Charting the Economic Life Cycle

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Introduction

The shape of the demographic life cycle is of fundamental interest, which demographers recognize through extensive efforts to estimate, describe and interpret the age-shapes of fertility, mortality, marriage, divorce, and migration. These age-shapes are influenced by biology, culture, economic constraints and individual choice. Similarly, the shape of the economic life cycle is of fundamental interest in its own right, and this shape is influenced by the same set of factors. Here we are primarily concerned with the estimation and description of the basic economic life cycle, and some illustrative comparisons of how it differs across countries and over time within countries in recent years.

The life cycle is a longitudinal concept, referring to the passage through life of an individual or generation. It is most properly examined using longitudinal data. Nonetheless, data limitations and the desire for measures that reflect current conditions often lead demographers to employ cross sectional measures such as the period Total Fertility Rate and period life expectancy, and for the most part we also will be examining cross sectional data in our exploration of the economic life cycle. When we refer to the economic life cycle we will mean these cross sectional age patterns. Later we will discuss how their shapes have changed over time. Demographers have analyzed how changes across generations in the shape of longitudinal age profiles can distort cross sectional measures (tempo and quantum effects), and it would no doubt be revealing to analyze economic age profiles from this perspective as well.

Economic behavior over the life cycle can be summarized by the amount consumed at each age and by the amount produced through labor at each age. One sort of economic dependency occurs when consumption exceeds labor earnings[1], a condition that marks off periods in childhood and old age. From this point of view, an older person is economically dependent even if she has accumulated claims on output that more than offset her consumption, claims that could take the form of entitlements to transfers or ownership of assets. Often the economic lifecycle is treated in a highly stylized fashion. Dependency ratios and other similar age structure variables, for example, capture only the broadest features of the economic lifecycle, and quadratic functions smooth through important details of the age patterns. Our goal here is to measure the life cycle in comprehensive detail. However, we have not attempted to take time use into account, so such important issues as the time spent by parents caring for their children, or time spent caring for elderly relatives, are not covered here.

Individual consumption or production by age are seldom calculated, because attention naturally turns toward more disaggregated measures such as wages, labor force participation rates, hours worked, or household expenditures. However, although per capita consumption and production may seem like crude measures, they summarize and incorporate the influences of many factors that may have contradictory or complementary effects on the economic life cycle.

[1] Throughout this paper, we will use interchangeably the expressions “labor income”, “labor earnings”, “product of labor” and “labor compensation”, even though labor earnings has a narrower technical meaning. All terms will be used to mean total labor compensation including employer provided benefits and including an estimate of labor’s share of self employment income.

Demographic age profiles for fertility and mortality are of interest because they describe a basic aspect of human behavior. But they are also important because they can be applied to a population age distribution to calculate the number of births and deaths occurring in a period. Such a calculation requires the assumption, seldom made explicit, that variations in the population age distribution and in the age profiles of fertility and mortality, are independent. The Easterlin Hypothesis asserts the contrary: that an unusually large age group will experience unusually low fertility. Similarly, an unusually large share of young children in the population might, in some contexts, be expected to cause mortality of young children to be higher. The assumption of independence makes it possible to generate numbers, but various feedback processes render the calculations suspect.

Concerns of the same sort arise when age schedules of consumption and production are applied to population age distributions to generate levels of aggregate consumption and labor earnings, which we will call expected consumption and expected labor earnings. When the population age distribution changes, it alters the ratio of expected earnings to expected consumption, called the support ratio.[2] There has been recent interest in the demographic dividend, which occurs during a sustained period of improving support ratios during the demographic transition, and which is estimated using age profiles of per capita consumption and labor earnings of the sort described above. However, as with fertility and mortality, such calculations are undermined when there is feedback from the population age distribution to the age profiles of consumption and labor earning. For example, there is ample reason to expect an unusually large cohort to experience reduced earnings (Easterlin, 1978, and a large subsequent literature).[3]

Just as broad changes in aggregate economic dependency may be illuminated by age profiles of consumption and labor earnings in general, more specific consequences of changing population age distributions can be illuminated using per capita age profiles for more specific kinds of consumption, production, or other economic behaviors, but always in reference to population level age group averages rather than conditional on participation. Examples include the demand for housing (Mankiw and Weil, 1989; McFadden, 1994), stock market fluctuations (Poterba, 2005), saving rates (Modigliani, 1988; Mason, 1987, 1988; Cutler et al. 1990), interest rates, and impending fiscal problems (Lee and Edwards, 2001, 2002). As always, such disaggregation carries its own hazards, since there may be substitution across subcategories such as publicly provided health care or education, and private expenditures on these, and the overall patterns of change may be obscured.

The estimates presented here draw upon a number of studies that are being carried out as part of a larger study of the economic lifecycle and the reallocations systems -

[2] For example, Cutler et al (1990) estimate support ratios for the US from 1950 to 2050. The inverse of the support ratio is the Chayanov ratio. Chayanov (1925:1966) used standardized age profiles of production and consumption to form ratios of expected consumers to expected producers at the household level. Such ratios are now known as "Chayanov ratios" (See Lee and Kramer, 2002). Later, Lorimer (1967) developed some of the same ideas.

[3] The effect of a small change in population age structure on the macro-economy can be decomposed into two additive components: the effect of the change in population age structure weighted by the initial age profiles of production and consumption (or other items of interest), plus the induced changes in the shapes of these age profiles weighted by the initial population age distribution (Lee, 1997). The first effect is compositional or mechanical, and the second is behavioral.

primarily through saving and public and familial transfers – that respond to the economic lifecycle. A system of accounts, called National Transfer Accounts, is being developed that is consistent with National Income and Product Accounts but provides much-needed age data (Mason et al. 2005). The methodology for constructing estimates is discussed briefly in this paper, but more detailed information is available on the project website – www.ntaccounts.org.

We begin by discussing the conceptual background for our estimates, and then discuss our methods of estimation. We go on to present the actual estimates of the consumption and labor income age profiles for a number of countries. Next we consider the two sets of age profiles in relation to one another. In the final empirical section we discuss the changing shapes of the age profiles over two decades for the US and Taiwan, and then conclude.

Conceptual Background

Individuals versus Households

Age profiles of consumption and production are viewed from an individual, rather than a household, perspective in this paper. In economies where formal sector employment dominates, measuring production (or earnings) for individuals is a relatively straight-forward task. In traditional settings, where employment is informal and production is often organized within a family enterprise, estimating production by age for individuals is difficult. In any setting, allocating consumption to individuals is a challenging task, because most expenditure data are collected for households rather than individuals. Moreover, some goods are jointly consumed or involve increasing returns to scale so that allocating consumption to individuals inevitably involves arbitrary rules.

From the household perspective, production and consumption are attributes of households, varying with age of the household head. Constructing production and consumption profiles is more straight-forward, but there are tradeoffs involved. The first is that the effects of co-resident children and elderly on household consumption and production profiles must be explicitly modeled or – as is often the case – neglected altogether. Indeed, a large share of all societal income redistribution occurs within households, and would therefore be invisible to accounting on a household basis. The second is the difficulty of translating changes in population age structure into changes in the age structure of household heads and household membership (Lee, 1980).

Here we opt for the individual perspective, but irrespective of the methodology employed, the age patterns of consumption and production are central to understanding the role of population in the macroeconomy.

Forces shaping age profiles of consumption

A large body of theory and empirical research in economics addresses the age-time trajectory of consumption chosen by individuals. In the absence of intergenerational transfers, the expected present value of consumption must be no greater than that of labor earnings over the life cycle. With perfect foresight about future labor earnings, taxes, survival, discount rates, and other relevant information, with perfect credit markets, and with typical assumptions about how consumption affects utility, standard lifecycle theory concludes that consumption will increase exponentially with age along the optimal path

at a rate equal to the discount rate less the rate of time preference. Because this optimal path typically differs from the age trajectory of labor earnings, individuals borrow and lend at the market rate of interest to achieve the desired consumption path.

The real world circumstances of individuals violate each of these assumptions, and a large literature explores the consequences. The ability of individuals to borrow is often limited by their current net worth, credit cards aside. Future wages are unknown due to uncertainty about the macroeconomy, career success, and health, for example. Intergenerational transfers are pervasive. An individual's consumption is funded by his parents until the age of economic independence, which may not come until after age 20. Consequently adults must allocate a substantial portion of their income to consumption by their children. In most contexts, elderly people live and consume in the household of an adult child. Thus an individual's consumption may be governed by at least three different budget constraints over the life cycle, depending first on the resources of parents, then on personal resources, and finally on resources of children. Marriage, divorce and widowhood complicate the situation further. Bequests, which are highly uncertain in timing and amount, also alter the available resources. Some scholars have questioned the value of the lifecycle model altogether and proposed alternatives (Carroll, 1992; Carroll and Summers, 1991; Deaton, 1991).[4]

There are many problems in estimating individual consumption. Fertility and the age pattern of consumption may be jointly determined, in the sense that parents may choose to have fewer children precisely because they want to invest more resources in each one of them, as in the quantity-quality theory of fertility (Becker and Lewis, 1973). Only a fraction of the consumption in a household is assignable to individuals, even conceptually. Much is joint consumption of public goods, as when a family watches TV. Some consumption comes in the form of in-kind transfers from the government, for health care, education, food, housing, or energy assistance, and these transfers are chosen through the political process and subject to a government budget constraint.

Public and Private Consumption

The consumption side of the economic lifecycle depends on both public and private consumption, but their relative importance is not easily judged. Many public programs target particular age groups for in-kind transfers – education for the young, health care for the elderly. Other public programs, such as pension programs, family allowances, or unemployment benefits, provide cash rather than in-kind transfers. These programs lead to increases in private rather than in public consumption affecting the economic lifecycle indirectly. An additional complexity is that public consumption may crowd out private consumption with little effect on the composition or age pattern of total consumption. Thus, the public-private breakdown of consumption provides useful and suggestive information, but it is by no means definitive about how public policy influences the age pattern of total consumption.

The importance of public consumption varies quite substantially across countries (Table 1). In general, public consumption as a share of total consumption rises with per capita income, but demographic and institutional factors play very important roles. Public spending on health and education rise more sharply with income than does

[4] Also see Attanasio et al 1999 which provides support for the lifecycle model.

combined public spending, suggesting that age targeting is more important in high income countries. The relationship between the level of economic development and public consumption holds to some extent for the five countries compared below. Public consumption as a share of total consumption was smallest in Indonesia and Thailand and largest in France and the United States. Pubic spending on health is highest in France and the US, countries with both higher income and older populations. Public spending on education is high in France and the US, but also in Thailand which has lower income but a relatively large school-age population. The substantial variation among the five countries compared in Table 1 stands out, suggesting the importance of country-specific institutional factors.

<INSERT TABLE 1 ABOUT HERE>

Forces Shaping the Age Profiles of Labor Income

Standard economic theory views work as a tradeoff between the utility of leisure and the utility of the consumption that increased work allows. An individual at each age chooses to work that number of hours which equates the marginal utility gained through these wages to the marginal utility lost from reduced leisure time. Experience, health and vitality, and other factors that vary over the life cycle affect the productivity of labor and, therefore, its wage value. But they also influence the utility of leisure. Variations with age in the competing demands on time at home, for example due to child rearing, also affect the opportunity cost of work. At some ages, the optimal choice may be not to work at all. In theory, with perfect credit markets, these decisions made at different ages are all closely linked over the life cycle. You can choose not to work and yet to consume at age 27, for example, by borrowing based on earnings you anticipate at age 52 with due account taken of discount rates and survival probabilities. In addition to entering the labor force or staying at home, individuals may spend time investing in their human capital through education or training, thereby raising their future earnings. Once working, they may devote some time to maintaining or upgrading skills, or they may let them decline. Work experience itself tends to raise productivity and wages.

As with consumption, the real world is more complex. Credit markets are imperfect. Workers do not have complete flexibility in choosing their hours. Institutions may constrain wages to rise with age through seniority systems, regardless of productivity. The productivity of labor, and therefore wages, will depend on macroeconomic conditions that are outside the control and foresight of an individual. Public pension programs may be unexpectedly instituted or terminated, altering the life cycle budget constraint and perhaps introducing strong incentives to retire from the labor force or return to work. Changes in tax policies may alter the tradeoff between work and leisure. Unemployment may thwart individual plans, and age discrimination or mandatory retirement may prevent older people from finding work.

Aside from these contextual factors, it appears that individual productivity varies by age. Skirbekk (2003) reviews a dozen studies, concluding that they point to an inverse U-shaped individual productivity profile, with significant decreases taking place from around 50 years of age. There are a number of reasons for declining productivity at older ages. A large body of literature supports the view that mental abilities decline during adulthood (Maitland et al. 2000, Verhaegen and Salthouse, 1997). Poor physical and

mental health is also strongly related to early retirement (Quinn et. al. 1990; Bound, 1991, Dwyer and Mitchell, 1999). Rapid technological progress has an uneven influence on skills and competencies by age (Autor et. al. 2003). Rapid changes in educational systems might also give middle-aged and younger workers a competitive advantage over their older counterparts.

All these factors can vary over time and between countries, leading to differences and changes in the way earnings vary with age. Perhaps most important, however, are the decisions made by three demographic groups. First, many teenagers and young adults are extending their time in school and delaying their entry into the labor force as returns to education rise. Second, many women are increasing the time spent in the labor force as rates of childbearing have declined and labor market opportunities have improved. Third, older men are withdrawing from the labor force at a younger age as incomes have risen and pensions have become available.

Methods for Constructing Consumption Profiles

Consumption consists of private and public components. Age patterns of private consumption have been much more extensively analyzed, but public consumption – the consumption of in-kind transfers from the public sector – is important to developing a full picture of the lifecycle of consumption.

Private Consumption

Private consumption by age is particularly difficult to estimate because, for the most part, we only have data at the level of the household. Consequently this section will be longer than the others.

Consumer expenditure surveys provide information on household level consumption expenditures. Many studies have addressed the problem of allocating these consumption expenditures between adults and children, typically as part of an effort to estimate the costs of children. Much less is known about the allocation of household consumption between prime age adults and the elderly. This issue is not important in societies where the elderly live independently because their consumption can be directly observed. In societies where multigenerational living arrangements are common, the issue is an important one.

The general approach taken in the literature is based on some measure of the consumption utility of the adults in a household. With such a measure, we can ask by how much the total consumption of a household with one additional child would have to be increased in order to restore the adults' consumption utility to its original level. The size of the increase measures the cost of that incremental child.

The Engel method uses the share of the household budget spent on food as the measure of adult welfare. It has been used extensively (Espenshade, 1984), but it is also widely criticized on conceptual grounds. The difficulty with the method is that children may be more intensive consumers of food than are adults. If so, families with more children would spend a larger share of their budgets on food in part because their real income is lower, but also because the household's preferences are tilted toward food. Thus, children would appear to reduce the parent's welfare more, and therefore to cost more, than is actually the case. The consensus among researchers is that Engel's method

yields an upward biased estimate of the cost of children. On *a priori* grounds we can only say that Engel's method will generally yield a biased result (Deaton 1997).

In the Rothbarth method, the welfare metric is the level of spending on goods that are consumed mainly by adults, usually taken to be tobacco, alcohol, and adult clothing. The Rothbarth method does not suffer from the same problem as Engel's method because these adult goods are not consumed by children. The Rothbarth method, however, must assume that the presence of children in the household has no direct effect on the utility that adults derive from consuming their adult goods. Children must affect adult consumption of these goods only because they reduce the amount parents can spend on themselves. If the presence of children induces parents to smoke and drink more because of stress, for example, the Rothbarth method yields an under-estimate of the cost of children, and vice versa. Views vary as to whether or not this assumption is plausible.

Several practical difficulties with the Rothbarth method limit its application. First, in some instances the only adult goods available are tobacco and alcohol. Expenditure on these is insensitive to income, owing to their addictive characteristics. Furthermore, in some societies alcohol and tobacco are rarely consumed. Second, the method cannot be used to allocate consumption among adults of different ages, and it is often contaminated by the presence of older children, who may also consume the "adult" goods. This leads to an underestimate of the cost of these children. While the Rothbarth method cannot be used to estimate expenditures for the elderly, the Engel method can be used to estimate age-profiles of consumption for all ages, but the flaws in the method make it relatively unattractive.

Estimates are often reported in the form of equivalence scales which express the consumption going to different ages relative to that of a prime age adult. These scales are often called Equivalent Adult Consumer scales, or EAC. These have been estimated for many countries, both developing and developed, using the Engel and Rothbarth methods. It would be useful to address several questions. First, are the available methods robust? Do they yield plausible estimates of child costs when applied in varying contexts? Second, do the available methods suggest similar or substantially different equivalence scales when applied to the same data? If similar, the biases identified in the literature may be tolerable in practical applications. Third, does the comparison of estimates using the same method across countries or time yield useful information about changes or differences in child costs?

Despite the extensive literature on equivalence scales, it is not yet clear to what extent these questions can be answered. Table 2 reports estimates of equivalence scales for Indonesia based on the 1996 socio-economic survey (Indonesia, 1996 round of SUSENAS; Maliki, 2005). Results from three methods are reported – the Engel method and, the Rothbarth method, and Ray's demographic method, a variant of the Engel's method which uses budget shares for several expenditure items rather than just food. The Rothbarth method was estimated using tobacco and adult clothing to represent adult goods.[5] The results are not reassuring. The one consistent finding is that children consume less than adults. The Engel method and Ray method both yield high estimates for children. The Rothbarth method yields very low estimates, with children under five having a negative cost. The age pattern also varies across methods. Costs decline with

[5] Although alcohol is not illegal in Indonesia, the population is predominantly Islamic. Thus, alcohol is not an appropriate variable.

age according to the Engel method, increase with age according to the Rothbarth estimates, and are non-monotonic according to the Ray method.

If the Engel method is upward biased and the Rothbarth method is downward biased, then the true value would lie somewhere in between. However, it cannot be conclusively demonstrated that the true value in fact lies between the two estimates.

These difficulties have led us to adopt a simple and transparent approach to allocating consumption to household members. First, we allocate education and health expenditures to members using a method similar to one employed by Attanasio et al. (1999). We regress total household education expenditures on the number of household members in each age group enrolled in school and the number of household members not enrolled, with the intercept suppressed. Private health expenditures are allocated using a similar regression approach, using numbers of household members in each age group as regressors. For some age groups, private health spending might be very low and estimated coefficients may sometimes be negative. To avoid this happening, health spending can be constrained to be non-negative.

Second, other household consumption is allocated to individuals using an *ad hoc* allocation rule. The allocation rule is based on an extensive review of the literature and follows the advice of Deaton (1997) that an *ad hoc* approach to child costs is probably the preferred approach, given problems of the Engel and Rothbarth methods. He suggests that children age 0-4 be 0.4 of an adult and the children age 5-14 be 0.5 and children 15 and older be 1. We employ a more continuous, but similar equivalence scale, which is equal to 1 for adults aged 20 or older, declines linearly from unity at age 20 to 0.4 at age 4 and below.

In some cultural contexts there might be other special expenditures specific to an individual in the household, such as a dowry for example, which are itemized in the expenditure survey. According to our methods, this would be a transfer received by the bride at the specific age at which it occurs. Of course there are ambiguities, such as whether the dowry is a transfer to the groom or to the groom's family or to the bride? There might be a corresponding bride price paid by the groom which would be treated similarly. Any effect of the dowry or bride price on consumption might occur over many years. This transfer would be averaged across all individuals at this age in the survey, including the majority who did not receive a dowry or bride price. A dowry may have been funded in part by earlier reductions in schooling for the girl in question. This would be reflected in a longitudinal survey that included information on the school enrolment of the particular girl in question. In cross-sectional data, this girl's earlier experience would not be available. However, other younger girls in the survey would have reduced schooling in anticipation of their dowries, and they would represent the dowry recipient's earlier reduced schooling. In this way, the cross-section should capture even subtle longitudinal patterns to a considerable extent.

Using these methods, we estimate consumption for each individual in each household in the sample. We average across all the individuals in the survey of a given age to construct age schedules of private expenditures on education, on health, and on other items. Often, expenditures are underreported in surveys, so some further adjustment of the age profiles may be desirable to make them consistent with reliable national level control totals for total private expenditures on health, on education, and on the balance of total private consumption. National Income and Product Accounts (NIPA) and other

reliable public statistical sources provide suitable control data. In this way, the profiles can be made consistent with NIPA, in general, and private and government final consumption expenditure, in particular.

Public Consumption

Public transfer programs are classified according to the following list of 11 expenditure categories—Public goods and services; Congestible goods and services; Health; Education; Sickness and disability; Old age; Survivors; Family and children; Unemployment; Housing; and Other. This classification scheme is based on the United Nation's COFOG (Classification of Functions of Government) System. COFOG was developed by the UN in order to harmonize the accounting of government expenditures among the member nations.

Our approach is to assign the benefits to the individual for whom the government intends them. For example, an educational voucher might be provided by the government to the parents of school-age children. In this case, the benefits are assigned to the children who are receiving the education, not to the parents who received the voucher. In some cases the government may provide a single cash payment to an adult in the household on behalf of all members of the household. In this case, each household member is assigned their share of this benefit.

For estimation, we would like to know the cost of the service provided to the individual by the government. Survey data are unlikely to include such costs, but they can be calculated from administrative data. For example, Medicare (US) administrative data such as the Current Beneficiary Survey contain information on the medical costs of individuals. These data can be used to derive age profiles of costs of Medicare benefits.

If we lack information on the actual costs incurred for services to individuals, then we obtain information on program usage. For example, hospital admissions data by age are used to develop an age profile of medical costs. If we lack information on program use, then the minimum data we need is program participation, for example, school enrollment rates by age. We can improve our estimate by using public school enrollment rates rather than general enrollment rates which include public and private schooling. We can further improve estimates by disaggregating by grade level of schooling since costs may differ substantially by grade level.

Many public goods and services are not targeted at particular age groups. We allocate these equally to all members of the population.

Methods for Constructing Age Profiles of Labor Income

We are interested in labor income at a given age averaged across all members of the population at that age. This is not the usual concept of an age-earnings profile, which would typically be calculated conditional on being in the labor force and perhaps even conditional on working full time year round. Our measure will include non-workers in the denominator, so it can vary across age because labor force participation varies across age, because annual hours worked per participant varies across age, or because earnings or productivity per hour vary across age. Our profiles are also averages across sex.

We measure labor income as the sum of earnings, fringe benefits, other labor income, and a share of entrepreneurial (self-employment) income. While estimating earnings is straight-forward using individual survey data, estimating self-employment

income is not, except for the cases of Taiwan and the United States, where self-employment income is provided on an individual basis and individual labor income is estimated directly as described above. Perhaps the most difficult problem in our estimation is the fact that some young children, older people and prime-age women in developing countries may work as unpaid family workers in family-based enterprises.

Estimating the Labor Portion of Self Employment Income

The National Transfer Accounts are designed to be consistent, when weighted by population and summed, with NIPA totals. The labor income of the self-employed is not reported separately in NIPA. Rather the operating surplus of unincorporated businesses or mixed income, as it is called in NIPA, includes returns both to capital and to workers who are not paid employees. Gollin (2002) considers three methods for estimating the portion of mixed income that is a return to labor: (1) attributing all mixed income to labor; (2) attributing a share to labor equal to the share of labor income for the rest of the economy; and (3) imputing to the self-employed the labor income of employees. He finds that the first of these methods clearly over-states the labor income of the self-employed. The other methods yield an average labor share that varies from 0.654 to 0.686 depending on the method and sample used. The labor shares in high and low income countries are very similar. Thus, the simple method of allocating two-thirds of mixed income to labor is consistent with the best available evidence on this issue.

We have done a sensitivity analysis using different sharing rules such as 0.85 instead of two-thirds. This did not affect the labor income profile substantially, suggesting that errors in the estimates of total labor income due to the two-thirds rule are not important.

These NIPA estimates may sometimes involve important errors which, along with other difficulties in estimating self-employment income and the value of unpaid family labor, mean that this aspect of labor income in our accounts may sometimes be less accurate than other elements, particularly in poor Third World economies.

Estimating Self Employment Labor Income by Age

For most countries discussed here, household surveys report mixed or self employment income for the household while we require estimates for individuals. But the surveys also report which individuals in the household engaged in unpaid family labor. We combine these two sources of information to estimate self employment labor income for individuals in each household. We assume that within a household, the labor income for reported unpaid family workers by age is proportional to the labor income by age of *employed* workers in the total sample, reflecting both hours supplied and marginal product per hour. For each household we then calculate the constant of proportionality that implies a total of self employment labor income for the household that matches our estimate of that total, that is two thirds of reported self employment income.

This provides an estimate of self employment labor income by age for each individual in each household in the survey. Averaged across all the individuals in the sample including those who did not provide unpaid family labor it provides an age profile of self employment labor income for the population. This age profile is then adjusted proportionately so that in combination with the age distribution of the total population it implies a number equal to two thirds of the NIPA total for self employment income.

These steps were used to create the self employment component of the labor income age profiles. For purposes of comparison, we normalize each curve by dividing it by the unweighted average labor income for ages 30-49. This age range was chosen to exclude younger ages that might be affected by educational enrollments, and older ages that might be affected by retirement. We have also smoothed the raw age profiles for graphical presentation.[6]

Before moving to results, we note that the profiles presented here represent the current best estimates of consumption and labor income for the included countries. Our estimates of these profiles continue to change over time as we refine them in various ways. For example, future United States profiles will incorporate more detailed data on consumption by the institutionalized population. This will change the estimated shape of consumption somewhat, especially at the oldest ages with large proportions living in nursing homes. This leads to a more gradual increase in consumption at older ages followed by a more sudden jump as the proportion in nursing homes accelerates with age. While we do not expect this or other improvements to alter the basic conclusions drawn here, it should be noted that work to improve profile estimates is ongoing.

We are now ready to consider the actual estimated age profiles that result from application of these methods.

Results for Consumption

There is a striking contrast between the cross-sectional age profiles of total consumption for Taiwan and the US, as shown in Figure1a and 1b. In the US, consumption rises by 150% from birth to the early 20s; in Taiwan the corresponding increase is only 67%. In the US, consumption rises by a further 67% from the early 20s to age 90, whereas in Taiwan, there is virtually no increase at all over this age range. In total, consumption more than quadruples from birth to age 90 in the US, while in Taiwan it grows by only 77%.

<Figure 1. Per Capita Consumption, Private and Public by Sector, United States, 2000 and Taiwan, 1998. ABOUT HERE>

To be sure, these cross sections are a poor guide to the longitudinal changes for actual generations, which in Taiwan have been exceptionally rapid as we will see later, whereas in the US they have been relatively slow. Nonetheless, these age profiles do tell us about the age gradient in consumption in any given year, and this gradient is flat in Taiwan for adult ages, and steeply sloped across all ages in the US. We believe that the family support system for the elderly in Taiwan, versus public sector transfers for the elderly in the US, lies behind this difference.

Age targeting of public consumption is less important in Taiwan than in the US. Public education targets school age children with a noticeable effect on their total consumption, but public education is relatively less important in Taiwan. Note, however,

[6] Smoothing was performed on the log of population-weighted age-specific averages using SUPSMU in the R statistical package. Smoothing spans were determined on an ad hoc basis. Any ages with a profile value of zero because of survey assumption were left out of the smoothing calculation and set to zero after smoothing. For example when a survey only covers ages 14 and above, all values below 14 were set identically to zero.

that private education consumption is very high and that total spending on education is higher in Taiwan than in the US relative to labor income. Taiwan relies on national health insurance to fund health care spending. Taiwan's National Health Insurance program (NHI) was introduced in 1995 and by 1998 was 4.7% of total consumption as compared 6.4% for US Medicare and Medicaid. The elderly consume only modestly more health care services financed through NHI than do the young in Taiwan, whereas the US program is largely limited to those 65 and older.

Figure 2 charts the age profile of public consumption by age relative to average public consumption for all those aged 0 to 85 for the US, Taiwan, Indonesia, Thailand, and France. To make the estimated profiles more easily comparable, we have divided each age schedule by the unweighted average of per capita public consumption at each age over the range 0 to 85. Thus, a value of 0.5 at some age implies that a person at that age consumes half the annual amount averaged over the first 86 years of life (assuming perfect survival). In the absence of any age targeting, the profile would equal 1 at all ages. The extent of age targeting is most easily judged by comparing values for those in the 30-59 age groups. Judged in this way, the US and France target public consumption the most, while Indonesia targets public consumption the least. The extent of targeting in Thailand is similar to that in France, however, and the extent of Taiwan's targeting is similar to Indonesia's. Again, there is danger in looking at components of consumption as compared with total consumption, because public and private consumption may be close substitutes. For example, France emphasizes public funding for education more as compared with Taiwan.

<Figure 2. Per Capita Public Consumption Age Profile ABOUT HERE>

The age profile shows us the relative age orientation of public consumption in each country. The US and French programs target the young and the old. In the case of France, the allocation is roughly balanced with the young and the old receiving similar levels of public consumption. In the US, the program is biased more toward the elderly, particularly those 75 and older. In Taiwan, Indonesia, and Thailand the programs are dominated by consumption by the young to the extent that they are age targeted at all. In Indonesia age targeting is quite limited as compared to Taiwan or Thailand.

Private Consumption

Most consumption is private rather than public, and in many important areas, food, housing, and clothing, for example, the private sector dominates. The public sector is also important, particularly in education and health. In some instances, the overall shape of the consumption profile differs significantly from the private sector, as we saw for the United States elderly. By and large, however, it is private consumption that shapes the consumption side of the lifecycle equation.

Estimates of private consumption profiles are presented for four countries in Figure 3. These estimates are based on the standard NTA methodology and, hence, the differences across countries are not due to the use of different methods nor to different allocation rules within households.

<Figure 3. Age Profiles of Private Consumption, Four Economies. ABOUT HERE>

There are two distinctive patterns apparent in Figure 3. The Asian profiles are more or less similar. Consumption rises rapidly with age from a value of about 0.4 among newborns to a value of 1 for those in their mid- to late-teens. For prime-age adults consumption ranges from the lifetime mean to 30 percent higher than the mean among younger adults. Private consumption among adults declines gradually with age. For those aged 65 and older, consumption varies from a high of about 10 percent above the lifetime mean to a low of about 5 percent below the lifetime mean.

Two other features of the Asian profiles are notable. One is the sharp increases among children especially in Taiwan that reflect private spending on education. The second is a pronounced generation-length cycle in the Taiwan consumption data. This is a Chayanov cycle that reflects the variation in per capita household income in multi-generation families, as their age composition changes (Lee and Kramer, 2002). The peaks of the consumption profile correspond to ages at which two generations – those in their late twenties and late fifties – are employed.

The US pattern is quite different from the Asian. Relative consumption by children is consistently lower than in the three Asian cases. Consumption by newborns at 0.27 is particularly low which bears further investigation in light of the importance of consumption at this age to subsequent child development. While young adults have relatively high consumption in the Asian cases, this is not true in the US. Those in their early twenties are consuming below the lifetime US mean. Private consumption continues to increase with age in the US reaching a peak at about 35 percent above the lifetime mean in the late-50s. Thereafter consumption declines with age and at a faster clip than in the Asian cases. By age 85 US private consumption is about 10 percent above the lifetime mean, which is a bit higher than the Asian countries.

What accounts for the differences in these age patterns? First, consider consumption by children, which is tied to consumption by their parents. Consumption by children is low in the US because children live in households which have low levels of consumption. The connection between consumption by adults of childrearing age and children is far from one-to-one, however. First, the rate of childbearing obviously matters. If parents have more children, then per capita consumption by both parents and children will be depressed. Second, the relationship between fertility and income matters. If low income (low consumption) adults have high fertility then consumption by children will be depressed. Third, the variance of childbearing matters. If the variance is high, a larger percentage of children will live in large families with lower per capita consumption than if the variance is low.

Next consider adult consumption. One possible explanation is that the age profiles of consumption are influenced by the age profiles of current labor income. Consumption by young adults (and their children) may be lower in the US relative to older adults because young adults earn less relative to older adults in the US as compared to Asia. We will see later that labor income peaks at a younger age in these three Asian countries than in the US, but this explains a relatively small part of the difference in the consumption pattern. A final and important explanation is that private intergenerational transfers are much more important in the Asian countries than in the US. A much higher percentage of Asians live in multi-generation households, pool their budgets, and share standards of living.

Private Education

A potentially important explanation for the high level of private consumption of children and young adults in the Asian cases is a strong commitment to education. Private spending on private education by age was estimated directly for each country using the standard NTA methodology described above. A relatively broad measure of education is used that includes pre-school costs and tutoring where it is available. The values are normalized by dividing by the average consumption of an adult 30 or older.

Emphasis on education is often mentioned as a key ingredient in East Asian economic success. Private spending on education is very high in Taiwan, as shown in Figure 4, and in South Korea (not shown). Spending on ages 16-18 in Japan is high, and a substantial part of this expenditure is devoted to *Juku* – private tutoring that prepares students for college entrance examinations. High spending on private education is not confined to East Asia – private spending in Brazil rivals that in Taiwan. However, three of the four countries with the highest private spending on education are Asian.

<Figure 4. Private Education Consumption by Age. ABOUT HERE>

Private spending on education per child is summarized by the sum up to age 29 which gives the total expenditure per child in terms of years of adult consumption. In Brazil and Taiwan this measure shows 3.3 and 3.4 years of mean adult consumption, respectively. Lifetime spending is much less in the other countries for which estimates are available. In Japan, 2.0 years of adult consumption is devoted to education; in Indonesia, 1.5; in Thailand 0.8; in the US and France the figure is 0.7 years.

Summarizing

In many respects the US and Taiwan represent polar cases with respect to the cross-sectional consumption profiles. Ignoring some important details discussed above, the Asian countries for which estimates are presented have similar private consumption profiles, lower levels of public spending, and public sectors that emphasize education more and health less. The evidence is far too fragmented, however, to suggest that there is a general Asian pattern.

The differences and similarities between the age profiles of consumption for the US and Taiwan are summarized in Table 3. The values are constructed for a synthetic cohort subject to the period survival rates from the 1985-89 US life table and the per capita age profiles for the US and Taiwan. The mean age of consumption is younger in Taiwan than in the United States by 5.4 years. This is significant, because the demand for life cycle saving or transfers arises from the difference between the average age of consumption relative to the average age of earning. Other things equal, a higher average age of consumption implies a greater demand for wealth.

What accounts for this large difference? One can formally answer the question using the data in Table 3 and decomposition techniques, because the mean age is equal to the weighted sum of the mean ages of the components where the weights are the consumption shares. Here we take a more informal approach.

<Table 3 ABOUT HERE>

First, consider private versus public. In both sectors, the mean age of consumption is lower in Taiwan than in the US. The difference is 5.2 years for private consumption and 4.7 years for public consumption.

Second, education can have a potentially large effect on the mean age of consumption. Because the mean age of education consumption is so different than the average age of total consumption, increases in the share of education lead to a relatively large effect on the overall mean. In both the US and Taiwan, the mean age of education consumption is more than 25 years less than the mean age of consumption. The high level of private education spending in Taiwan reduces both the mean age of private consumption and the mean age of total consumption. The effect on the mean age of total consumption is partially offset by the higher level of public consumption of education in the United States.

Third and clearly of great importance is the effect of high public spending on health of the elderly in the United States, which is similar in magnitude to the share of public spending for health at all ages in Taiwan, resulting in a higher mean age in the US by 17 years. Private spending on health is much less important in Taiwan than in the US and the mean ages are similar.

Finally, not to be overlooked is other private consumption. The difference in the mean ages is 3.3 years. This is an important difference given that private other consumption accounts for roughly two-thirds of total consumption in both Taiwan and the US. By itself this accounts for more than two years of the difference in the mean ages of total consumption. It underlines the significant difference in private consumption between the US and Asian countries described above. Differences in education spending and health spending do not, by themselves, explain why private consumption favors the young in Taiwan and the old in the United States.

Cross-sectional estimates of labor income

For all eight economies shown in Figure 5 the age profiles of labor income have the familiar inverse U-shape. However, the figure also shows large differences in the importance of labor income at younger and older ages relative to the prime working ages and in the age of peak income.

<Figure 5. Per Capita Labor Income Profile, Selected Countries. ABOUT HERE>

In the Philippines where income is relatively low and agricultural and informal employment dominates, 9.8 percent of income is earned after age 65, a share 12 times as great as in France and four times as great as in Taiwan (see Table 4). These measures abstract from demographic differences because they are conditional on survival– that is the cross-section is treated as a synthetic cohort assumed to survive until age 85. The elderly share of income does not vary strongly with development. The income of the elderly is quite high in the Philippines and Indonesia, but it is also relatively high in the US, Japan, and Thailand. The elderly share is extremely low in France.

<Table 4 ABOUT HERE>

There are also large differences at younger ages. In the three poorer countries, the average labor income per 16 year old is six times the average labor income in the four richer countries (including Taiwan), where each is measured relative to average income ages 30-49. In all the poorer countries, more than 2 percent of life time labor income accrues to those 20 and under, whereas in all the richer countries including Taiwan, this share is less than 2 percent and is mostly close to 1 percent. In Thailand the share is 4.2 percent, more than four times the share in France. A similar pattern holds for the share age 25 and under.

Comparisons like these across rich and poor countries with very different cultures and institutions may provide crude or misleading information about how development influences labor income profiles. We can supplement the cross-sectional age profiles with longitudinal data from Taiwan and the US. The labor income of those 15-29 relative to those aged 30-49 dropped by 70% in Taiwan between 1979 and 1999 and by 20% in the US between 1982 and 1997 (Figure 6), consistent with the cross sectional association of labor income at younger ages in relation to development.

The age at which income peaks varies from 36 to 49– a difference of 13 years. This peak age is associated with the level of development. It is highest in the three most advanced economies, the US, Japan, and France, with peaks between age 47 and 49. Income in Indonesia, Thailand, Uruguay, and the Philippines peaks between 37 and 43. Surprisingly, Taiwan has the youngest peak at age 36, which calls for further investigation.

What are the sources of the differences in these age patterns? A detailed explanation of why earnings peak later in high income than in low income countries is not pursued here, but a range of explanations are possible and the patterns are intriguing. Earnings rise fastest (in cross-section) with age in the lower income countries, even though ample research shows that wages rise faster (longitudinally) in industrial countries for those with more education. In Japan, the seniority wage system ties wages closely to experience, and its age earnings profile is the highest during the late 40s to the 50s. The share of earnings of the elderly is broadly consistent with studies of the effects of pension and tax systems on labor incentives (Gruber and Wise, 2001; Gruber and Wise, 1999). As expected, the earnings shares of the elderly in Taiwan, the US, and Japan are high compared to France.

Considering the consumption and earning profiles together

So far, we have been considering consumption and earnings separately. It is also interesting to consider them together, for it is together that they determine the periods of economic dependency and the roles of intergenerational transfers. Table 5 summarizes and compares consumption and labor income profiles for four countries. The upper panel reports the two crossing points, the youngest age and oldest age at which labor earning exceeds total consumption, and the span of years between these. The ages at the first crossing point are remarkably similar, all between 23 and 26, and might appear to be surprisingly high. It is important to keep in mind that consumption here includes in-kind transfers from the government, including a per capita share of "Other Public" which includes such items as the military, roads, sewer systems, government funded research,

and so on. Also, some young adults are living in their parents' households and consuming based on a pooled household budget.

<Table 5 ABOUT HERE>

The other crossing ages are also clustered tightly, with elders become net consumer at ages 55, 56, 57, and 58 in Thailand, Taiwan, the US, and Indonesia respectively. The corresponding net producing ages span 31 years for the US and 32 years for the other three countries. These features of the economic life cycle can differ because of varying amounts of capital income versus labor income; differing levels of saving; differing enrollment in higher education; short-run economic fluctuations; differences in public policy and social systems; but also due to higher or lower support ratios which will raise or lower the whole consumption profile relative to the labor earnings profile across countries. We have not yet tried to parse out the specific factors responsible for the differences shown in the Table.

It is also interesting to compare the average ages of consumption and production for a synthetic cohort in these countries. Table 5 shows average ages of consumption and labor income based on the per capita labor income and consumption profiles of each country, weighted by the US survival rates (so differences in population age distribution have no direct effect on these averages). The differences between these average ages indicate the direction and distance of reallocations of income across age within a synthetic life cycle, assuming a zero discount rate.

We find that these reallocations are minutely upwards—really essentially neutral—in the US where the average age of consumption is 45.5 and the average age of earning is 44.3. Even smaller reallocations upwards are observed in Thailand at 0.8 years and Indonesia at 0.2 years. Taiwan shows a small downward reallocation by 1.4 years. There is little difference in the mean age of labor earning or consumption across the three Asian countries, but the mean ages of both labor earnings and consumption are several years later in the US. The consumption difference for the US is doubtless due in part to the important role of Medicare expenditures on the elderly. The labor income cause is harder to isolate.

Changes in Consumption and Labor Income over Time

Time series of private consumption and labor income age profiles have been estimated to this point only for Taiwan, from 1976 to 2003, and for the United States, from 1980 to 2000. A comparison of these two economies is quite interesting, however, for a variety of reasons, but particularly because of the great difference in their rates of economic growth. Here we will examine the rates of growth by age. We leave the examination of the cohort trends for another occasion.

Figure 6 plots the average annual growth in real private consumption and labor income at each age. To remove the effects of short-term fluctuations, the estimates are based on five-year centered moving averages of the age profiles. Labor income for persons aged x in year t is the average of labor income of persons aged x for years $t-2$ to $t+2$. The time series are thereby reduced to 1978-2001 for Taiwan and for 1982-1997 for the US. The growth rates are presented only for ages 15 and older as those who were younger had no significant labor income in either economy. If these growth rates were

constant across age, it would indicate that the age profiles were not changing shape over these periods.

<Figure 6. Annual Growth of Private Consumption and Labor Income by Age, Real, Taiwan 1978-2001 and the US 1982-1997. ABOUT HERE>

As should come as no surprise, the growth rates for both private consumption and labor income at most ages in Taiwan are higher than in the US. For Taiwan, the age-profiles of consumption and labor income increased at annual real rates of 6.1% and 2.6% per year, respectively. The age profiles of consumption and labor income in the US shifted upwards at real annual rates of 1.6% and 1.4%.[7] Growth in Taiwan was strong; in the US it was moderate.

The stability of the age-profile of private consumption in Taiwan is remarkable. Consumption of those in their forties and the very young grew somewhat faster than average. Consumption by those in their late sixties and early seventies grew somewhat slower than average. Overall, however, there is virtually no generational shift in consumption in Taiwan during this period. The lack of change is all the more surprising given the many other dramatic changes in Taiwan during this period, e.g., rapid economic growth and large changes in age structure. We believe that this sustained equality across adult ages reflects resource sharing within co-residential households, in contrast to the nuclear families of the U.S.

The consumption profile growth rates for the US increase steadily from the mid-30s to the oldest ages. The range is substantial in comparison with the average US growth rate during this period, and reflects the trends in private consumption that helped to produce the striking consumption pattern shown earlier in Figure 1a.

The labor income growth rates vary more with age than the consumption growth rates in both economies, more so in Taiwan than in the US. Certain features are common to both economies. The slowest growth was at the youngest ages – among teenagers in Taiwan and twenty-year-olds in the United States. The most rapid growth was at older ages – those in their mid-seventies and older in Taiwan and those in their mid-sixties and older in the US. Note that at the highest ages, labor income in both economies is relatively low and a large percentage increase does not translate into a large absolute increase. In Taiwan, the labor income of adults near conventional retirement age grew much more slowly than the labor income of younger adults.

Is there any connection between private consumption and labor income? The simple correlation between the growth rates of private consumption and labor income across ages are 0.87 in the US and -0.11 in Taiwan. This does not suggest a strong relationship, but reflects in part the inclusion of age groups (the young and the old) for which labor income is relatively unimportant. If we consider only those aged 21 to 60, the simple correlation increases to 0.89 in the US and 0.29 in Taiwan. This suggests that current earnings are to some extent driving private consumption, but there are also variations in consumption growth that exhibit a considerable degree of independence from variations in labor income.

[7] Values are calculated using survival weights to calculate average private consumption and labor income and are explained in more detail above.

Conclusions

Understanding the economic lifecycle – how it varies and why – is important in its own right, but is also critical to understanding how changes in population age structure influence many features of the macroeconomy. There are few previous efforts, however, to estimate how consumption and production of individuals vary over the entire lifespan. Very little research has sought to estimate consumption profiles for a society from cradle to grave (in a cross-sectional sense), including both public and private transfers, as we seek to do in this paper. A number of technical difficulties, some of which are described above, create substantial hurdles to such an enterprise.

We have presented estimates of labor earnings and consumption for a wide range of contemporary economies, including mature economies, rapidly growing economies, and low-income countries, from the West and from the East. The estimated cross-sectional age profiles of labor income are broadly similar and the hump shape is consistent with our expectations. However, there are striking contrasts in the timing of earnings over the life cycle, with the peak age ranging from 36 in Taiwan to 49 in the US.

The consumption profiles reveal even more striking contrasts, starting with the flat age profile of total consumption in Taiwan and the steeply rising one for the U.S., which we believe reflects the extended family versus the state as the primary locus of transfers to the elderly. Profiles for private consumption are also quite variable, with Taiwan peaking early at age 20, and the US rising until its late peak at 58. In Taiwan, Indonesia and Thailand, consumption declines after the 20s or 30s. Private expenditures on education show wide variations, with unusually high expenditures in some Asian countries. Because of possible public-private substitutions, it is questionable to assign causality to either for differences in total consumption, but it is hard to avoid noticing that without public spending on Medicare and institutional Medicaid in the U.S., total consumption would decline after 58, whereas with them, it rises strongly.

Considering the consumption and earnings profiles together, we are surprised by the short period of life during which individuals are producing more than they are consuming, only between 31 and 32 years in the US, Taiwan, Indonesia and Thailand. The brevity of this phase contrasts sharply with high life expectancy, approaching 80 years in the US and Taiwan.

We have also looked at two decades of change in the U.S. and in Taiwan. The stability of the Taiwan consumption profile is remarkable in light of its extraordinary economic growth, and we attribute this stability to the extended family. In the US we find that consumption at older ages has been rising over time faster than in childhood, increasing the steepness of the lifecycle consumption gradient.

Many important questions remain to be explored, and we look forward both to broadening the analysis to include the experience of more countries and to deepening it by probing the causes of the differences we observe.

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Tables

Table 1. Government Share of Final Consumption Expenditure, 2000, Selected Countries and Countries of the World by Per Capita Income.

	Government Share of Final Consumption Expenditure (%)		
Name (Per Capita GDP)	Total	Health	Education
Indonesia ($2,807)	9.6	0.8	2.0
Thailand ($5,846)	16.5	3.1	7.9
Taiwan ($14,114)	19.3	0.3	3.9
France ($23,225)	29.8	9.1	7.4
US ($31,338)	23.8	6.4	5.8
Per Capita GDP			
Less than $1,000	15.6	2.2	3.0
$1,000-4,999	16.1	2.9	4.5
$5,000-9,999	20.7	4.6	5.9
$10,000 or more	25.4	7.1	7.0

Notes and Sources: Per capita GDP is purchasing power parity adjusted using 1995 prices. Source is World Bank World Development Indicators 2004, except for Taiwan for which source is DGBAS Statistical Yearbook of Taiwan 2004 and Mason et al. (2004). For the US Medicare and Medicaid expenditures are included in public health spending.

Table 2. Alternative estimates of equivalence scales, Indonesia, 1996.

Method	0-4	5-9	10-14	Notes
Engel's	0.87	0.72	0.62	
Rothbarth	<0	0.06	0.32	Cigarettes
Rothbarth	<0	0.22	0.64	Adult clothing
Ray	0.88	0.91	0.83	

Source: Maliki (2005) and calculation by authors.

Table 3. A Summary of per Capita Consumption Profiles, US 2000 and Taiwan 1998.

	United States		Taiwan	
	Share of Total	Mean age	Share of Total	Mean age
Consumption	100.0	45.5	100.0	40.1
Private Consumption	76.4	45.7	73.1	40.5
Education	1.4	16.8	5.9	15.1
Health	8.0	50.5	3.5	50.0
Other	67.0	45.7	63.6	42.3
Public Consumption	23.6	43.3	26.9	38.6
Education	5.2	13.9	3.6	15.0
Health	7.0	67.2	6.0	50.0
Other	11.4	39.5	17.3	39.5

Note. Mean ages are calculated for a stationary population age distribution based on the US period life table for 1985-89 and therefore do not reflect differences in population age distribution across countries.

Table 4. A Summary of Per Capita Earnings Profiles, 8 Countries.

	Mean age	Peak Age	Share 25 and under	Share 20 and under	Share 65+
Indonesia (1996)	43.0	41	8.9	2.5	5.5
Philippines (2002)	45.3	43	8.4	2.3	9.8
Uruguay (1994)	42.0	38	9.9	2.5	2.6
Thailand (1996)	40.9	37	13.0	4.2	3.3
Taiwan (1998)	41.4	36	8.2	1.2	2.3
France (1996)	42.4	47	6.4	0.9	0.8
Japan (1999)	43.9	46	7.7	1.1	3.0
US (2000)	44.3	49	7.2	1.6	5.0

Note. Mean ages are calculated for a stationary population age distribution based on the US period life table for 1985-89 and therefore do not reflect differences in population age distribution across countries. The shares and mean ages are calculated from unsmoothed data while the peak ages are calculated from smoothed data.

Table 5. Comparisons of labor income and consumption, selected countries.

	Indonesia (1996)	Taiwan (1998)	Thailand (1996)	US (2000)
Crossing ages for consumption and labor income (YI(x)>C(x))				
First age	26	24	23	26
Last age	58	56	55	57
Span	32	32	32	31
Mean ages based on US stationary population				
Consumption	41.2	40.1	41.7	45.5
Labor income	41.0	41.4	40.9	44.3
Differences	0.2	-1.4	0.8	1.2

Note. Estimates are calculated for a stationary population age distribution based on the US period life table for 1985-89 and therefore do not reflect differences in population age distribution across countries

Sources for Figures in "Charting"

Figure 1a. Authors' calculations.

Figure 1b. Authors calculations.

Figure 2

France (1996): Stephane Zuber, National Transfer Account Estimates for France, East Aspects of Population Aging Workshop Report, 35th Summer Seminar on Population, East-West Center, Honolulu, Hawaii, June 2004.

Indonesia (1996): Maliki, personal communication, 2006.

Taiwan (1998): Authors calculations.

Thailand (1996): Chawla, A. (2006). A Comparative Study of the Economic Lifecycles and Support Systems of Thailand and Taiwan, Department of Economics, University of Hawaii at Manoa.

US (2000): Authors calculations.

Figure 3

Indonesia (1996): Maliki, personal communication, 2006.

Taiwan (1998): Authors calculations.

Thailand (1996): Chawla, A. (2006). A Comparative Study of the Economic Lifecycles and Support Systems of Thailand and Taiwan, Department of Economics, University of Hawaii at Manoa

US (2000): Authors calculations.

Figure 4

Brazil (1996): Turra and Queiroz (forthcoming)..

France (1995): Stephane Zuber, National Transfer Account Estimates for France, East Aspects of Population Aging Workshop Report, 35th Summer Seminar on Population, East-West Center, Honolulu, Hawaii, June 2004.

Indonesia (2001): Maliki, personal communication, 2006

Taiwan (1998): Authors calculations.

Thailand (1996): Chawla, A. (2007). A Comparative Study of the Economic Lifecycles and Support Systems of Thailand and Taiwan, Department of Economics, University of Hawaii at Manoa.

US (2001): Authors calculations.

Japan (1999): Ogawa and Matsukura (forthcoming) and Maliki, personal communication, 2006.

Figure 5

Brazil (1996): Turra and Queiroz (forthcoming).

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Thailand (1996): Chawla, A. (2007). A Comparative Study of the Economic Lifecycles and Support Systems of Thailand and Taiwan, Department of Economics, University of Hawaii at Manoa.
Uruguay (1994): Marisa Bucheli, personal communications, 2007.
US (2000): Authors calculations.
Philippines (2002): Marjorie Pajaron, personal communications, 2007
Japan (1999): Ogawa and Matsukura (forthcoming), and Maliki, personal communication, 2006.

Figure 6
Taiwan (2001): Authors calculations.
US (2000): Authors calculations.

Figure 1a. Per Capita Consumption, Private and Public by Sector, United States, 2000

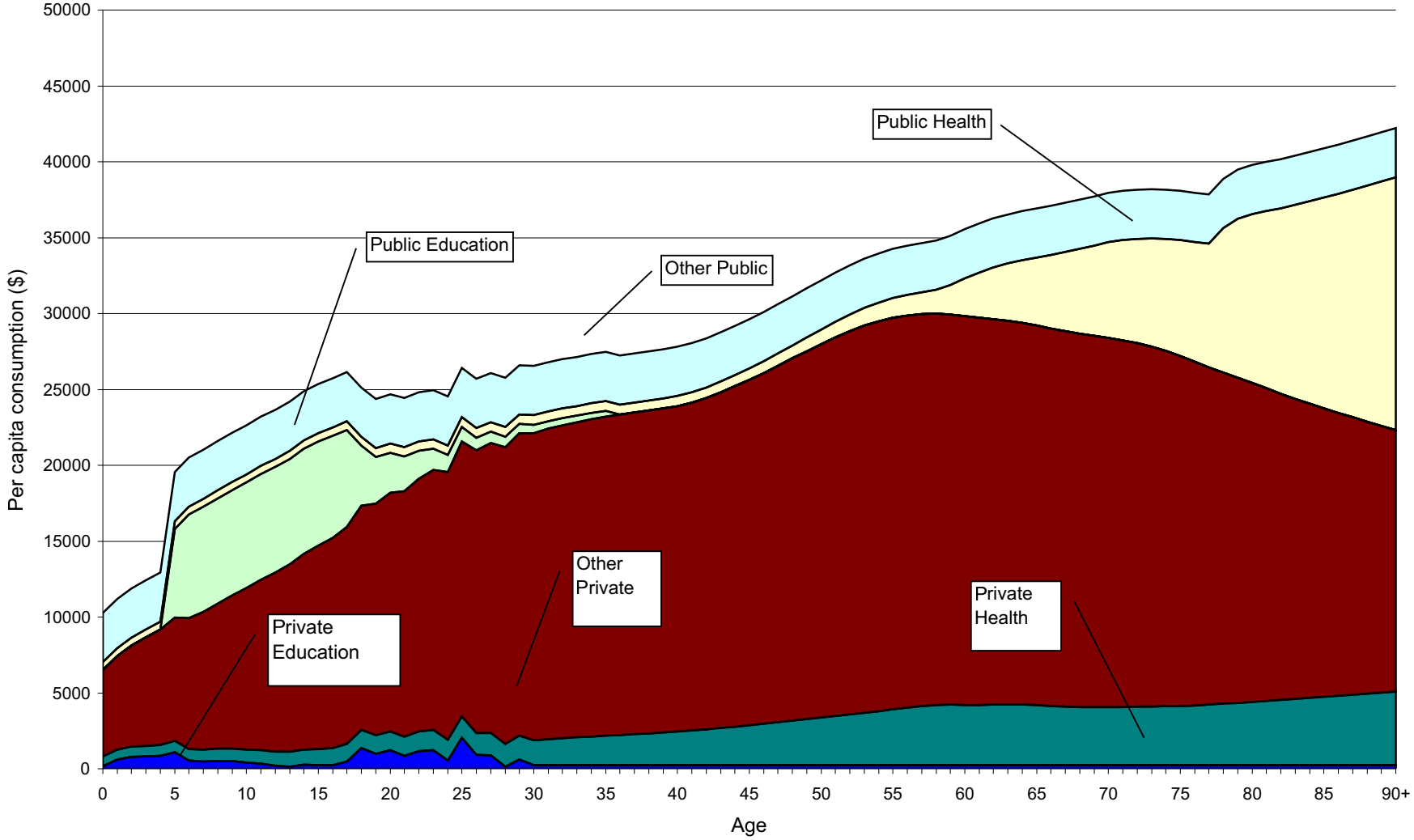


Figure 1b. Per Capita Consumption, Private and Public by Sector, Taiwan, 1998

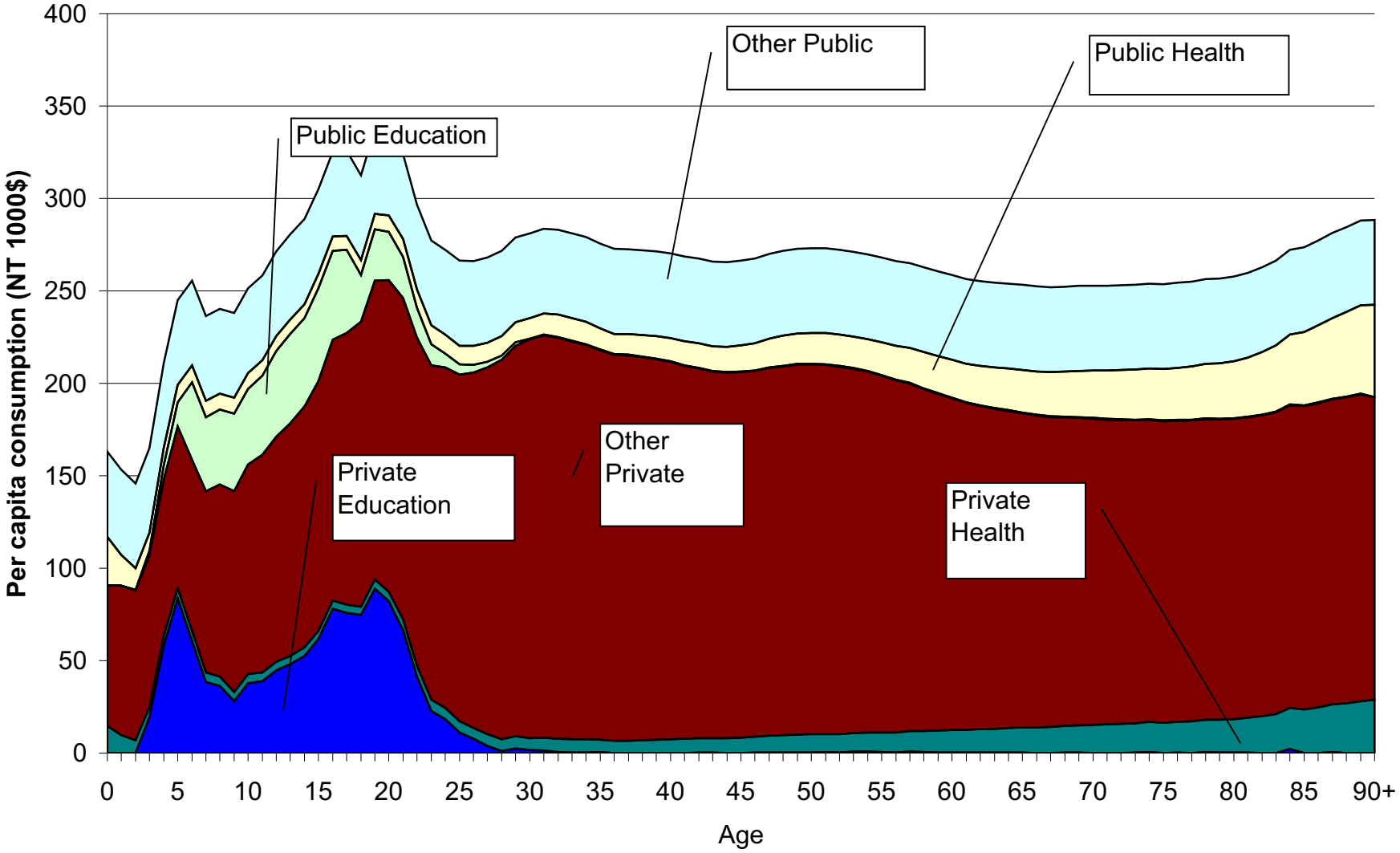


Figure 2. Per Capita Public Consumption Age Profile

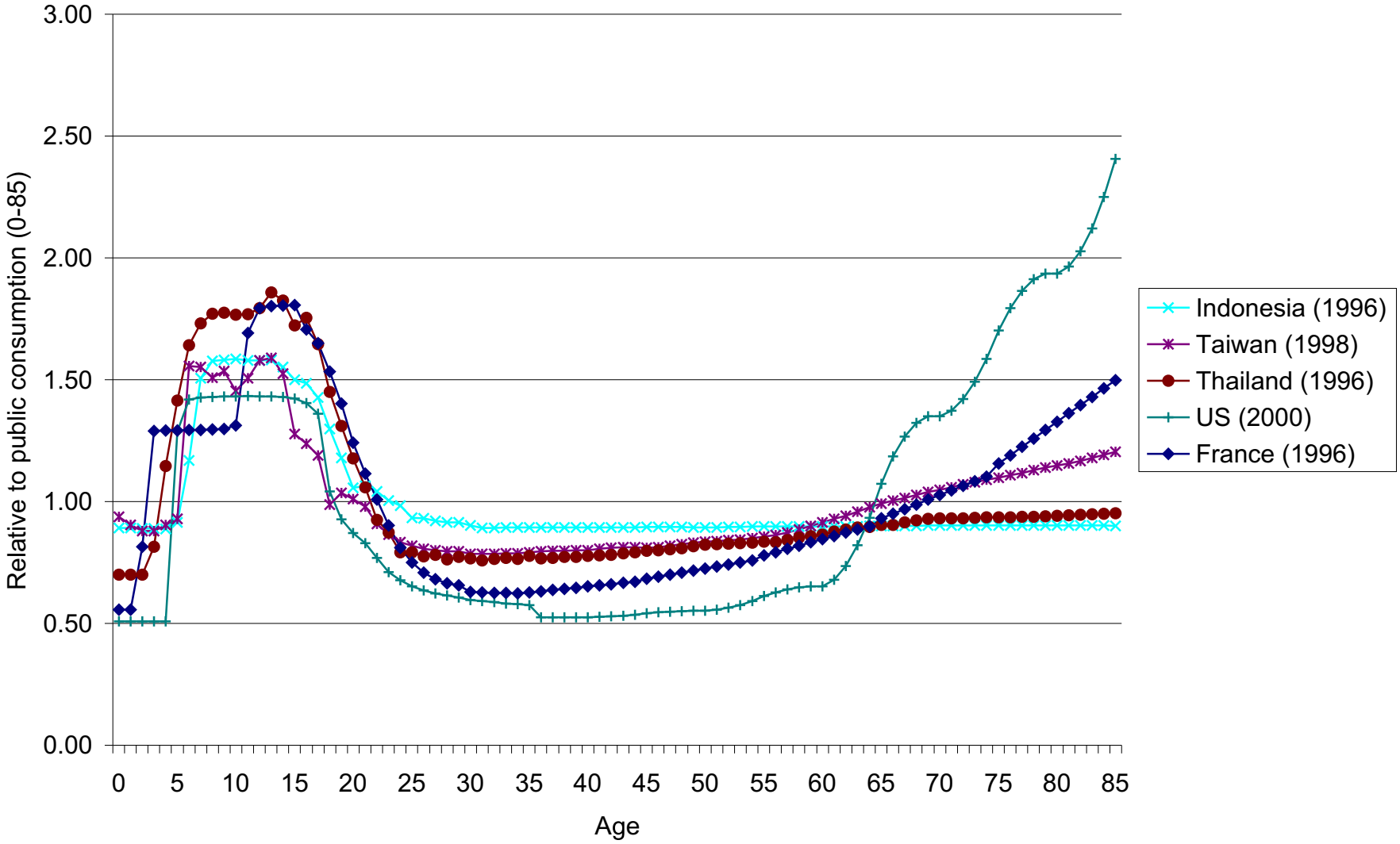


Figure 3. Per Capita Private Consumption Profile

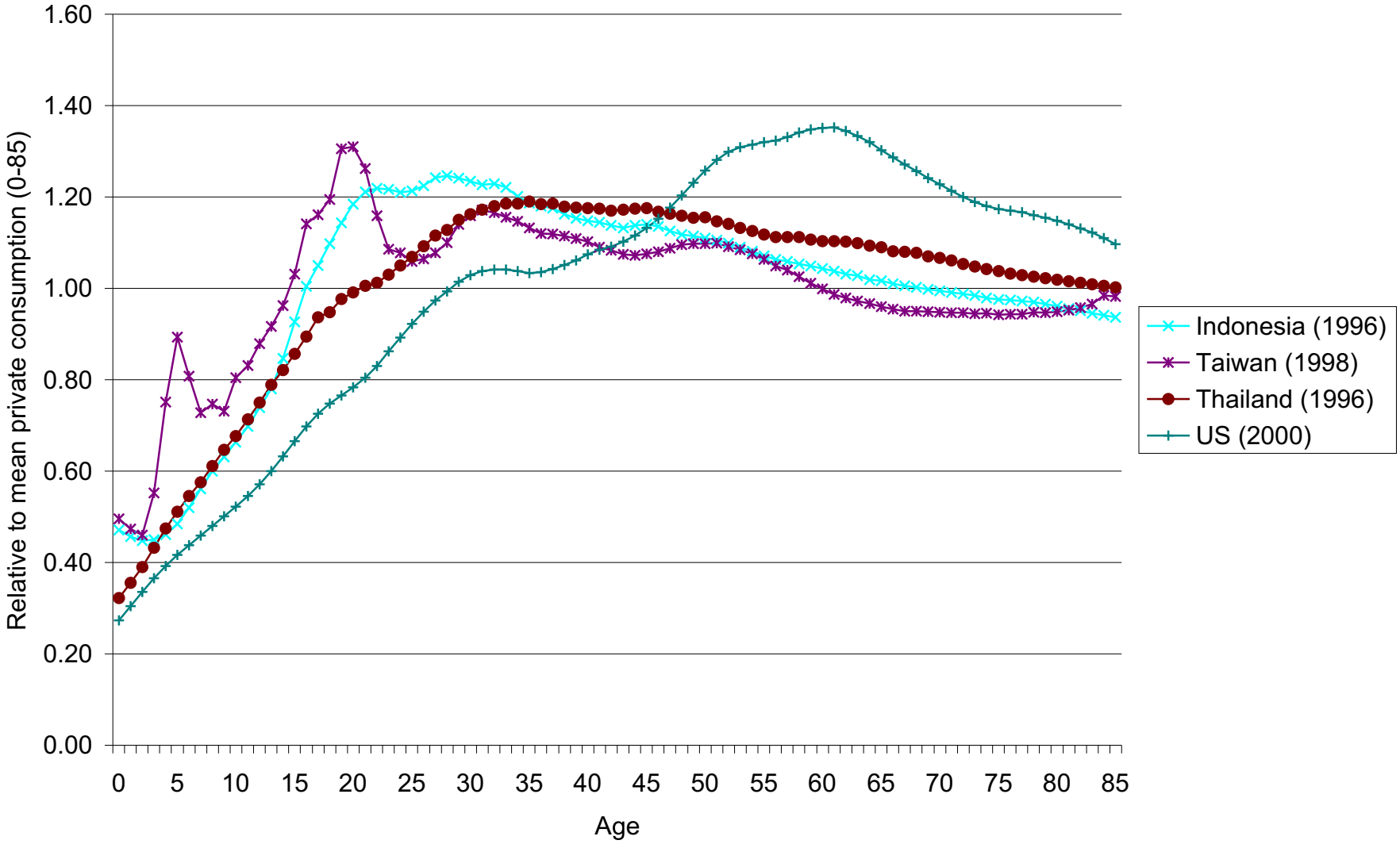
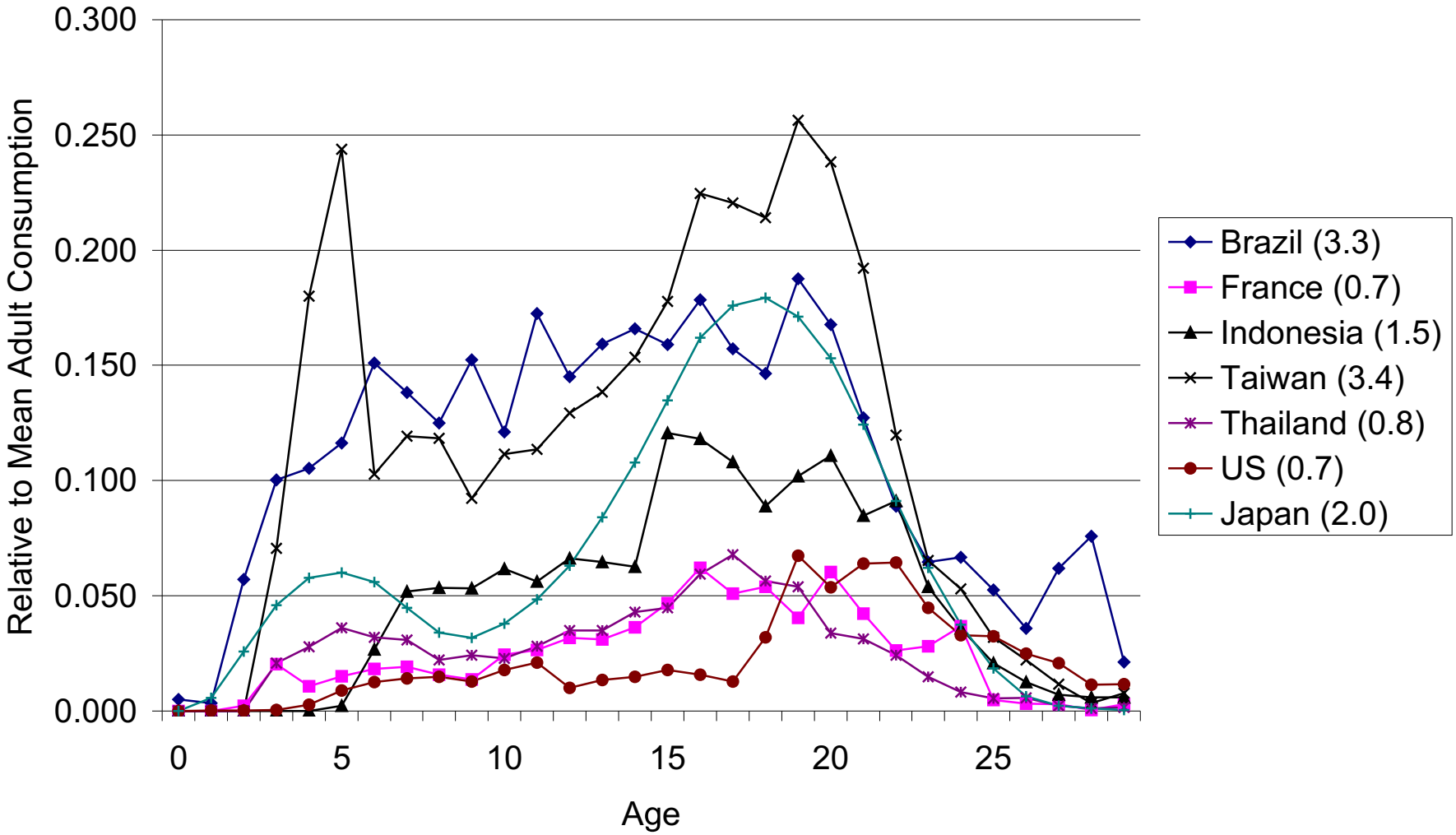


Figure 4. Private Education Consumption by Age



Values in parentheses are the sums of the age specific education values for each country.

Figure 5. Per Capita Labor Income Profile

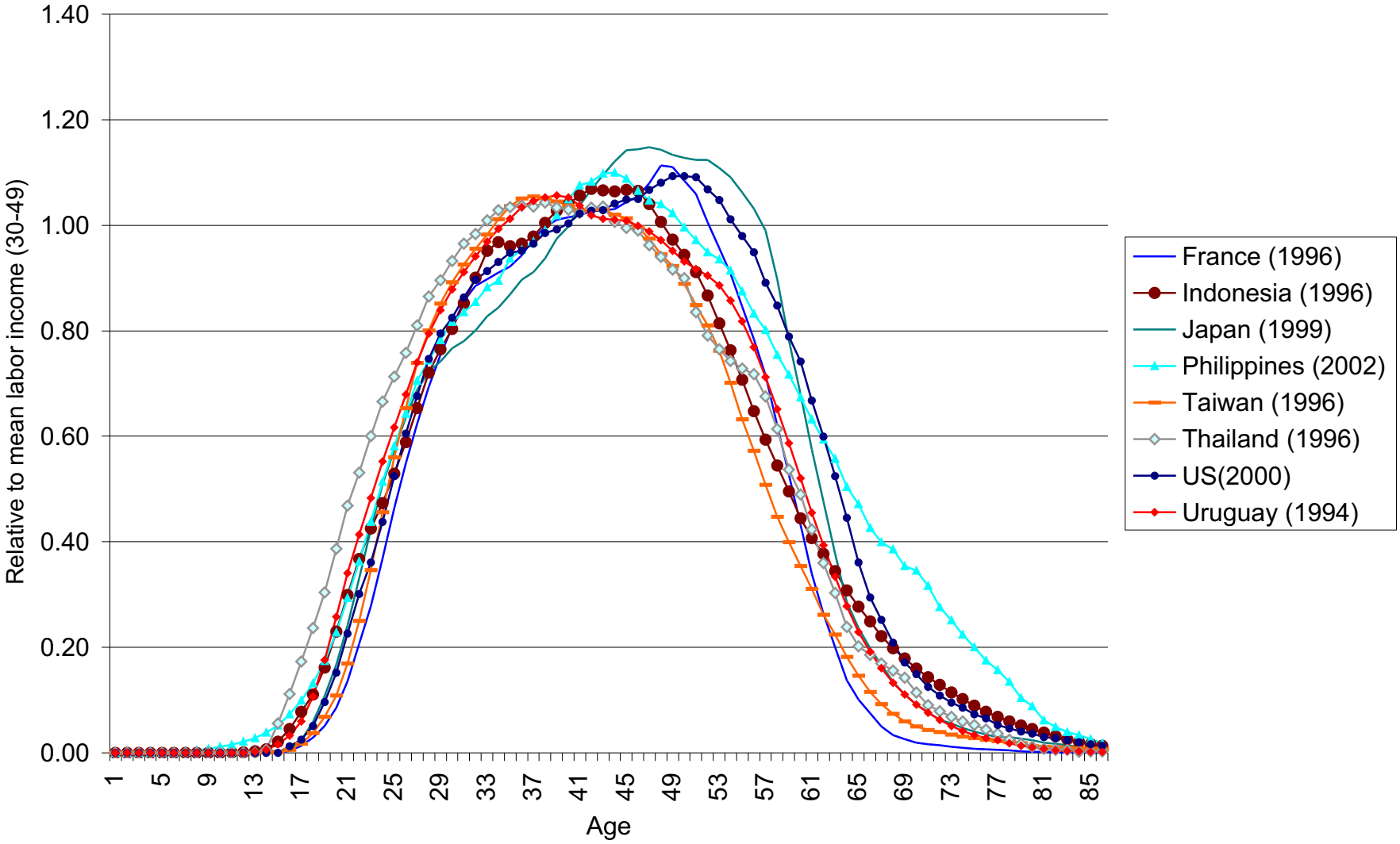


Figure 6. Annual Growth of Private Consumption and Labor Income by Age, Real, Taiwan 1978-2001, US 1982-1997