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Macroeconomic implications of demographic changes: A global perspective

Ronald Lee
Departments of Demography and Economics
University of California
2232 Piedmont Ave
Berkeley, CA 94720
E-mail: rlee@demog.berkeley.edu

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Introduction

The populations of the World are aging, both in rich countries and in poor ones. This process will accelerate during the next few decades. The macroeconomic consequences will depend partly on the particular aging process within each country, and partly on the global process of aging since markets are increasingly linked. Population aging is viewed as a problem because the elderly consume but largely do not work, so their consumption must be funded in other ways than through their labor income. Higher fertility and more rapid population growth would reduce the proportions of elderly and ease the dependency burden on the working age population. However, more rapid population growth would also require higher savings rates to provide capital for the more rapidly growing labor force, or else lead to less capital per worker. This tradeoff between the effects of demographic growth on dependency and on capital intensity is a central problem in the macroeconomics of population aging, first posed by Paul Samuelson (1975) in an influential article.

In this paper I will focus on this classic theme. However, there are many other issues one might discuss under this topic, and here are some examples, some followed by brief comments of my own: a) How are aggregate saving rates affected by the demographic transition and during its last stage, population aging? Under life cycle saving behavior, they first rise as fertility declines, and

then fall as the population ages (Lee et al, ***). b) Composition of consumption demand shifts (e.g. toward health care). c) Does productivity decline as the labor force ages? Probably not, in aggregate, since there are fewer less productive younger workers and more possibly less productive older workers. d) Will innovation and technological progress slow down? Not much is known about this, but in any event technological progress originating in other countries will not be affected by aging in a single reference country. e) How will population aging affect international capital flows? The typical case is probably that population aging will raise the capital intensity and reduce the profit rates in the older richer countries, and consequently that capital will flow from them to the younger poorer ones, but clearly this is not always the case. f) Are workers saving adequately to prepare for old age? Adequacy of saving must be assessed in the context of the public and familial transfer systems of each country. In some countries, old age consumption is funded virtually entirely through public pensions and publicly provided health care. The National Transfer Account studies (to be briefly reviewed later) find that in most countries, on average the elderly consume at least as much as younger adults in a given calendar year. However, much of this consumption is health care. g) Do the elderly exploit the young and future generations through public transfer systems that are unsustainable as currently structured, passing on to them enormous implicit debts? This is obviously a contentious and controversial topic. In my view, it is necessary to take into account the massive public and private transfers to

children through investments in their human capital via publicly and privately funded education. When this is done, it is not clear that transfers to the elderly outweigh these benefits received early in life (Bommier et al, 2010). h) Will population aging lead to a collapse of asset prices? Most careful studies have concluded that this is highly unlikely, not least because population aging can be foreseen many decades in advance so that we would expect at most gradual changes in asset prices (Poterba, 20**).

I will now return to the central theme of this paper, Samuelson's tradeoff between the two fundamental consequences of low fertility, slow or negative population growth: rising dependency, on the one hand, and the reduced need for saving and the rising capital intensity of the economy, on the other. I will begin by presenting empirical age profiles of consumption and of labor income drawn from the National Transfer Accounts project (NTA). This large international project is constructing estimates of National Accounts broken down by age and generation, including estimates of intergenerational (inter-age) transfers occurring within families as well as through the public sector. More information is available in Lee and Mason (2011) and at the project url, NTAccounts.org. There are currently 37 countries participating in the project, each with its own research team. The Japan team is lead by Professor Naohiro Ogawa.

The changing economic life cycle: consumption and labor income

In NTA, consumption includes household expenditures. Household expenditures on health and education can often be directly assigned to individuals, but other consumption must be imputed to individual members, which is done in proportion to a set of weights: .5 for children up to age 5, then increasing linearly to 1.0 at 20 and above. Other consumption also includes the imputed value of services of owned housing and sometimes consumer durables. Consumption also includes public in-kind transfers, which are primarily public education, publicly funded health care, and publicly funded long term care. It does not include public pensions which are income, and need not be consumed. Consumption is given by age, and is an average across males and females.

Labor income includes pre-tax wages and salaries plus fringe benefits. It also includes two thirds of self-employment income. The other third is treated as asset income. Estimates are population averages for males, females, those in the labor force and those with zero earnings. For purposes of comparison across countries, both consumption and labor income are standardized by dividing by average labor income at ages 30 to 49 in each country.

Figure 1 presents averaged results for the top and bottom income quartiles of countries represented in Lee and Mason (2011). The top quartile includes Japan, the US, Sweden, Germany, Austria and Finland. The bottom quartile includes Kenya, Nigeria, India, Philippines, China and Indonesia. Starting with labor income, we note that labor income is higher in childhood in the poorer countries, and that in these countries income peaks earlier but drops more slowly and is much higher in old age. The influence of the incentives built into public and private pension plans in the rich countries is apparent in the rapid decline in labor income at 60 or soon after. Consumption also shows interesting differences. In the rich counties there is a noticeable bump at younger ages representing heavy investment in the human capital. In the poorer countries, consumption is remarkably flat across adult ages and extending all the way through old age, as noted earlier. In sharp contrast, consumption rises strongly with age in the rich countries. The net effect of these differences is that old age is far more costly in rich countries because older people work far less and consume far more. Consequently the support cost of each elderly person relative to labor income is far higher in the rich countries than in the poorer ones, which amplifies the dependency costs of population aging in the richer countries.

Figure 2 shows that Japan in 2004 looks very much like the other rich industrial nations, which strongly rising consumption at older ages. It is distinguished by unusually high investment in

human capital, as are other East Asian countries. It is also distinguished by higher labor earnings at older ages than in most European countries, probably because the public pension system does not penalize continuing work at older ages (Gruber and Wise, 1998).

One might wonder how these distinctive age patterns of labor income and consumption emerged in the rich countries. It is well known that around 1880 or 1900, the age at "retirement" (when labor force participation rates of men first declined to 50%) was far older, in the 70s, in Europe and the US (Costa, ***). During the 20th century the age at retirement declined steadily, in part due to the increasing demand for leisure as incomes rose, in part due to the opportunities presented by public pension programs, and in part to the early retirement incentives built into these programs. In the US, this declining trend ended in the 1990s and since then the male and female age at retirement has risen by a year or two. Changes in the incentive structure of both public and employer provided pensions have clearly played a role.

On the side of consumption, Figure 3 shows the changes that have occurred over the past half century. In 1960, consumption declined after age 60, and public and private spending on both education and health was quite limited. During the 1960s, two new public programs were introduced to pay for health care: Medicare, for the elderly and disabled, and Medicaid for the

poor. By the 1970s public pension benefits had become more generous. The age profiles for 1981 reflect these changes. Private consumption did not begin to decline until age 70, likely due to the increased pension generosity, while total consumption now rose with age, as both public and private spending on health had expanded remarkably, particularly at older ages. By 2007 the age profile of consumption rose very sharply throughout adulthood beginning in the early 20s and continuing in the late 80s when spending on long term care (nursing home care for the elderly) grows explosively. Analysis of Swedish historical data shows similar trends and patterns. It is clear that the growth of the Welfare State, with its massive transfers of income and goods and services to the elderly, has profoundly affected the age patterns of consumption in ways that were probably unexpected and unintended.

Population aging and economic support ratios

We can roughly approximate the effect of changing population age distributions on economic dependency through the so-called "support ratio". This takes as given the age profiles discussed above. Assuming they remain fixed, the support ratio is calculated as the ratio of population-weighted labor income to population-weighted consumption. We will refer to this as the ratio of effective producers to effective consumers. In light of the preceding discussion of how these change over time, we must recognize the artificiality of assuming them constant. Nonetheless,

we get some useful indications by doing so, and tracing out the implications of changing population age distributions.

Before there is population aging, there is an important earlier stage in the demographic transition, in which fertility declines leading to reduced proportions of dependent children, while the share of the population in the working ages rises, and the population share of elderly remains low. This phase can last for many decades, and the rate of increase in the support ratio during this period gives rise to what is called the "demographic dividend". Figure 4 presents illustrative trajectories of the support ratio for four developing countries, China, India, Costa Rica and Nigeria, based on NTA age profiles and United Nations estimates and projections (2011). The vertical line marks 2012. The dividend phase occurs from the trough to the peak of the support ratio, and the annual pace of increase during this period is seen to range from .67% in China and Cost Rica, both of which had rapid fertility declines, and .37% and .27% in India and Nigeria, which had slower declines. Other things equal, these rates translate into rates of increase in age standardized consumption, that is consumption per effective consumer – not much different than rates of growth of per capita income. We see that the dividend phase for China is just about over; that Costa Rica may have another decade or two; India somewhat more than that; and that Nigeria's dividend phase is projected to last through 2100. The dividend phase is followed by population

aging which causes declining support ratios, and reduces consumption, other things equal. Calculated from this downturn until 2100, China and Cost Rica will both experience an average annual decline of around .3%, but this is much more rapid in the few decades following the onset of aging.

The situation in a few rich countries is shown in Figure 5 for Japan, the US, Germany and Spain. Japan had the earliest onset of serious population aging, because unlike the other countries fertility was not raised for so long by a postwar baby boom. Population aging begins slowly in the 1970s, but accelerates in the 1990s, and the support ratio drops dramatically until around 2060. After 1990 the trajectory in Germany is similar to Japan, although muted. Spain is just at the start of the process, and currently enjoys a high support ratio. The US stands out as experiencing only mild population aging up to 2050, largely due to its relatively high fertility which has largely been close to replacement levels for the past three decades. Between 2010 and 2050, both Germany and Japan will experience average annual declines of .7%, while for Spain it will be .8%, and for the US only .3%. Once again, these declines in the support ratio, other things equal, would imply equal declines in age-adjusted consumption, and nearly equal declines in per capita income. These rates can be subtracted from the expected rate of productivity growth

to find a net effect – assuming that other factors such as saving rates or government borrowing remain unchanged.

These projected declines in the support ratio in the rich industrial nations are the main cause of concern about population aging. Perhaps to some, these calculated impacts of population aging may seem surprisingly small. These support ratios take into account all kinds of consumption, not just government transfers. If we were to calculate fiscal support ratios, reflecting only taxes paid by age and public cash and in-kind benefits received, the consequences of population aging would appear rather more severe. This is because in all of these countries, the public sector makes massive transfers to the elderly, far greater than the transfers to children (Miller, 2011). I will return to this point toward the end of the paper. Suffice it to say for now, however, that I believe that the general support ratios give a more accurate picture of the fundamental forces at work than do the fiscal support ratios with their focus on one sector of the larger economy.

This concludes the discussion of the first part of Samuelson's story, the beneficial effect of higher fertility and more rapid population growth on the dependency burden falling on the working age population. But we must not ignore the second part of his story, the likelihood that higher fertility and more rapid growth would lead to reduced capital intensity in the economy,

and lower productivity of labor as a result. I will begin by discussing fertility and investment in human capital, and then turn to investment in physical capital and financial assets. It is possible that even as populations age and support ratios fall, that other changes in the economy will systematically raise productivity and offset this adverse effect.

Low fertility, population aging, and investment in human capital

The quantity-quality tradeoff theory of fertility and investment in children is well established in economics (Becker and Lewis, 1974; Willis, 1972). The basic idea is that parents derive satisfaction both from the number of children they have, and the average quality of their children. In its simplest form, parents first decide what share of their income to devote to their own consumption and what share to spend on their children. They then decide how to allocate their child-spending on numbers versus quality, with the product of the two constant, and a hyperbolic budget constraint. In this story, as various kinds of shocks affect the parents' choice, we might expect to observe an empirical elasticity of spending on quality versus quantity (other things equal) of something like -1, as we move around the budget constraint. This is a story based on individual behavior, but we might extend it to the public sector, which might operate under a similar budget constraint. In this case, spending on children's human capital, say health and education, might be a relatively fixed share of the budget or of National Income, while expenditures per child vary depending on national fertility and proportions of children.

Figure 6, which plots the log of human capital spending per child (relative to labor income) against fertility in recent years, for 23 NTA countries, shows something of the sort. Human capital expenditure is measured as the sum of public and private spending on health and on education on a child at age 0, at age 1, and so on, up to age 17 for health and 25 for education. It is thus a synthetic cohort estimate of life time spending on a child. It is expressed relative to average labor income, and the log of this ratio is on the vertical axis. On the horizontal axis is the Total Fertility Rate averaged over the five years preceding the NTA base year. Evidently there is quite a tight relationship (descriptive R^2=.7) with a slope of -.7. In Nigeria and Kenya, where fertility was about 5.5 births per woman, about 1.5 years of labor income is invested in a child's human capital, on average. In a country with low fertility like Japan, Taiwan, S. Korea, Hungary, Spain, or Slovenia, around 5 or 6 years of labor income is invested in human capital per child. The whole relationship is particularly strong across the Asian NTA countries, and holds separately for both private expenditures and for public expenditures (Lee and Mason, 2011). It also holds over time, even more strongly, in Taiwan, Japan and the US (Lee and Mason, 2011).

This substitution of quality of child for quantity of children carries over to the labor force when the children mature. The smaller number or workers is offset, at least partially, by their greater

productivity deriving from their greater human capital. For a more formal development of this idea, see Lee and Mason (2010). We now turn to assets and capital.

Population aging, provision for old age consumption, and asset accumulation

Consumption in old age is paid for in different ways in different countries. One way, of course, is for older people to continue to work as they age. As we saw in Figure 1, this is more common in poorer countries, but there are great variations in rich countries as well (Lee and Ogawa, 2011). Another approach is to accumulate assets during the working years, and then consume these assets and the income they generate, in old age. But in some societies, familial transfers may be more important. Older people may live with the family of an adult child, and share in the household's consumption, receiving in-kind intra-household transfers. Or children who have migrated to the city or to another country may send back cash remittances to help cover the costs of old age consumption. Yet another possibility is that the public sector taxes workers and transfers resources to the elderly in the form of public pension payments or in-kind transfers of health care or long term care.

Our NTA project finds that when elders rely mainly on public or private transfers for their consumption, they tend to work very little and have very little labor income. When they rely more heavily on asset income to fund their consumption, then they tend also to work more. For

simplicity, we will now look at that portion of old age consumption that is not funded by work in old age, which we can call net consumption. Figure 7 shows how net consumption of people age sixty five and over is paid for. It plots the proportional share of net consumption funded by assets, by public sector transfers, and by private transfers. The figure is a triangle graph, which is possible since the three sources of support must add up to 1.0. At the vertex labeled "assets", net consumption is paid for 100% out of asset income, and similarly at the vertices labeled "public transfers" and "private transfers". A point at the center of the triangle would indicate a country in which the elderly derive consumption support equally (33%) from each of the three sources. In a country situated on one of the edges the elderly derive support only from the two vertices at the ends of the edge. Countries outside the triangle to the right are those in which the elderly are making net transfers to their children rather than receiving support from them.

With that background, we see that Hungary, Austria, Sweden, Slovenia and Brazil derive 100% or more of their consumption expenses from public transfers. We also see that some Asian countries derive substantial old age support from family transfers: China, Taiwan, Korea, and Thailand. But it is striking that this is not the case in Japan (net familial transfers of zero), India, or the Philippines. In ten of the countries, the elderly make net transfers to their children, as in India, the Philippines, Indonesia, some Latin American countries, some European countries, and

the US. If we look more closely by age within the 65+ group (not shown here), we see that often, the younger elderly are making substantial transfers to their children, as in Japan, while the older elderly (say above age 75) are receiving substantial transfers, and these two may cancel out in the aggregate. Finally, there is a group of countries where asset income plays an important role, including the US (more so than any other rich country), India, Philippines, Thailand and Mexico.

The point of this long discussion of the sources of old age support is that the institutional and policy context matter a great deal when it comes to population aging and capital accumulation. When working age people anticipate support from transfer systems, particularly public systems, they have less incentive to save for retirement. In this case, population aging may simply increase the dependency load on the working ages and not generate any increase in productive assets. I suspect, although I have not evidence, that this is less so with the family support system, since workers may wish to ease the burden of support on their own children, but not feel this way in relation to government transfer programs. But when people do not expect to receive much in the way of transfer support in old age, as is the case when public pensions are absent or relatively small (the US case), then working age people will save and accumulate assets.

As the proportion of older people in the population rises with population aging, there is an increase in assets per capita and in assets per worker. Figure 8 shows the age distribution of new worth in the US, illustrating this point. Population aging between 2012 and 2050 would raise the ratio of net worth to the working age population in the US if the age profile shown in Figure 8 remained constant. In fact, we would expect asset accumulation to increase in response to longer life. If those assets are invested domestically, they will raise the productivity of labor and stimulate economic growth. If they are invested internationally, then they will not raise domestic wages, but they will generate flows of asset income. Similarly, in a closed economy the rising capital intensity will lead reduce the rate of return to capital, but in an open economy the return will be unaffected. Either way, the increase in assets per capita will lead to an increase in assets per capita, offsetting the declining support ratio, and reducing the need of the elderly to depend on transfers from the working age population.

Fertility, declining support ratios, and capital

In work in progress with Andy Mason, we ask what level of fertility would maximize the support ratio; what level would maximize the fiscal support ratio; what level would maximize consumption while maintaining a capital/income ratio of 3.0; and what level would maximize consumption when we can also vary the capital intensity (golden rule). The results are shown in Table 1, for different regions of the world and for Japan.

The first column reports the unweighted current average TFR for the NTA countries in each region. The second column shows the level of fertility that would maximize the fiscal support ratio. These levels are rather high in the rich industrial nations (3.1), and indeed they are high wherever there are generous public transfer programs for the elderly and not much for children – as in Latin America, where the outcome is a TFR of 3.9! But where there are low public transfers to the elderly, as in South and Southeast Asia, the outcome fertility is very low, at 1.2 births per woman. Nations would be ill-advised to strive for these levels of fertility. When we look at the general support ratio, all these fertility levels move toward replacement level. In the West, in Japan, and in East Asia, support ratios are slightly above replacement, while in Africa and South/Southeast Asia they are a bit below, and in Latin America right at replacement.

When we take the costs of saving to invest in a more rapidly growing labor force, or the possibilities of raising productivity by deepening the capital stock, rather lower fertility looks desirable, and every region does best with below-replacement fertility, some with fertility far below replacement.

I do not want to make much of these results. They are based on very simple calculations, they ignore the transition to steady state, and they don't consider policies aimed at altering economic behavior over the life cycle, such as raising the retirement age. Furthermore, nothing in here takes account of individual fertility preferences. Still, these calculations do bring us back to Samuelson's original analysis. We need to look at both sides of the matter, and when we do, low fertility, even below replacement, may not be such a bad thing. In fact, we find that small variations in fertility in the neighborhood of replacement or just below make rather little difference in the rich industrial nations.

Conclusions

Let me briefly reiterate the main points. We saw that on average, the elderly consume at least as much as younger adults, and in rich countries substantially more. However, much of this old age consumption, at least in the rich countries, is health care. It appears that over time, and with the development of a European style welfare state, very large transfers to the elderly raise the relative level of consumption by the elderly. At the same time, at least partly due to the growth in public pension programs, labor supply at older ages is reduced. The net result is that an older person becomes substantially more costly, as labor supply is reduced and consumption increased. These changes in the economic life cycle make the whole process of population aging a more expensive proposition for society. As populations age, the support ratio drops, reducing the

growth rate of consumption per capita by between .3% and .8% per year over a number of decades, below what it would otherwise be.

However, the same processes that lead to population aging also may lead to increased investment in both human capital and assets. Investment in human capital per child rises strongly as fertility declines, and as these children mature into adult workers, their increased productivity will at least partially offset their smaller numbers. Turning to assets, to the extent that workers expect to rely on asset income in old age and save accordingly during their working years, population aging will tend to raise assets per capita and per worker, also boosting labor productivity and wages, or at least generating increased asset income per capita in a globalized economy. The increased productivity of labor arising from both more human capital and more physical capital should to some degree offset the declining support ratio, and increased asset income will further offset these declines. However, the extent to which these offsetting processes unfold depends on the institutional structures and public policies that are in place.

Some simple calculations suggest that low levels of fertility are not seriously disadvantageous in the long run because even without taking into account the human capital effects, we find (in a

simple Solow growth model) that the capital-intensifying benefits of slower growth, or alternatively the benefit of lower saving rates, largely balance the declining support ratios.

While population aging will place severe strains on particular public programs, overall, the economic challenges of population aging need not be overwhelming, and need not pose a major threat to our economic well-being.

References— To be completed

Becker, G. and H. G. Lewis (1973). "On the Interaction between the Quantity and Quality of Children." Journal of Political Economy **81**(2): S279-288.

Boersch-Supan, A. (2006) "Demographic Change, Saving and Asset Prices: Theory and Evidence" in C. Kent, A. Park and D. Rees, eds., Demography and Financial Markets (Australian Government, The Treasury), pp.132-165.

Brian Bucks, Arthur Kennickell, Traci Mach, and Kevin Moore, 2009, "Changes in U.S. Family Finances from 2004 to 2007: Evidence from the Survey of Consumer Finances," Federal Reserve Bulletin 95 (February), A1-A55. http://www.federalreserve.gov/pubs/oss/oss2/2007/scf2007home.html

Gruber, J. and D. A. Wise (1999). Introduction and Summary. Social Security and Retirement around the World. J. Gruber and D. A. Wise. Chicago, The University of Chicago Press**:** 437-474.

Lee, R, S.H. Lee,. and A. Mason (2008) Charting Lee, Ronald, Sang-Hyop Lee, and Andrew Mason (2008) "Charting the Economic Life Cycle," in *Population Aging, Human Capital Accumulation, and Productivity Growth*, Alexia Prskawetz, David E. Bloom, and Wolfgang Lutz (eds.), a supplement to *Population and Development Review.* 34(Suppl.): 208-237.

Lee, R., G. Donehower, and T. Miller (forthcoming) “The changing shape of the economic lifecycle in the United States, 1970 to 2003” Chapter 15 in R. Lee and A. Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective.* Edward Elgar.

Lee, R. and A. Mason (2010) “Some Macroeconomic Aspects of Global Population Aging” In a special supplement to *Demography.* 47(Suppl): S151-S172.

Lee, R. and A. Mason, principal authors and editors (2011 forthcoming). Population Aging and the Generational Economy: A Global Perspective. Cheltenham, UK, Edward Elgar.

Lee, R. and A. Mason (2011) " Population aging, intergenerational transfers, and economic growth: Asia in a global context" (under review).

Perez-Brignoli, H. (2009) " Demographic transition in Latin America, 1800-2050" paper presented at a conference on the Long Term Consequences of the Demographic Transition, Madrid, Spain.

Rosero-Bixby, L.

Sanderson, W.C. and S. Scherbov (2010) “Remeasuring Aging” *Science* 10 September 2010: Vol. 329 no. 5997 pp. 1287-1288 DOI: 10.1126/science.1193647

United Nations Population Division (2011). World Population Prospects: The 2010 Revision. New York, United Nations.

Willis, R. J. (1973). "A New Approcah to the Economic Theory of Fertility Behavior." Journal of Political Economy **81**(2, Part 2): S14-S64.

Table 1.

Total fertility rate that maximizes alternative objectives in steady state. Far right columns also reflect saving rates under two assumptions.					
ountry/ Region	Actual current fertility	Fiscal support ratio	Support ratio	Max Consumption and:	
				Maintain K/Y=3	Maintain Golden rule K/Y
Africa	4.3	n.a.	1.5	1.1	0.8
East Asia	1.3	2.3	2.2	1.7	1.4
S and SE Asia	2.3	1.2	1.8	1.3	1.0
Latin America	2.2	3.9	2.1	1.6	1.3
West	1.7	3.1	2.4	1.9	1.5
Japan	1.4	2.7	2.3	1.9	1.6

35

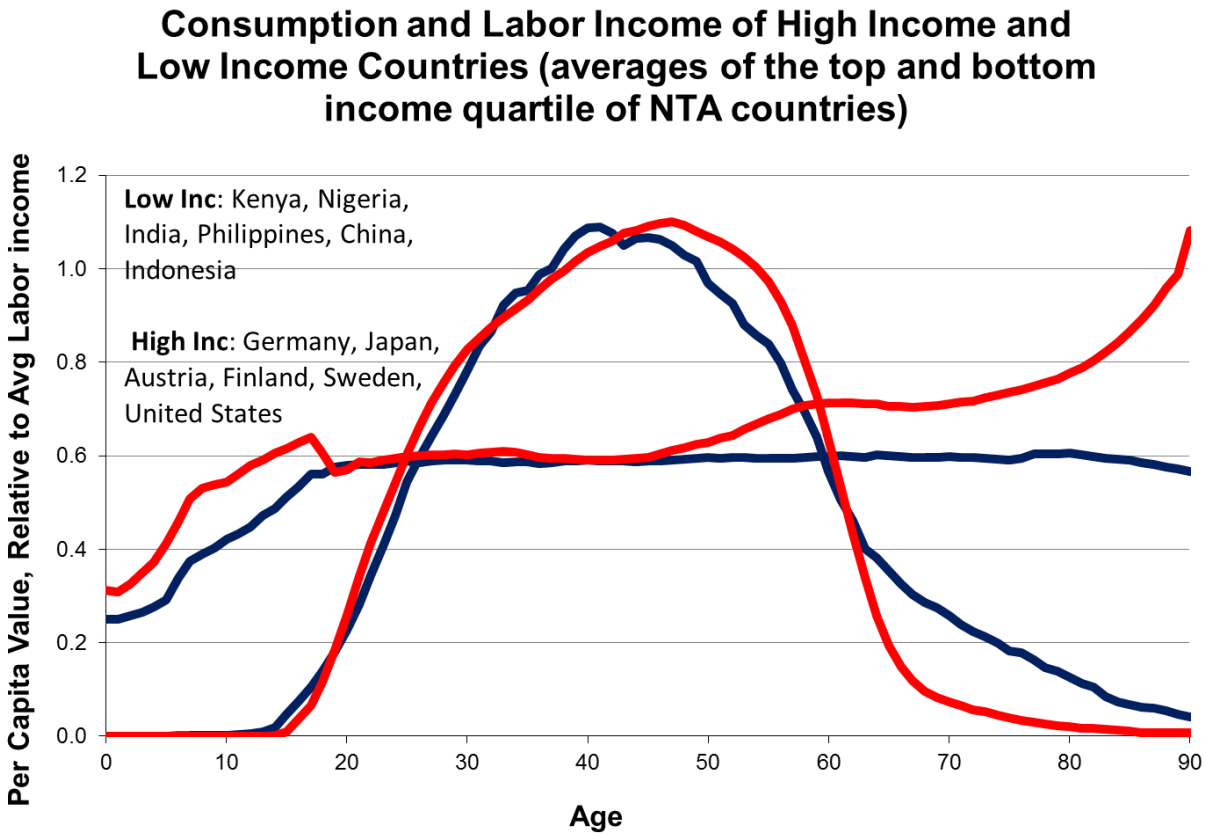

Consumption and Labor Income of High Income and Low Income Countries (averages of the top and bottom income quartile of NTA countries)
Per Capita Value, Relative to Avg Labor income
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Low Inc: Kenya, Nigeria, India, Philippines, China, Indonesia
High Inc: Germany, Japan, Austria, Finland, Sweden, United States
0
10
20
30
40
50
60
70
80
90
Age

Figure 1

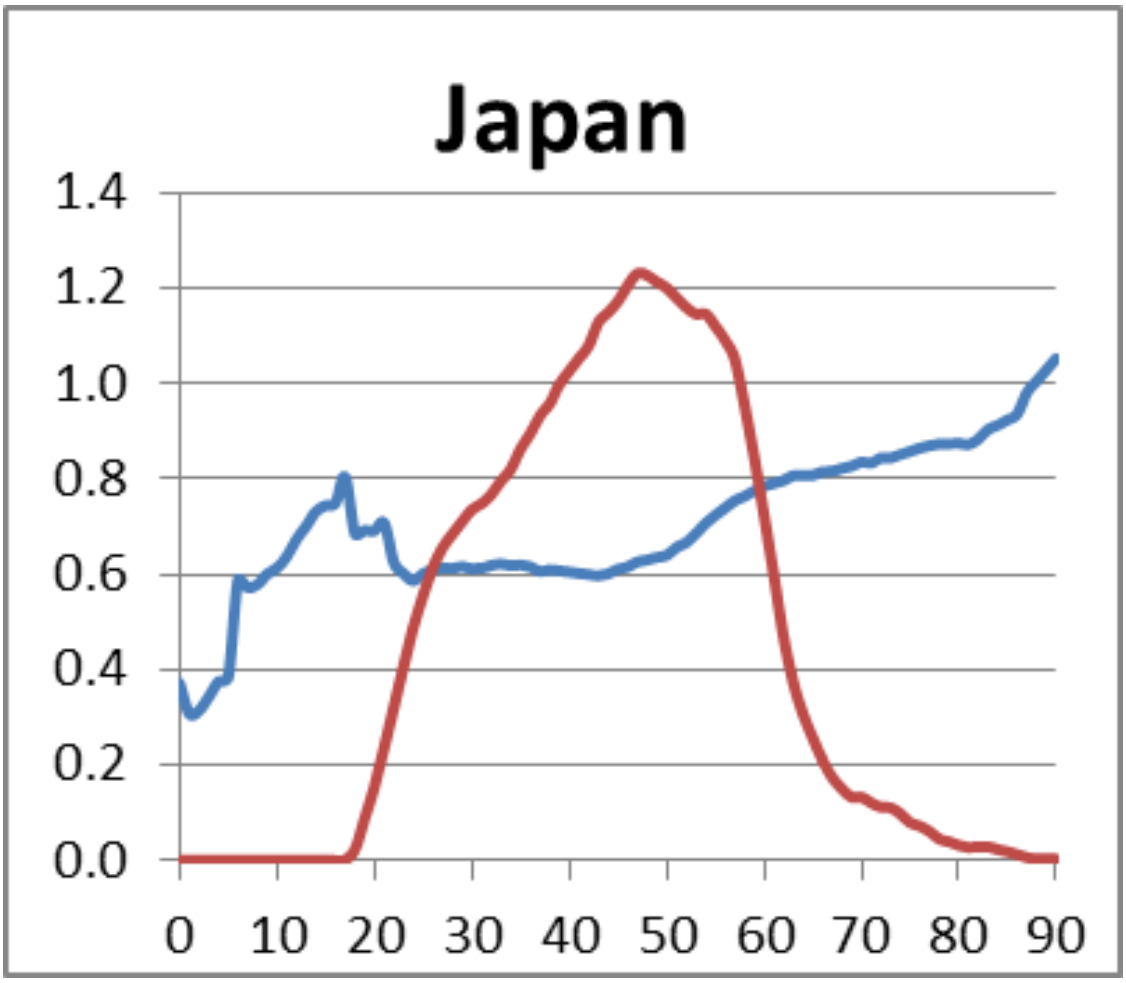
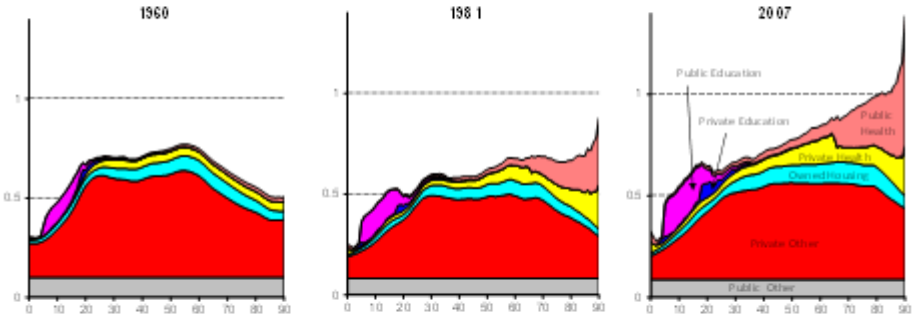


Figure 2

Growth of the Welfare State: US consumption over past half century: 1960, 1981 and 2007
(Ratio to labor income ages 30-49).



Source: US National Transfer Accounts, Lee, Donehower and Miller, 2011

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Figure 3

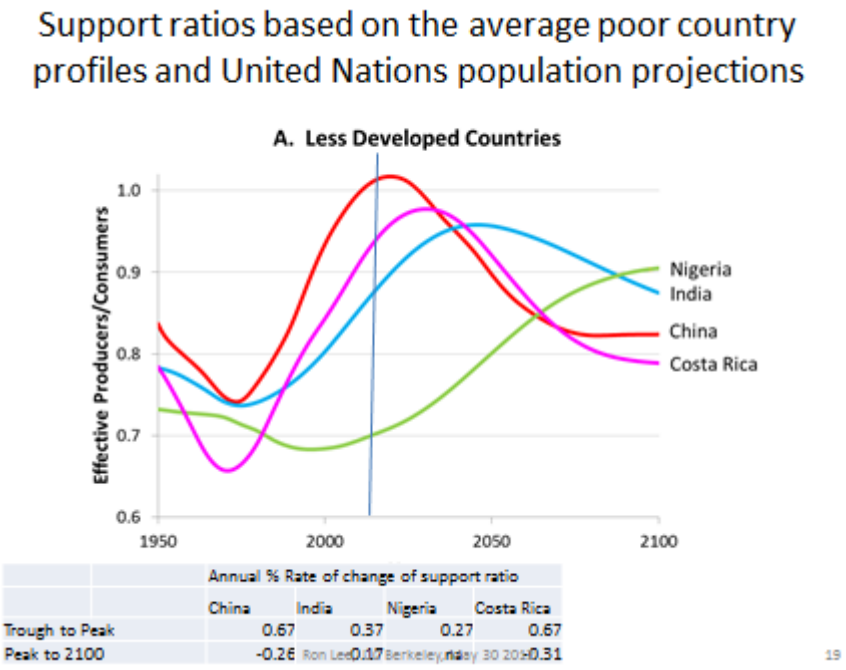
Support ratios based on the average poor country profiles and United Nations population projections
A. Less Developed Countries
Effective Producers/Consumers
1.0
0.9
0.8
0.7
0.6
1950
2000
2050
2100
Nigeria
India
China
Costa Rica
Annual % Rate of change of support ratio
China
India
Nigeria
Costa Rica
Trough to Peak
0.67
0.37
0.27
0.67
Peak to 2100
-0.26
-0.17
-0.31
Ron Lee Berkeley May 30 2014
19

Figure 4

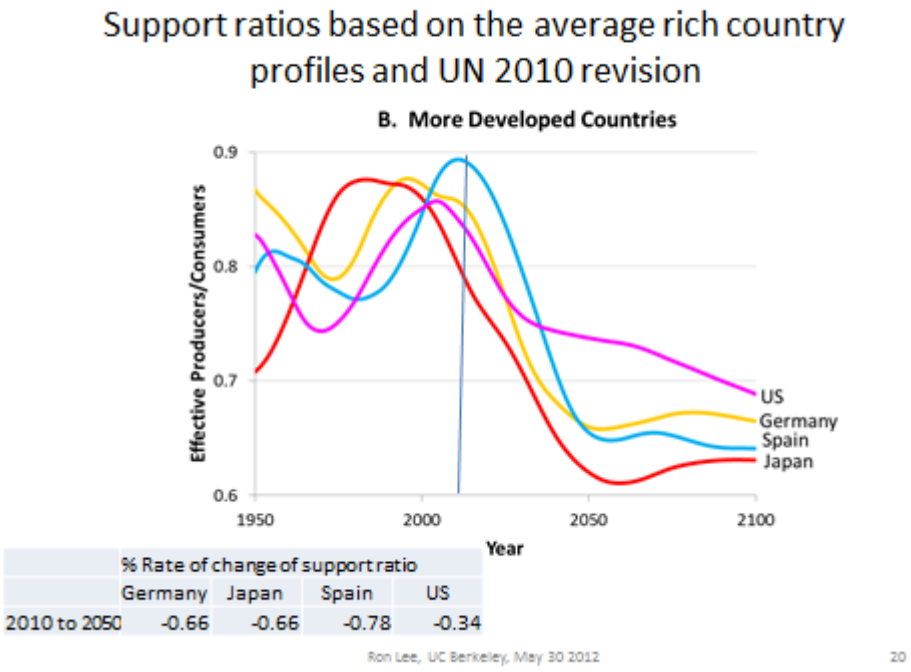
Support ratios based on the average rich country profiles and UN 2010 revision
B. More Developed Countries
Effective Producers/Consumers
0.9
0.8
0.7
0.6
1950
2000
2050
2100
Year
US
Germany
Spain
Japan
% Rate of change of support ratio
Germany Japan Spain US
2010 to 2050 -0.66 -0.66 -0.78 -0.34
Ron Lee, UC Berkeley, May 30 2012
20

Figure 5

Figure 10. Total Human Capital Investment in 23 NTA Countries in Relation to Total Fertility Rate

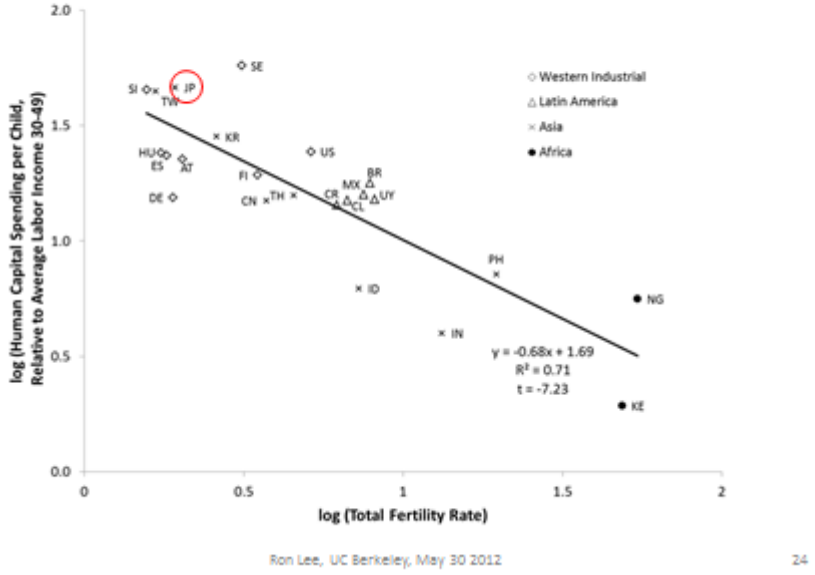

Figure 6

Shares of consumption not covered by labor income:
Family Transfers, Public Transfers and **Asset income**
(part not saved) sum to 1.0

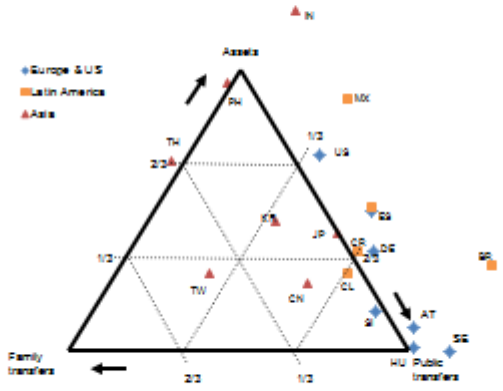

Figure 7

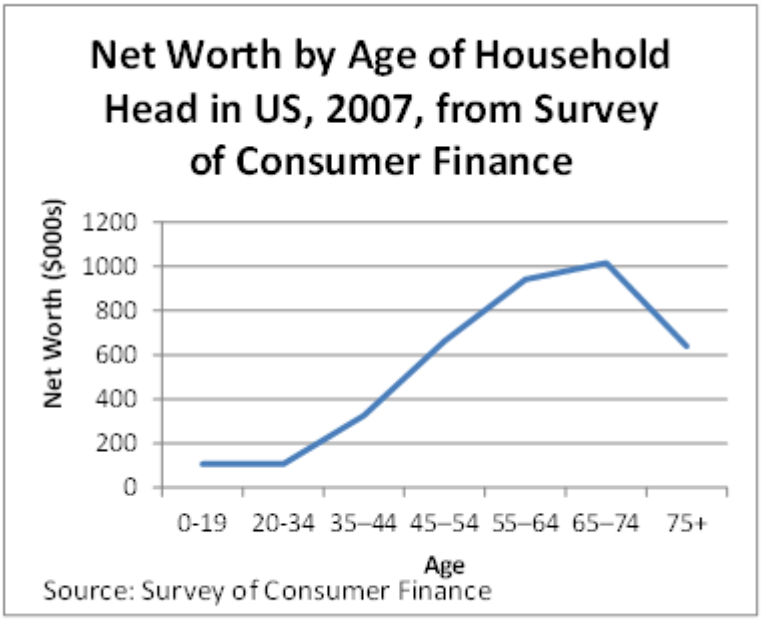
Net Worth by Age of Household Head in US, 2007, from Survey of Consumer Finance
Net Worth ($000s)
1200
1000
800
600
400
200
0
0-19
20-34
35–44
45–54
55–64
65–74
75+
Age
Source: Survey of Consumer Finance

Figure 8