rate will also tend to fall.

Other major economic activities in which the composition and relative income effects are complementary or in which one or the other is the only effect involved include the relative attractiveness of skill intensive versus unskilled intensive products, the average productivity of labor, the relative capital intensity of production, the household and skill related income distributions, and the rate of immigration. All these variables move inversely with the key ratio. On the other side, expected to vary directly with the key ratio are, to mention a few, such outcomes as the natural rate of unemployment (so the inflation necessary to achieve a given rate of unemployment), the rate of emigration, the age of marriage and of leaving home, and political alienation, suicide and divorce rates.

Many other variables, including such key outcomes as crude birth rates, internal geographic mobility, and the savings ratio, may increase or decrease in response to a key ratio increase since for these variables, the composition and relative income effects can pull in opposite directions. Because age-specific fertility rates are higher for the 15-29 age class, the composition effect of an increase in the key ratio will be to raise crude birth rates. However, the relative income effect of the same change will tend to reduce crude birth rates by raising the age of marriage and the age of leaving home, by increasing

example, since it is much simpler to choose between living with one's family or forming an independent household when young and unmarried than after marriage and children, the response of headship rates to changes in relative income will also differ between the entering and basic populations. That there will be a differential response for many other age-specific rates, e.g., fertility rates, demand for education, immigration, emigration, migration, suicide and divorce rates, is also apparent.

11. These changes do not mean household formations will fall, only that they will be lower than if the key ratio had not increased. They will fall if the combination of the CE and RE more than offsets the current population growth. After World War II what would have been a large decrease in household formations at beginning period headship rates in the US was partly offset by the current CE and turned into a large increase by the even larger impact of the RE on age-specific headship rates of the young.

the female labor force participation rate, and by decreasing the perceived well-being and foreseen accomplishments of the most fertile age groups. No *a priori* conclusions can be drawn, but Easterlin shows a clear inverse relation for the US between the key ratio and the crude birth rate. A necessary link in the relation, if increases in the key ratio are to lead to reduced crude birth rates, is that the fertility rate must move inversely with the key ratio, a relation investigated in Section 5.

Internal migration falls in the "unpredictable" category because, given the greater geographic mobility of young people, the CE effect of an increase in the key ratio is to raise migration, while the decline in relative income, especially the associated increase in unemployment rates or difficulty in locating a job, has the opposite effect. Because the CE and RE have opposing directional pulls, the demand for education and the relative markets for goods specialized to the two age classes involved also belong to the "uncertain" category.

Finally, the saving ratio is *a priori* unpredictable because, while the CE and the "pure" relative income or "keeping up with the Joneses" effect work in the same direction, the "aggregate" relative income effect can pull in the opposite direction. The first two will reduce the aggregate propensity to save as the key ratio increases, but the last may increase, decrease, or leave it unchanged, depending on what happens to the share in total income of the 30-64 age class. If the income share of the basic population increases, then the higher age-specific saving ratio for the 30-64 age class will receive a proportionately greater weight on the average, raising the propensity to save and possibly more than offsetting the impact of the other two effects. If the change in relative numbers is exactly offset by the change in relative wages so that the income shares of the two age classes are unchanged, then only the CE and the "pure" relative income effect will be involved and the propensity to save will fall. Predicting the effect of key ratio changes on the propensity to save (or other ratios involving income as a denominator) then involves predicting the probable response of the aggregate income share of the 30-64 or of the 15-29 age group, which requires country-specific knowledge.¹²

12. In addition to the effects discussed, changes in age structure are likely to affect the composition of demand and the allocation of resources since tastes differ widely between age classes and the dynamics of taste development depend

Since the effect of key ratio changes on the propensity to consume is uncertain, the effect on aggregate demand must also be uncertain. This conclusion is supported by the fact that the effect of key ratio changes on investment and on government expenditures and taxes relative to income is also uncertain. Although the neoclassical or supply side argument used in this paper essentially assumes away any significance for aggregate demand variations, the latter may be important in a cyclical context, (business cycle or long-swing) and country-specific research to reduce the uncertainties described would clearly be desirable. However, in the following analysis, the aggregate demand effects of age structure changes will have to be ignored.

Before turning to the empirical part of this study, it is important to remind the reader that the relations between relative income changes and the social, demographic, and economic outcomes listed have been asserted, not adequately derived or tested. They are based on simple economic analysis or partial empirical evidence. However, for any but the stated "educational" purpose of this paper, the theoretical underpinning would have to be improved and the theoretical implications derived from the improved underpinning would have to be empirically tested in a model sufficiently large to show holding the effects of other major determinants constant. This is obviously so for attempts to explain how age structure changes did or will affect the economy or society of a specific country. As is, the conclusions reached below must be interpreted as stating "what would have happened" and "what will happen" if changes in the key ratio are the only changes involved and have the asserted effects via relative income and employment changes on the economic, demographic, and social outcomes listed. However, the CE component of the explanation, being based on information about the actual age-specific rates at different life-cycle stages, can be taken as the actual past and future contribution of the composition effect alone to these outcomes.

on the relative sizes of different age classes. Under these circumstances, since age structure will be one determinant of the market size for different products, they will also be one determinant of the relative costs, via economies of scale, of different products, again affecting the allocation of resources.

4. Key Ratio Changes in ASEAN and Japan: 1950-2015

Before looking at the evidence, three important qualifications to the basic results presented must be discussed. First, the age classes 15-29 and 30-64, combined in the key ratio may, on closer inspection, not be the best in the sense of maximizing between class and minimizing within class variation. In fact, it is likely that different dichotomies would be "better" in this sense in different countries, depending on the stage of development and on cultural and institutional constraints. For example, in some developing countries substantial numbers may enter the labor force in their early teens (10-14) and, because of this and the fact that schooling stops early for the vast majority, most may reach "experienced" or "skilled" status and thus have a stable family life by their twenty-fifth year. At the other end of the life cycle, because of earlier physical aging as well as cultural practices, effective retirement may come considerably before the sixty-fifth year. These considerations might suggest a 10-24/25-54 ratio instead of the one used. Although most ASEAN countries (Indonesia is a possible exception) seem to have achieved a stage of educational and industrial development consistent with the age classes included in the key ratio, instead of simply assuming this to be true, the proper procedure would be to define the key ratio independently for each country after investigating labor market conditions in each country.¹³

Also, as noted, although some two-way dichotomy of the labor force may be reasonably appropriate for capturing the relative income effect, no two-way breakdown of the population can give anything but a very rough approximation of most of the composition effects of changes in age structure. Further, if a two-way classification is used, the best classification almost certainly would not be the same for all the variables exhibiting an age-specific life cycle. Again, the composition effects based on the breakdown used have to be considered as only roughly indicative of the role that age structure changes might play.

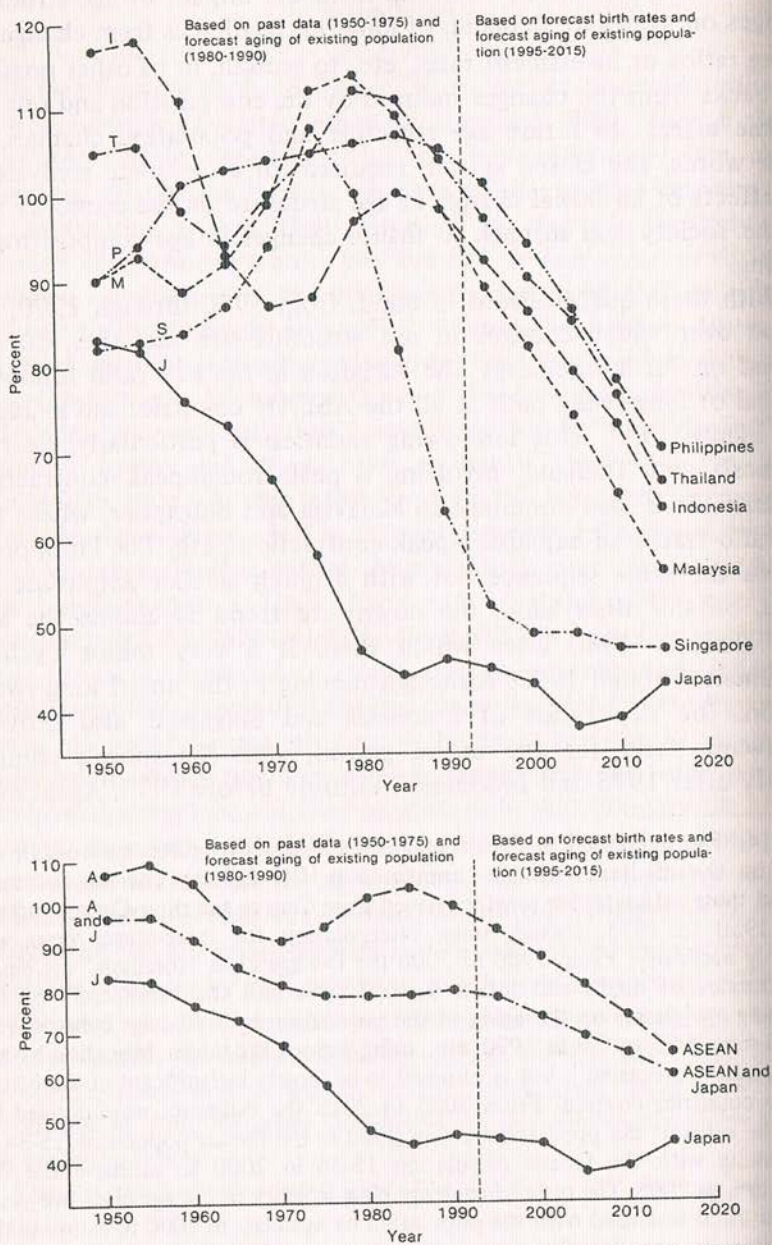
Finally, the results presented do not take account of possible

13. If this is done, two key ratios, one for agriculture and one for the rest of the economy, with weights changing as agriculture's share changes, may turn out best.

short-run income effects resulting from the impact of age structure changes on aggregate demand, of long-run feedbacks from changes in saving ratios or investment rates, etc. to growth, or of other possible feedbacks from the changes induced by the composition and relative income effects to future age structure and population changes. In other words, the closed system required for a complete analysis of the effects of an initial change in age structure on the economy and on the society and so back to future changes in age composition is missing.

With these qualifications in mind, from 1950 through 1990, the period over which changes in age structure are fact (i.e., do not depend on birth forecasts), the variation in the key ratio follows a cyclical or long-swing path in all the ASEAN countries and in Japan (see Figure 1).¹⁴ This long-swing variation is particularly clear in Indonesia and Thailand, involving a peak-trough-peak contraction sequence. It is also dominant in Malaysia and Singapore, where the key ratio traces an expansion-peak-contraction path. The Philippines follows the same sequence but with a much smaller amplitude. In Japan, on the other hand, the downward trend dominates the key ratio through 1980 after which there is a very minor cyclical movement through 1990. Although moving in the noted long-swing fashion, the key ratios of Indonesia and Singapore also show a downward trend for the entire period, with Singapore's coming entirely after 1975 and Indonesia's entirely before 1975. Again over

14. The data used in Figure 1 and in subsequent figures are from or are based on the medium estimates contained in UN (1980). For the countries covered these estimates are mostly derived from Census and inter-Census surveys from 1950 to 1975, though some interpolation for inter-censal years was probably necessary. From 1980 to 2000 the 0-4 age class "forecasts" are based on estimates of births and infant survival rates and the "forecasts" of the remaining age classes on the aging of the population by 5 year age cohorts, e.g., from 0-4 in 1985 to 5-9 in 1990, etc., using various life tables. Migration by age class is also "forecasted", but is assumed to be largely insignificant in the future for the countries covered. From 2005 to 2015 the estimates were derived by using the ratio of the population 0-4 in 2000 to the female population 15-34 in 1995 along with the female population 15-34 in 2000 to estimate the 0-4 population in 2005. The ratio of each age class in 1995 to the age class five years older in 2000 was used with the population by age class in 2000 to estimate the population by age class five years old and up in 2005. The process was then repeated to obtain the population by age class in 2010 and 2015. Based on data derived as described, the key ratio will be independent of birth forecasts until 1990.



Sources: Derived from UN (1980).

FIGURE 1
 THE KEY RATIO: ASEAN MEMBERS AND JAPAN, 1950 TO 2015

the period, the Philippines shows a slight upward trend while Thailand and Malaysia show no trend at all.

Reflecting these varying trends, there were many shifts in relative positions over the 1950 to 1990 period. Indonesia, for example, starts with the highest ratio, falls to the lowest (for ASEAN) in the 1970s and 1980, and will increase to third place in 1990. Malaysia's key ratio rank also varies considerably, moving from fourth place in 1950 to first place in 1980 and forecasted to fall to third (with Indonesia) in 1990. Thailand and the Philippines generally have high key ratios, ranking first, second, or third in most periods. Singapore's key ratio moves from last place in 1950 to second in 1975 before dropping, if the population forecasts hold, to a level far below the other ASEAN countries between 1980 and 1990. Japan's key ratio, from an initial level slightly above Singapore, was less than that of the other countries throughout the rest of the period, falling, as noted, sharply from 1950 to 1980 and reaching a level less than half that of the lowest ASEAN country in the latter year. Given the relatively large share of Indonesia in the ASEAN total, it is not surprising that for ASEAN as a whole the key ratio mirrors that of Indonesia in both long-swing and trend aspects and in relation to Japan's experience.

Based on the UN birth rate forecasts, discussed (and questioned) below, after 1990 the variation across countries will be greatly reduced, with the Philippines, Thailand, Malaysia and Indonesia all falling sharply and monotonically toward the Singapore level, which will remain relatively unchanged from 1990 on. Japan, also relatively trendless, will trace out a contraction-through-expansion cycle between 1995 and 2015. If the forecasted drop in birth rates after 1975 does not occur, as it will not if relative incomes are effected as expected by key ratio changes between 1980 and 2000 and crude birth rates are effected as expected by the change in relative incomes, then, instead of falling after 1995, the ASEAN key ratios will increase.

Clearly, as measured by the key ratio, the age structure has changed and will change significantly in every ASEAN country and in Japan over the 65 year period covered in Figure 1. And, in addition to the variation in age structure within the different countries, there has been and will be considerable inter-country variation. Thus, if the asserted relations hold, changes in age structure could have played and could play a significant role in

determining what happened and what will happen to key economic, demographic, and social variables in the ASEAN countries and in Japan and in determining the comparative fortunes of these countries over the period considered.

The basic relation, it will be recalled, is that, *ceteris paribus*, relative incomes of the two age groups involved vary with changes in the key ratio and that numerous economic, demographic, and social outcomes vary with changes in relative income and with the composition effects of changes in the key ratio. In more detail, if, for example, all other determinants of the following variables were the same in all countries, the country with the highest key ratio, e.g., Indonesia in 1950, would have the lowest average product and per capita income, the lowest desired capital-labor and capital-output ratios, the highest rate of emigration and the lowest rate of immigration, the lowest ratio of households to the total population, the highest unemployment or underemployment rate, the lowest fertility rate and the greatest inequality of household incomes, to name a few of the outcomes for which the direction of the age structure effect is known.

Given the many other factors involved, the relative rankings based on age structure differences of the variables just discussed clearly, would not be expected to match the actual country rankings of the same variables. However, Japan's relative position on most of the outcomes a priori predictable conforms to what would be expected on the basis of age structure.¹⁵ For the other countries involved, it is left to the reader to carry out the exercise. The relative rankings sometimes conform to age structure differences and sometimes do not. Only a larger model, allowing measurement of the influence of other determinants, would make it possible to meaningfully assess the probable past and likely future contribution of the large swings in age structure that have been and will be experienced on the *relative* performance of the countries covered. The main point to be made is that age structure, a variable often not included in such models, could be an important determinant of the final outcome.

5. Fertility Rates and Age Structure

For most variables influenced by changing age structure, quin

15. Fertility rates are an exception for both Japan and Indonesia, suggesting the importance of absolute income differences.

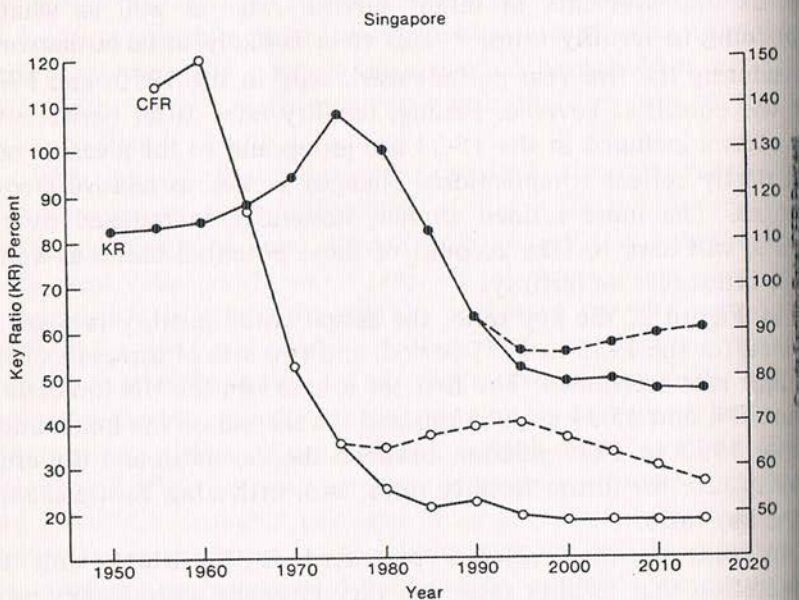
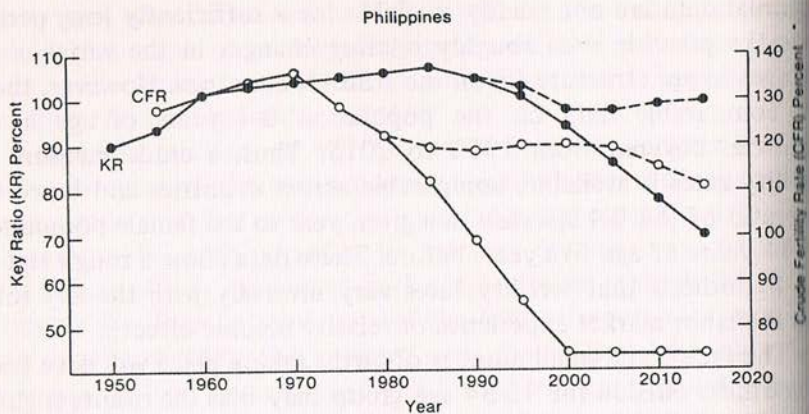
quennial data are not readily available for a sufficiently long period to make possible even roughly relating changes in the variables to changes in age structure for all the ASEAN countries. However, there are comparable data on the population 0-4 years of age in all countries covered from 1950 to 2015. Thus, a crude measure of fertility rates is available, comparable across countries and based on the ratio of the 0-4 age class in a given year to the female population 15-34 years of age five years before. These data allow a rough test of the hypothesis that fertility rates vary inversely with the key ratio (via the labor market experience or relative income effect).

The fact that a small number of births taking place will have been to mothers outside the 15-34 age group may bias the results slightly when changes in the fertility ratio are very small, but more important is the potential for error arising from the fact that the measure used records improvements in infant survival rates as well as what is happening to fertility rates.¹⁶ This error is likely to be bothersome, considering the five year periods used, only in the 1950s and 1960s for the countries covered. Finally, fertility rates differ between the age classes included in the 15-34 age group and so the measure used will partly reflect compositional changes as well as relative income changes. The more refined studies, hopefully encouraged by our results, will have to take account of these potential biases as well as other influences on fertility.

In Figure 2, the key ratio, the actual crude fertility rate as just defined for the 1955 to 1975 period, and two sets of forecasts of this fertility rate are shown. The first set is based on the UN forecasts of future 0-4 and 15-34 populations and the second on the implications of the 1955 to 1975 relation between the key ratio and the crude fertility rate for future fertility rates, and, with a lag, future changes in the key ratio.

In general, the evidence presented is consistent with the expectation that fertility rates will vary inversely with the key ratio. Looking at the country relations, the hypothesized inverse relation is found in all the countries covered except the Philippines, with the relation strongest in Indonesia, Thailand, Malaysia, and Singapore,

16. Another source of possible error is that the 0-4 age class may include migrants or that the 15-34 age class five years before may have been increased during the interval by immigration or decreased by emigration. A bias in the 0-4 age class data for this reason is unlikely in the countries involved, except that a bias, based on emigration, in the 15-34 age class is possible in the Philippines.



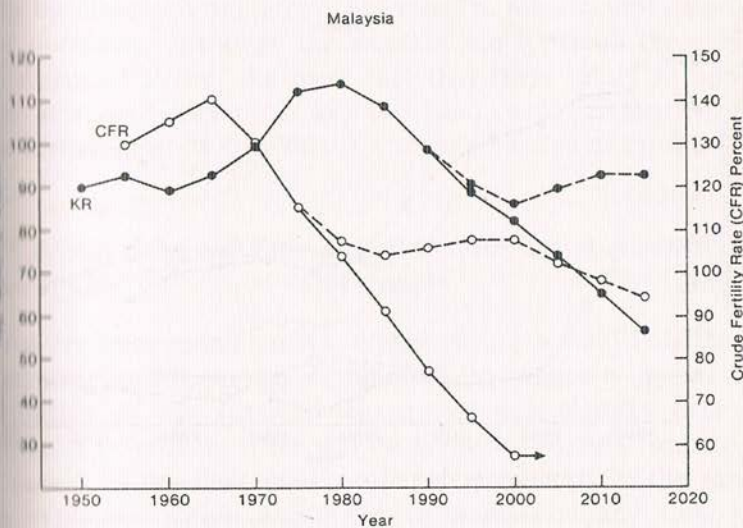
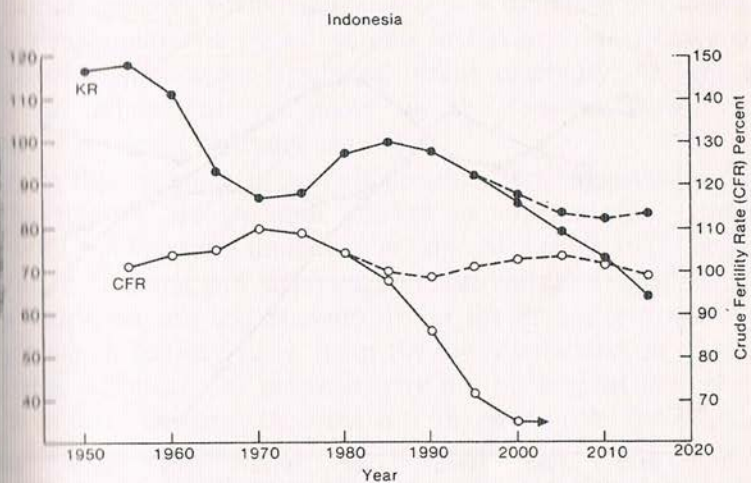
— UN medium population forecasts*
 - - - BOC forecasts (based on 1955-1980 relation)

Note: Crude fertility rate is the ratio of the population 0-4 at one point in time to the female population 15-34 five years before.

*Sources: Derived from UN (1980)

FIGURE 2
FERTILITY RATES AND THE KEY RATIO, ASEAN MEMBERS
AND JAPAN, 1950 TO 2015

Figure 1 (Continued)



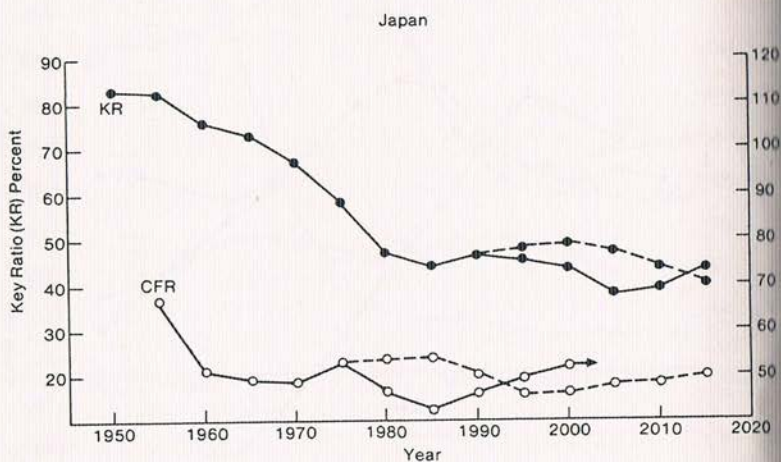
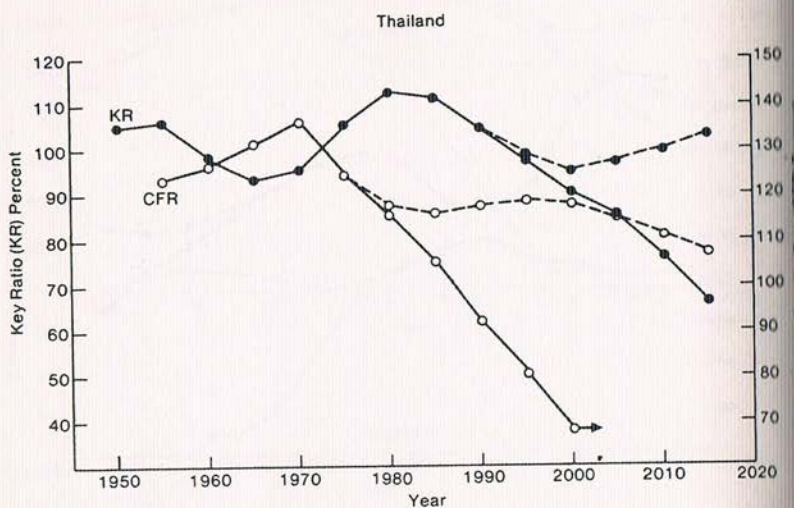
— UN medium population forecasts*

- - - BOC forecasts (based on 1955-1980 relation)

Note: Crude fertility rate is the ratio of the population 0-4 at one point in time to the female population 15-34 five years before.

*Sources: Derived from UN (1980).

Figure 2 (Continued)



— UN medium population forecasts*

- - - BOC forecasts (based on 1955-1980 relation)

Note: Crude fertility rate is the ratio of the population 0-4 at one point in time to the female population 15-34 five years before.

and weakest in Japan. For pooled ASEAN data, the relation is as expected in 14 cases and the opposite in 6 cases. Four of the six exceptions came in periods and were of a direction (an increase in the key ratio matched by an increase in fertility rates) that suggests the possible influence of reduced infant mortality. On the other hand, no adjustment was made for the long-run downtrend in fertility rates noted by many observers.

If, as this evidence suggests is possible, fertility rates do depend on the relative income-labor market experience effect, then the decline in the key ratio underway in Singapore since 1975, beginning in 1980 in Thailand and Malaysia, and that will take place from 1985 on in Indonesia and less dramatically in the Philippines, will lead to an increase in fertility rates, from the dates indicated, in all of these countries. Although the response may not be as great as in the past, if it is as just discussed, then the UN forecasts of the 0-4 population from 1980 on will be erroneous. As a reflection of this, so will the forecasts of the 15-29 population and thus the key ratio from the year 1995 on. Alternative estimates of future fertility rates, and with a lag, of future key ratios based on this historical experience, done simply by inspecting the graph, are given to suggest another possible set of outcomes. Although this result is subject to all the qualifications discussed above, the mere fact that there exists an apparent inverse relation between the key ratio and crude fertility rates, and hence births, suggests that this is a topic deserving of careful further study.

6. Age Structure Changes and Country Developments: An Example

Just as for cross-country comparisons, a multi-equation or general equilibrium model is required to correctly measure the contribution of age structure changes in one country over time. However, it is unlikely there will be as much variation from one five year period to the next in the other determinants of the variables being explained within a country as there is at any time across countries. Thus, the contribution of age structure changes to changes in these variables may be more easily traced for individual countries over time. In any event, to illustrate what the effect of age structure changes would be if all the hypothesized relations noted in Table 1 hold, the effect of changes in age structure *alone* on economic,

demographic, and social outcomes in Indonesia is briefly discussed below. The analysis is based on the relative growth rates of the 15-29 and 30-64 age classes shown in Figure 3. Comparing these growth rates provides a visually descriptive way of presenting changes in the key ratio. If it is assumed that Indonesia was moving from growth stage 1 to 2 in the 1950s, was beginning to move from stage 2 to stage 3 from the mid-1960s through the 1970s and is now about there, then there would be a relative income effect from the late 1950s on in Indonesia. Growth would have varied with the 15-29 age class through most of the 1960s, with transition to a 30-64 age class constraint underway in the 1970s and dominating the future.

From 1950 to 2015, the growth in the 15-29 age class swings widely around the growth rate of the 30-64 age class in Indonesia, accounting for the observed long wave in the key ratio. From 1950 to 1970 the 30-64 age class grew much more rapidly than the 15-29 group, which, if age structure was the only variable involved, should have caused an increase in the relative wages of the 15-29 age class and served to discourage labor intensive industrialization in the early part of this period. Thus, the thrust of age structure changes, combining the CE and RE, would have been to increase average productivity and per-capita income (by the composition effect only), stimulate skill intensive and possibly capital intensive production relatively speaking, raise fertility rates, discourage emigration, reduce household income inequality, increase the national headship rate, and decrease suicide rates and the political alienation of the young, to name two of the possible social outcomes.

With a large jump in the growth rate of the entering population, from zero to almost 10 percent between the first and second halves of the 1960s, the changes brought about by a falling key ratio would have slowed down and then halted in the first half of the 1970s. Then, in the second half of the 1970s and in the first half of the 1980s all the above outcomes would be reversed, with the relative and possibly the absolute incomes of the young decreasing. The initial impact of the absolutely and relatively high 15-29 growth rate would have been sharply increasing underemployment (unemployment, although less important in the Indonesian context, would also increase). If these age structure changes alone are considered, the result would be decreased average productivity and per-capita incomes, a stimulus to less capital intensive and skill intensive production, reduced average headship rates, lower fertility rates,

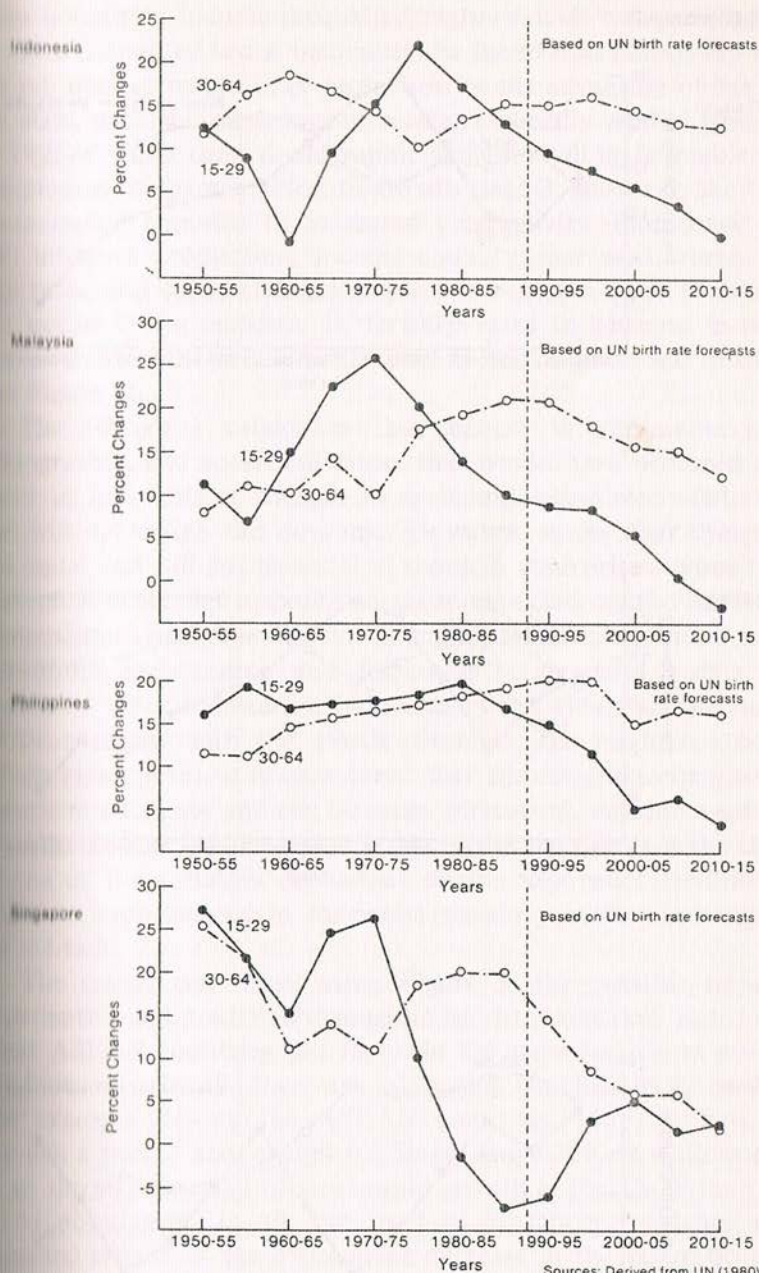
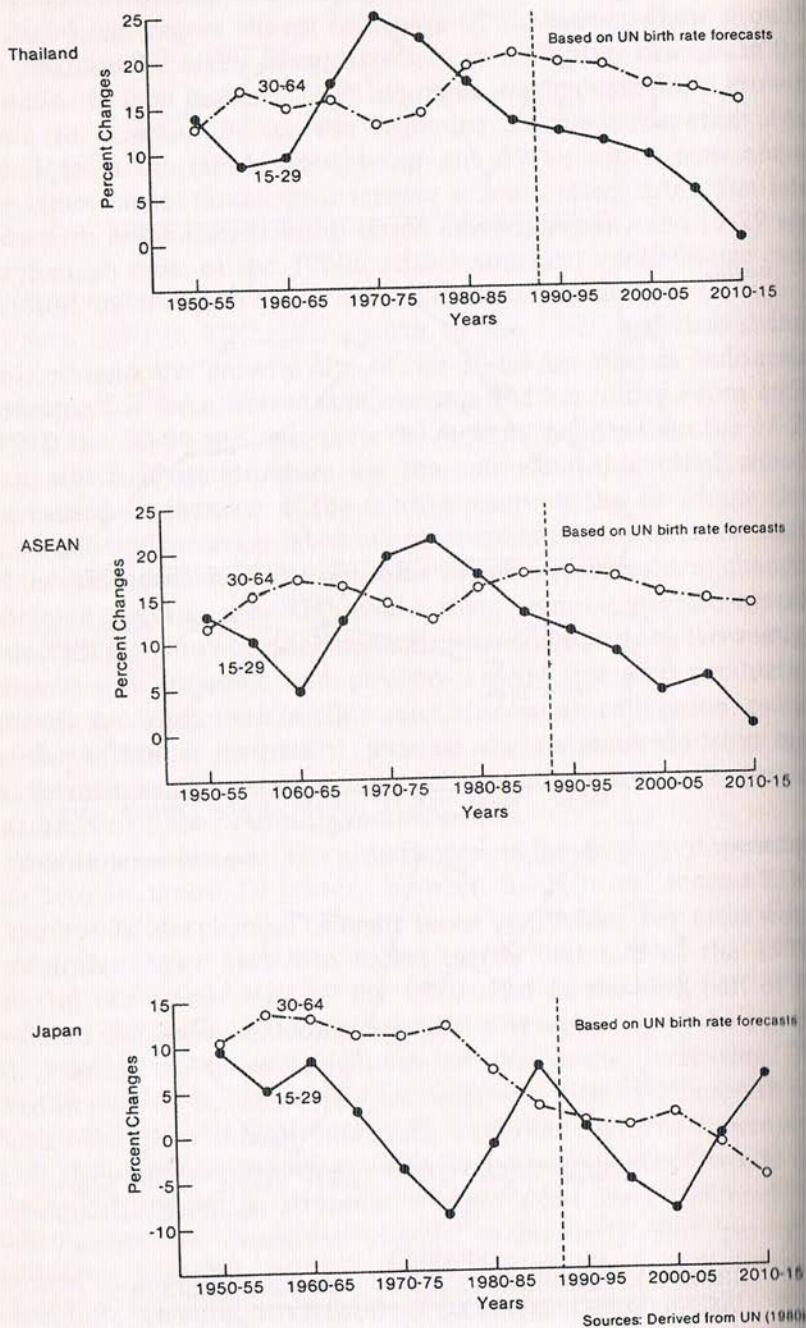


FIGURE 3
GROWTH RATES OF THE 15-29 AND 30-64 AGE CLASSES IN
ASEAN COUNTRIES AND JAPAN, 1950-1955 TO 2010-2015

Figure 3 (Continued)



more household income inequality, higher suicide rates and increases in other indices of social instability. In the second half of the 1980s, the job market would once again turn to the advantage of the 15-29 age class, with this advantage increasing especially rapidly from 1990 to 1995. At that time, demographic variables will be favorable to the completion of the transition to growth stage 3. However, the further demographic stimulus to increased productivity, more capital and skill intensive production, income equality, increased average headship rates, and social stability implied in Figure 3 down to 2015 will not occur if the response in fertility rates to changes in relative income in the next decade is the same as this response was in the past (see Figure 2).

The foregoing catalogues the changes in various economic, demographic, and social indicators that would have occurred or will occur in Indonesia if changes in age composition alone determined and will determine the outcome. However, since other things were not equal and will not be equal, it should not surprise anyone to find the actual outcomes opposite to those expected on the basis of age composition changes only. For example, Sukarno's policies and the disruptions surrounding and following his removal had a major impact on what occurred in Indonesia in the 1960s and on how the 1970s compare with the 1960s. Even so, the record of possible effects given, when it is considered that age structure changes affect the entire economy and can be easily forecasted, should be sufficient incentive to carry this research further. And the fact that the changes in one of the variables dependent on the key ratio, fertility rates, occur as hypothesized in Indonesia should provide encouragement for the task.

The reader can trace, using Figure 3, the possible impact of experienced and predicted changes in age structure (key ratio) on the other ASEAN countries and Japan in the same fashion as was done for Indonesia. In all, there are interesting conclusions to be drawn. For example, taking the ASEAN countries, they all have gone through a period and, except for Singapore, will for a while continue to go through a period of more rapid growth in the 15-29 than in the 10-64 population. In all, but least in Singapore, evidence of the expected effects of the consequent decrease in the key ratio can be found. And all will, in the 1990's, experience the opposite pressures resulting from a relative shortage of young compared to established workers. This situation will reverse again in the early part of the 21st

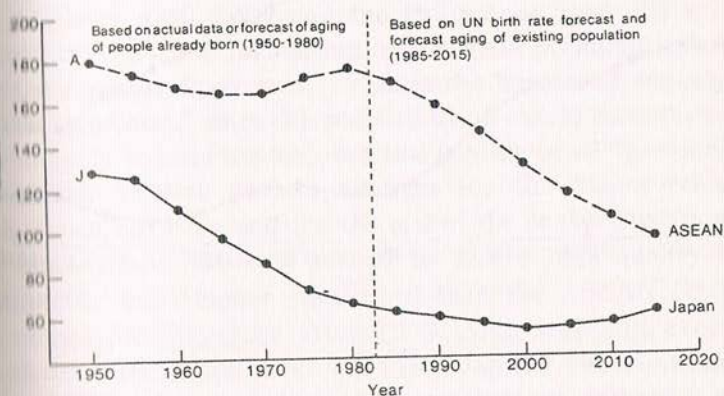
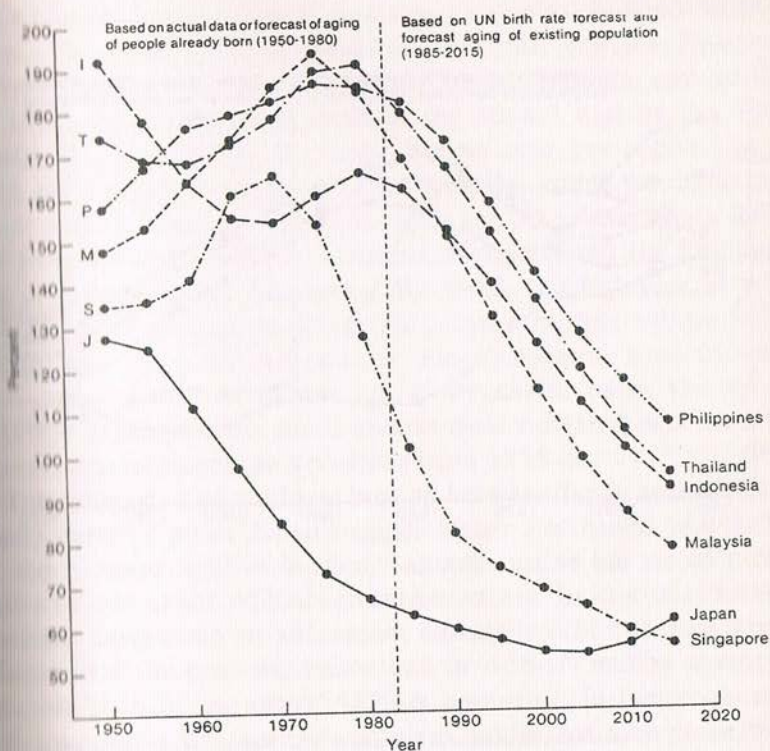
century if the above arguments about the key ratio and fertility rates are correct, setting up a demographic-based repetitive long-swing. Finally, the stimulus to increased capital and skill intensive production, to increased income equality, and to social stability in Japan coming from changes in age structure alone over the last thirty years is noteworthy as are the changes, especially the decline in the growth of the 30-64 age class, just ahead.

7. Other Age Related Outcomes: Education and Dependency Burdens in ASEAN and Japan

Two effects of changing age structure not measured by the key ratio are the educational burden and the dependency burden. The education burden can be measured in various ways but to roughly illustrate how countries rank in terms of this burden and to indicate the changes that have been and will be occurring, the 5-24 age class is related to the 30-64 age class in Figure 4.¹⁷ The former is taken to measure the school age population and the latter the population providing most of the taxable surplus or private spending used to support a country's educational effort. Measuring the educational effort in terms of this ratio implicitly holds the quality of this effort constant over time. When the ratio increases the quality may be reduced, with long-run implications, to keep the burden relatively constant, and vice-versa. Since there is no way to monitor how each country responds to the pressures involved, this aspect is simply ignored in the following discussion. In addition to the total educational burden, the higher education (high school plus college) burden, measured by the ratio of the 15-24 age class to the 30-64 age class is also given for each country in Figure 4.

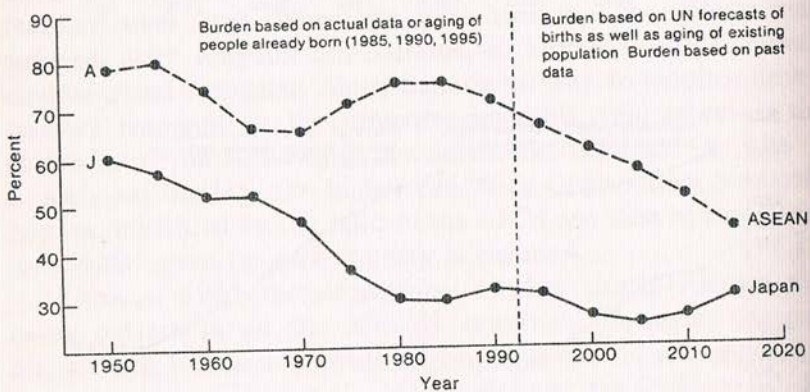
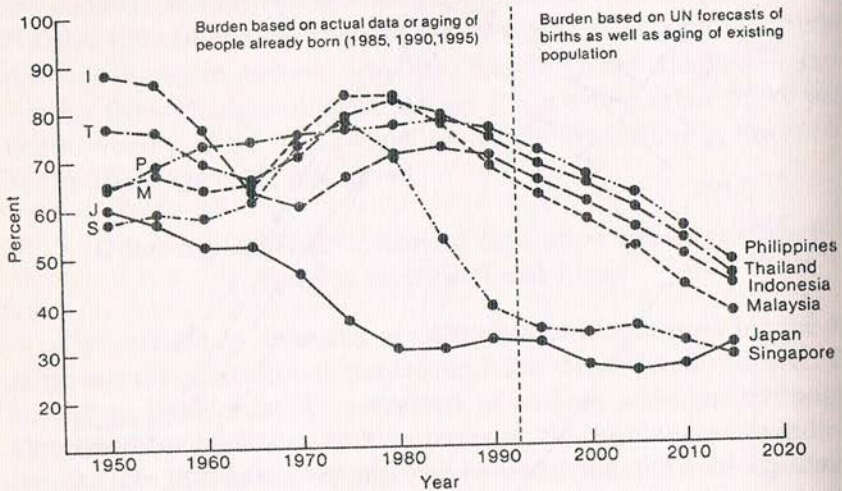
Through 1985 the educational burden clearly follows a long swing pattern in all the ASEAN countries. However, the pattern differs with Indonesia's swing moving inversely to and generally at a lower level than Thailand's, Malaysia's, and the Philippines'. Singapore

17. This ratio "measures" the burden, given quality, of the current operating costs, including the opportunity costs of keeping the 15-24 age class in school, of education. The share of available investment funds required to maintain plant and equipment in education at a given level would be "measured" by the ratio of the *change* in the 5-24 population to the basic population. Since education as used here covers pre-school to graduate school, there will be a composition effect within the 5-24 age group. This is also ignored in the rough index presented.



Source: Derived from UN (1980).

FIGURE 4a
TOTAL EDUCATIONAL BURDENS IN ASEAN MEMBERS AND JAPAN:
POPULATION 5-24/POPULATION 30-64



Source: Derived from UN (1990)

FIGURE 4b
HIGHER EDUCATIONAL BURDENS IN ASEAN MEMBERS AND JAPAN:
POPULATION 15-24/POPULATION 30-64

poor's burden is much less than and peaks considerably ahead of the others. The experiences of Thailand, Malaysia, and the Philippines are very similar, with the education burden trending upward from the 1950s to a long-swing peak in the second half of the 1970s. Clearly, if they all had the same real income per capita (for the 30-64 age class), the burden of educating the young would be much greater and the resources available then for other uses much less, at least from 1960 to 1980, in Thailand, Malaysia, and the Philippines than in Indonesia and Singapore. By 1980, the last year in which birth forecasts are not involved, Singapore's burden will be far less than for any other ASEAN country. Since Singapore's real income is much higher than the others, on a per capita basis, the relative advantage of Singapore is much greater than indicated as is the actual improvement in Singapore's position from 1975 on.

The contrast in educational burden between Japan and ASEAN is equally extreme given Japan's much higher per capita real income and much lower relative burden. Japan's burden has steadily fallen relative to that of the ASEAN countries except Singapore after 1970. This must have made growth easier, especially skill intensive growth, in Japan over the post-war years than in ASEAN and by analogy, in Singapore than in the other ASEAN countries. In fact, even if the overly optimistic UN forecasts of birth reductions take place, it will not be until the year 2000 that the education burden in Malaysia and Indonesia falls to the 1950 level in Japan. Thailand's burden will not reach this level until 2005 and the Philippines until 2010! If all these countries acted as one nation, government policy might well be to tax the Japanese "province" to share the burden of education in the other "provinces" since this redistribution would seem both equitable and likely to raise the long-run real income of all "provinces"

A similar relative picture emerges for the higher education burden. Japan has been and for the rest of the century will continue to be much more favorably placed to afford high quality higher education (or mass higher education) than the ASEAN countries, again except for Singapore after 1990. And, with this exception, none of the ASEAN countries will reach Japan's 1950 burden until the year 2000, a fact that shows how much more difficult it will be for these countries to meet the educational challenge brought about by a rapidly changing high technology world than for Japan. In this context, the fact that the long-swing in the higher education burden for ASEAN as a whole moves very nearly inversely to that of Japan

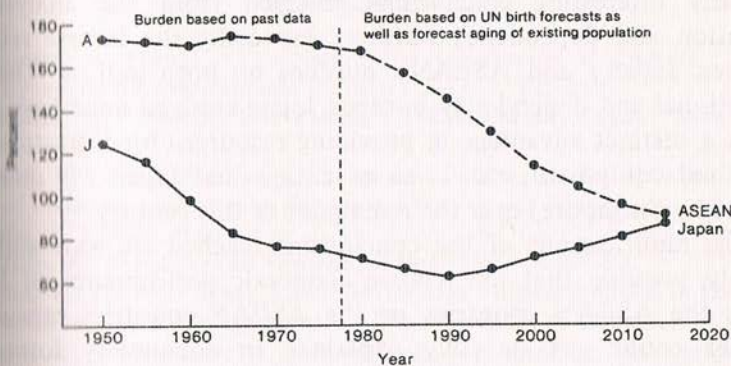
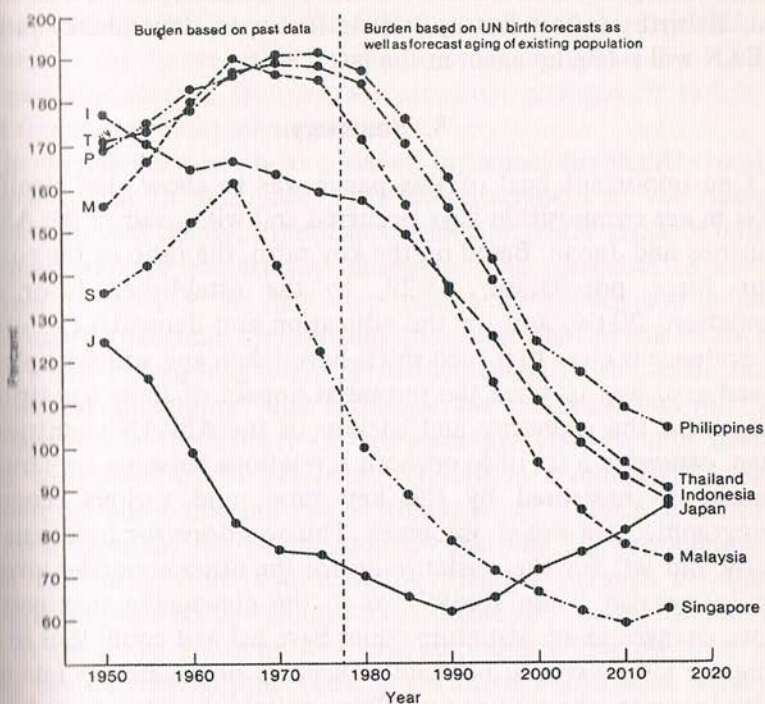
suggests that cooperation, at a relatively low cost to Japan, to share this burden would have been possible in the 1970s and will be feasible in the 1980s.

Figure 5 gives the dependency burden, measured by the ratio of the dependent population, defined here as 0-14 and 65 and up, without adjustment for the different costs of maintaining individuals in these two groups, to the 30-64 age group, taken again as primarily shouldering the tax or direct burden of dependency. The time pattern of changes in the dependency burden across the countries included is similar to that of the education burden with the peaks coming earlier since the dependency ratio is dominated (except for Japan after 1990) by changes in the 0-14 age class. To the extent that the savings ratio moves inversely to the dependency ratio,¹⁸ Japan's much higher savings ratio could be explained by this source alone. On this basis, Japan's savings rate would have been expected to increase dramatically between 1950 and 1975 and to be much higher than for any ASEAN country through 1980. From 1990 on, because of the rapid increase in the population 65 and over, Japan's dependency ratio will increase continuously, surpassing the Singapore and Malaysian ratios in 2015. However, Japan's burden will remain very low by past standards and, even in 2015 and with some very optimistic ASEAN birth rate forecasts, below the ASEAN average.¹⁹

The dependency burden for Malaysia, Thailand, and the Philippines increased sharply in the first two postwar decades and has remained high in the latter two countries. Remarkably, this ratio slowly improved in Indonesia over the same period and by 1975 was much lower than for the other ASEAN countries except Singapore. If births follow the UN's expectations, dependency ratios will fall sharply for all ASEAN countries through the remaining years of the 20th century, stimulating increased savings and growth. However, to put these changes in perspective, the dependency ratios for all the ASEAN countries except Singapore and for ASEAN as a whole will not fall to Japan's 1950 level until 1995 or later. Thus it will be some time until these demographic factors offer as much stimulus to

18. Conclusions based on the dependency ratio ignore the concurrent effects of changes in the key ratio on savings. Although this effect is not a priori predictable, this does not mean it is necessarily negligible.

19. For an analysis of the economic and demographic effects of the future changes in Japan's age structure see Ogawa, H. (1982).



Source: Derived from UN (1980).

FIGURE 5
DEPENDENCY RATIOS IN ASEAN MEMBERS AND JAPAN, 1950 TO 2015
(Population 0-14 Plus 65 + 1 Population 30-64)

savings and growth in ASEAN as they did in Japan 40 years ago! And, if births follow less optimistic forecasts, dependency ratios in ASEAN will swing up again in the late 1990s.

8. Summary

One important goal of this paper was to show that significant shifts in age composition have occurred and will occur in the ASEAN countries and Japan. Based on the key ratio, the ratio of the entering labor force population, 15-29, to the established labor force population, 30-64, and on the education and dependency burdens, the evidence is clear that such shifts have taken and will take place. A second goal was to trace the potential impact of these age structure changes on the economy and society of the ASEAN countries and Japan, *assuming* a set of hypothetical relations between age structure changes, as measured by the key ratio, and various economic, demographic, and social outcomes. This was done for Indonesia very briefly and left for the reader to do for the other countries involved. The Indonesian "case study" led to the conclusion that past and future changes in age structure could have led and could lead to wide swings or long waves in per capita incomes or the growth rate in per capita incomes, the skill and possibly capital intensity of production, household formation rates, emigration and immigration rates, fertility rates, and suicide rates and other indicators of social instability. Similarly interesting conclusions emerged from the analysis of education and dependency burdens, especially the inverse relation between Japan's and ASEAN's burdens on both indices. The low educational and dependency burdens Japan enjoyed must have given Japan a distinct advantage in providing resources for infrastructure, plant and equipment, etc. . . . an advantage that Japan will maintain (joined by Singapore) over the remainder of this century.

The ramifications of the conclusions reached are wide and it is entirely possible that the relative economic performance of Japan versus the ASEAN countries or the ASEAN countries versus one another could not be fully explained or adequately forecasted without considering the impact of age structure and changes in age structure. And it seems unlikely that the past or future performance of these countries individually can be adequately understood or forecasted without considering the long-swing apparent in the key ratio and in the education and dependency burdens of each. For one

example, future fertility rates in several of the ASEAN countries and in Japan will be different from UN forecasts if they vary with the key ratio in the future as they have in the past. Even if this result is only partially correct, ignoring age structure changes could lead to major forecasting and planning errors.

The significance of these possible outcomes highlights the final and major goal of this paper, the encouragement of the research necessary to test the hypothetical relations on which these outcomes are based and to empirically determine the contribution of age structure changes.²⁰ A first step would be to develop a more sophisticated theoretical framework than that used in this study and to carry out country by country investigations of the institutional and cultural constraints that influence the relations involved. The implications for the effects of age structure changes thus derived would then have to be empirically tested in a model sufficiently complete to allow holding "other things equal". The model should also make possible the explanation of past and the stimulation of future feedbacks from age structure changes through economic, demographic, and social changes to age structure changes. Obviously there is much to be done and completing bits and pieces of the mosaic can be very helpful. Perhaps the many conjectures advanced in this paper will encourage the doing.

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