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Population aging, intergenerational transfers, and economic growth: Latin America in a Global Context

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Introduction

The demographic transition has brought sweeping changes to population age distributions in almost all Third World nations, and all industrialized countries, with more profound changes to come in the next few decades. In some respects these changes are welcomed for the slower population growth and reduced child dependency ratios that they bring. In other respects they are feared for the anticipated shrinking of the labor force and the rapid increases in the old age dependency ratios, which will make current public pension programs unsustainable and perhaps health care systems as well. Because the generations are closely linked through family relationships and public programs, their changing relative numbers have many profound effects.

Here I will focus on some economic consequences of the demographic transition in Latin America, and more specifically in the five Latin American countries that are part of the National Transfer Accounts (NTA) project. The NTA project views the set of public and private intergenerational transfers in a comprehensive and coherent way. I will look at how the patterns of intergenerational transfers interact with the demographic changes over the demographic transition with special attention to the phase of population aging.

The Demographic Transition Changes the Relative Numbers of Young and Old. Illustrated by Mexico

The demographic transition is the process through which populations move from an initial state of high fertility, high mortality, and a young population, to a state of lower fertility, low mortality, and an old population. With very few exceptions, the transition begins with falling mortality and rising life expectancy starts. Fertility remains high for a number of decades, so the population begins to grow increasingly rapidly. In families and the population children become increasingly plentiful. Eventually fertility begins to decline as well, slowing population growth and reducing child dependency ratios. During this phase of the transition, child dependency falls rapidly and since the proportion of elderly remains low, each person in the working ages has fewer dependents to support. During this phase, a population experiences the “demographic dividend”, an acceleration in the growth rate of per capita income or consumption that occurs mechanically, resulting from lower fertility. Some analysts suggest that this occurs only if it is possible to employ the rapidly growing labor force. I prefer to think of the dividend as arising from declining fertility rather than from rapid labor force growth, so that even if unemployment rises, per capita income will be higher than it would have been without the decline in fertility. Eventually this dividend phase comes to an end when fertility levels off, and the proportion of elderly starts to rise. The pretransitional stage with high child dependency and few elderly is now replaced by the post-transitional stage with high old age dependency and few children. No country’s population has yet reached the end of this process, and even the oldest countries of today will experience a doubling or tripling of their old age dependency ratios in the coming decades. There are, or course, many uncertainties: how far will fertility decline? Will life expectancy continue to rise?

Pérez Brignoli (2009) has reconstructed the demographic histories of many Latin American populations, revealing considerable diversity[1]. Argentina, Uruguay and Cuba

all initiated early fertility transitions with timing similar to those in Europe, but fertility decline stalled at moderate levels in the middle of the 20th century. Chile also had an early decline which stalled at a relatively high level of fertility. These countries have not followed the classic pattern of a demographic transition. Other countries maintained high fertility until well after 1950, with decline in Mexico not starting until around 1970 or 1975, for example. Similarly, mortality decline in the region sometimes began before 1900, sometimes around 1900, sometimes two or three decades later. Current demographic structures reflect this diverse past, with Uruguay having a much older population than most other countries, for example. Some of the Latin American countries are projected to experience significant population decline after the middle of the 21st century, while others are projected to continue to grow.

The demographic transition in Mexico appears to have adhered fairly closely to the classic pattern, and it will be used here to illustrate the points made earlier. Figure 1 is based on Perez Brignoli (2009), on United Nations (2009) estimates, and on United Nations (2009) projections from 2010 to 2100. The first panel plots fertility, and we see the sudden and rapid decline starting around 1975 from above 6.5 and reaching 2.3 in 2008. Before this sustained fertility decline, we see a major fluctuation in fertility that may have been prompted by the revolution, but which persisted long afterwards. The next panel shows life expectancy which dropped from around 30 years at birth down below 20 during the revolution and flu pandemic of the 1910s, but began a steady ascent in 1920 reaching 75 in 2008. The third panel shows the population growth rate which rose rapidly to a peak at 3% per year around 1975 and is projected to fall steadily until turning negative after 2050. The fourth panel shows population size which has grown from under 20 million in 1900 to 110 million in 2008. It is projected to reach 129 million a bit before 2050, and then to decline. The last panel shows the changes in age distribution. The fluctuations in fertility and mortality in the first half of the century lead to a major fluctuation in the youth dependency ratio which is not part of the classic transition pattern. We will focus here on the initial increase in the total dependency ratio due to improving child survivorship and rising child dependency ratios, reaching 1.0 before fertility decline begins. The total dependency ratio then declines, and is projected to reach .5, declining by half. After this, the proportion elderly begins to rise strongly and total dependency rises to a level quite similar to its starting point in 1900. But in 1900 child dependency was high and old age dependency was low, in 2100 the situation will be reversed.

To appreciate the implications of these deep changes in population age distribution, it is useful to examine the shape of the economic life cycle, which we will now do using estimates from NTA.

Changing economic behavior across the life cycle: Age profiles of consumption and labor income

Changing population age distributions matter because human behavior varies systematically across the life cycle. These variations are rooted in biology: children are born helpless and take many years to mature and become independent; the elderly are weaker and more frail than younger adults, on average. But biology is only one of a

number of factors that shape the economic life cycle. Children may begin work very young or may not start earning income until well into their 20s, depending in part on educational enrollments and in part on family needs and expectations. The elderly may continue to work until they die despite weakness, illness and pain, or they may retire in their 50s and enjoy leisure while still in excellent health. Public programs, the level of wealth, availability of financial institutions, and cultural expectations all have an important influence. Relative consumption across the life cycle likewise depends in part on biological needs, but also on family living arrangements, public programs for children and the elderly, birth rates of the poor versus the rich, long term care arrangements, cultural expectations, and so on.

The National Transfer Accounts project, NTA, has estimated average per capita labor income and consumption across the life cycle from birth until age 90 and above for 23 countries. For labor income, we include everyone in the population at each age, whether in the labor force or not, and whether male or female. We count salary and wages, including fringe benefits, as well as two thirds of any self employment income which in poor agricultural countries can be very important. These labor income estimates will therefore reflect labor force participation rates by age, hours worked by participant, and income earned per hour, all in a single number. For consumption, we use household expenditure data. We estimate private educational expenditures for each age, and similarly for private expenditures on health. The remainder of household consumption expenditure we allocate to the members of each household in proportion to a simple set of equivalent adult consumer weights (see Lee et al 2008).[2] We average across all individuals at each age to get our consumption measure. For purposes of comparing the shapes of the age profiles across countries, we first standardize them by dividing all values of labor income and consumption by the average labor income for ages 30 to 49.

The resulting estimates are plotted in Figure 2 for labor income, and Figure 3 for consumption. In both cases for ease of exposition we plot the unweighted average for four of the poorer NTA countries (India, Indonesia, Kenya and the Philippines) and for four of the richer ones (Japan, US, Sweden and Finland). We also plot the average of the four Latin American countries in our sample: Brazil, Costa Rica, Chile, Mexico and Uruguay. We see that in the poorer countries, labor income starts at a younger age and is higher at younger ages, compared to the richer countries. The Latin American average lies surprisingly close to that of the poorer countries, despite a higher level of income. The peak labor income in the poor countries occurs earlier than in the richer countries, and labor income declines earlier in the poorer countries. But starting around age 60, labor income in the rich countries drops precipitously, reflecting the incentives built into their generous public pension programs (Gruber and Wise 1998). At the older ages, labor income continues in the poorer countries at around twice the level of the rich countries.

As for consumption, in the richer countries there is a strong hump in childhood consumption, corresponding to heavy investment in the human capital of children, primarily through education. This is largely absent in the poor countries, and to a surprising degree is also absent in Latin American countries. It is striking that in the poorer countries consumption is quite flat across age from the earlier twenties up to the

oldest ages. This probably reflects the fact that the elderly largely coreside with their adult children and share in the household budget. By contrast, in the rich countries we see that consumption is rising with age. A large part of this increase reflects increasing public and private expenditures on health care for older people, and above age 80 for long term care. However, some of it is due to rising private consumption expenditures of other sorts as well. In Latin America, there is a very mild increase in consumption with age, with the curve more like the poor countries than the rich ones.

Age structure and economic behavior interact: Trends in support ratios

An empirical literature has consistently found that population age distribution matters in cross-national studies of economic growth (Higgins and Williamson 1997; Bloom and Canning 2001; Bloom and Williamson, 1998; Kelley and Schmidt 2005. Here we expand on the simple simulation approach developed in Cutler et al 1990. To get a rough idea of the effect of changing population age distributions on the macro economy, we can use these average age profiles for Latin America to calculate the "support ratios" implied by changing population age distributions. The support ratio is the ratio of effective workers to effective consumers, where effective workers are calculated by multiplying our average labor income age profiles times population at each age, and summing; and effective consumers are calculated similarly. The support ratio is a more refined measure of the number of workers per dependent. For the same level of labor productivity per worker, per capita income and consumption per effective consumer will both vary in proportion to the support ratio. Of course, the age profiles on which it is based change over the course of economic development and in response to public policies, and we don't know what they will look like in 2100. The support ratio based on age profiles estimated from data collected around 2000 are necessarily a rough indicator. However, some features of these profiles appear to be quite robust, and the profiles for poor and rich countries give an idea of the amount of variation that might be expected. By using an average of the profiles for a number of countries, some of the transitory features of the profiles for a particular country may be minimized.

Figure 4 presents support ratios for the five Latin American NTA countries from 1950 to 2100, using the average Latin American profiles together with the demographic data for each country based on United Nations (2008) estimates and projections. We immediately see that Uruguay is a case apart. It had an earlier fertility decline, and its proportion 65+ is the same as the US. Age distribution changes over this period are very muted. For the other four countries we see that there is a strong trough in the support ratios around 1970, and that declining fertility after this raises the support ratios to a peak somewhat after 2010. After this peak, the ratios decline steadily, including for Uruguay, all the way up to 2100. For simplicity, we can contrast the next forty year period from 2010 to 2050. Table 1 calculates the growth rates of the support ratios from 1970 to 2010, and contrasts these growth rates to those from 2010 to 2050. The difference in the support ratio contribution is around 1% per year. That is, other things equal, the swings in the support ratios will in themselves make per capita income and consumption growth about 1% per year less rapid in the next four decades than in the previous four decades. Of course, many other things will surely be different; other things will not be equal. Some of the changes will be

systematically related to the changing demography, and I will discuss these over the rest of this paper. I will now consider

Longer life, lower fertility, and older populations raise the demand for wealth.

In many countries the elderly continue to supply a significant amount of labor and to fund an important part of their consumption through labor income. But in every country in the NTA collection, the elderly on average consume much more than they earn. We call this difference between consumption and labor income at some ages the "life cycle deficit". As working age individuals think about their future old age, they must be aware of this life cycle deficit and the need to deal with it in one way or another. Later, we will consider differences across countries in the way the life cycle deficit is funded. For now, I will just note that older people do consume more than they produce, and presumably working age people expect to be able to do so in the future. Expectation of future income in excess of labor income constitute wealth, a point that will become clearer later. For now, the point is that the need for such wealth, for expectations of future funding for consumption, are powerfully affected by population aging.

Indonesia has had relatively high fertility in the past, so it has only a small share of elderly. In Figure 4, we see that the aggregate life cycle deficit of the elderly is very small compared to the life cycle deficit of children, only about 15% as large. Japan, however, has a high share of elderly, and in the figure we see that aggregate life cycle deficit of the elderly is slightly larger than that of children, 115%. The average person in Japan has a much greater need to provide for future funding of a life cycle deficit than does the average person in Indonesia. We might say that the per capita demand for wealth is higher in Japan.

One way to measure the importance of this demand for wealth is to calculate the life cycle deficit of the elderly as a share of aggregate consumption in a country. In Japan this share is high; in Indonesia it is low. Figure 5 plots this share for 22 NTA countries against the proportion of the population that is 65+. We see that there is a close relation between the two (the descriptive R^2 is.975), suggesting that population aging is a powerful influence on the demand for wealth. However, we also know that the shapes of the age profiles are different in rich than in poor countries, a rich countries are older. To isolate the pure effect of population aging, the figure shows a second set of points and fitted line, this time using the average age profiles of four poorer countries (see Figure 2) for all the countries, while using the actual population age distributions of each country. There is still a strong relationship to population aging, but we now see that about one third of the increase in wealth is due to differences in age profiles, and about two thirds is due population aging alone.

What is wealth? capital, or expected public pensions, or expected private old age support.

Wealth, in the sense we use the term in NTA, can take a variety of forms, since it is some sort of claim on future output. Owning an asset like a home, a farm, financial assets or gold jewelry gives a claim on future output because the asset can be sold or mortgaged,

or the income it earns can be used to fund consumption. But participation in a public pension system, and the resulting expectation of receiving net benefits when elderly, is another form of wealth, often called “pension wealth”. This concept can be enlarged to include expectations of public provision of health care and long term care. And then it should also include the expectations of taxes to be paid in the future, with benefits measured net of these.

A further extension of this concept covers the expectation of old age support to be received from one’s adult children, net of support that a person expects to give to others. Formal models incorporating these relationships and forms of wealth have been developed by Willis (1988), Lee (1994), and Bommier and Lee (2002), building on ideas implicit in Samuelson (1958). In a country like Taiwan or Thailand, where familial net support of the elderly is important, there is positive private or familial transfer wealth. But we have found that in most countries, even Third World countries, older people on average are making transfers to their younger family members rather than the reverse.

How is old age deficit (net consumption) financed around the world?

The NTA project estimates the public and private transfers given and received at different ages for many but not all NTA countries. It also measures asset income received by age. From these data we can calculate the various forms of wealth (Lee and Mason, 2009), although I won’t report these here. Instead, I will use a triangle graph to show the proportion of the old age life cycle deficit (that is, consumption minus labor income above age 65) that is funded through use of assets, public transfers, or private transfers. If an elderly individual holds assets and receives asset income, but does not use these to fund her consumption, then assets would get a zero share in this accounting. Presumably the individual will eventually die and bequeath her assets to younger relatives, which would show up as bequests, but these do not appear in this graph.

The results for a dozen countries are shown in Figure 6, which requires explanation. The shares are measured along the axes on the three sides of the triangle. These shares must always sum to 100% by construction. The right hand side of the triangle measures the share of public transfers, and at the lower right hand point public transfers fund 100% of old age consumption. We see that Austria is approximately in this position. At the other end of this axis we the Philippines in which public transfers cover about 0% of old age consumption (net of labor income).

The bottom of the triangle measures family transfers. In Austria these are close to 0%. No country lies on this axis, but we can see that elderly in Thailand get about a third of their deficit funded by familial transfers, and in Taiwan the share is a bit more than this, perhaps 40%, while in S. Korea the figure is about 15%. Note that these three countries are the only ones in the graph with a positive contribution of familial transfers. Japan and Finland are both right on the 0% line, while all the remaining countries are to the right of the triangle indicating that they receive negative familial transfers and instead make net transfers to others.

Finally, the left side of the triangle measures the contribution of assets. We see that only in Thailand, the Philippines, Mexico and the US do assets fund two thirds or more of the deficit. In Mexico assets fund 100% of consumption and some public transfers fund substantial downward transfers from the elderly to younger people (of course, we don't actually know which source of funds is used to fund transfers versus consumption). In Costa Rica, Germany, Finland and Austria, assets fund a third or less of the deficit, with Japan, Uruguay and S. Korea in between.

Taiwan is the only country that is near the center of the triangle, sitting on a different kind of "three legged stool", where the third leg is familial transfers. The elderly in the Latin American countries in the diagram all make net private transfers to others, while receiving varying amounts of public transfers.

These different institutional arrangements are interesting in their own right, but they also have important implications for how the demographic transition and particularly population aging affects the economy. We have seen that population aging drives a major increase in the population demand for wealth. This demand for wealth might be satisfied through saving and asset accumulation, or it might be satisfied by an increase in transfer wealth, that is, by a higher proportion of the population expecting to be supported by their adult children or by public transfers. Increased asset accumulation would lead to increased income and possibly to higher productivity and wages for workers. Increased transfer wealth would simply lead to higher transfers of income from working age to the elderly, with no increase in income. That is, transfer wealth, whether public or private, substitutes for capital (Feldstein, 1974; Lee et al, 2000 and 2003; Borsch-Supan et al 2006. This is the down-side of transfers to the elderly. There is also an up-side, since expected transfers are subject to different kinds of risks (death of a child, alienation of a child, changes in the pension benefit structure, changes in old age dependency ratio making either public or private programs unsustainable) than are assets (melt down of asset values as in the current crisis, erosion of bond values through rapid inflation, housing price instability), and transfers are a concrete expression of social or familial solidarity.

The point is not that transfers are bad and assets are good, but rather that policy makers should be aware of the consequences of relying on each. It is probably best to support the elderly through a mixture of the two. Some countries have perhaps gone too far in reliance on public pensions.

The demographic transition promotes investment in human capital.

It is a well-known theory in economic demography that there is a trade-off between the number of children a couple has (quantity) and the amount they invest in each (quality) (Becker and Lewis, 1973; Willis, 1973). Total expenditures on children are the product of quantity and quality, times the price of child goods. Because of this peculiar nonlinear interaction in the budget constraint, the "price" of a child depends on the chosen quality; and the price of a unit of quality depends on the chosen number. As income rises, the demand for quality rises more rapidly than for quantity, it is believed, and the consequent

increase in the price of a child causes the number of births to decline at the same time that expenditure on each increases. This is a leading explanation for the decline in fertility as incomes rise across nations and across individual couples. At any given level of income, an independent decrease in fertility, for example due to a change in the availability or price of contraceptives or abortion, could then cause an increase in quality of child. Similarly an independent increase in the quality of children, for example due to availability of cheaper or more effective health care or education, could lead to a decrease in fertility. For these reasons we might expect that as fertility declines over the demographic transition, it might be accompanied by an increase in expenditure per child, with no assertion made about the direction of causality.

We have explored this possibility using NTA data, while focusing on the kinds of human capital investments in children that would promote their future labor productivity and wages, namely health and education. We have measured the investment made in the education of the average child as the sum over ages from 0 to 26 of public and private spending per child of each age. We have done similarly for health, from age 0 through 17. These are synthetic cohort estimates of human capital investment per child, combining public and private investments. We do not include in this measure ordinary consumption by children. We then standardize this measure by dividing by average labor income for ages 30 to 49, which allows us to measure human capital investment per child in units of labor input. To examine the potential quantity quality tradeoff, we compare this measure to the level of fertility (Total Fertility Rate, or TFR) for each country, measured over a five year period just preceding the measure of investment. The result is shown in the left hand panel of Figure 7.

We see there is a definite negative relationship, consistent with the quantity-quality theory, but this relationship is a noisy one. Some of the noise is due to the standardization used: dividing by labor income. We see that Mexico is a positive outlier, but that is in part because Mexico has highest ratio of aggregate consumption to labor income of any NTA country, and education spending is a part of this. China is a negative outlier, but that is in part because China has an exceptionally high saving rate, and has the lowest ratio of aggregate consumption to labor income of any NTA country.

Focusing on Latin America, we note that all five countries have very similar levels of fertility. Except for Mexico, they are all quite close to the regression line, which is to say that given their levels of fertility they are spending about as much on human capital per child relative to their average labor incomes as we would expect based on international evidence.

The right panel of Figure 7 shows some longitudinal relations between human capital investment and fertility in three NTA countries, the US, Taiwan and Japan. In each case there is a strong negative relationship.

Mankiw et al (1992) developed an extension of the Solow growth model that included human capital, and in empirical work found this to be important, and also found that the estimated model showed greater sensitivity if per capita income growth to population

growth than in the original Solow model. Lee and Mason (2009) presents a simple recursive model of economic growth with three overlapping generations including dependent elderly, assuming that this estimated relationship continues to hold in the future, and that human capital boosts wages as estimated in the recent literature (Card, 1999; Heckman and Ochner, 2008). We find that over a stylized demographic transition, rising human capital per worker can more than offset the decline in number of workers and rising old age dependency ratio.

Policy can alleviate the economic impact of population aging

The declining fertility and mortality of the demographic transition eventually cause population aging, now or in the future. This will lead to falling support ratios as the proportions of dependent elderly rise. Other things equal, these changes would lead to lower life cycle consumption and lower per capita income than had support ratios remained unchanged. However, the same demographic changes that cause support ratios to fall also promote the accumulation of physical and human capital.

Population aging raises the per capita demand for wealth, in part through the increasing share of wealth-holding elderly, and in part through the longer life (Kinugasa and Mason, 2007) and fewer children that lead each individual at a given age to hold more wealth. If this increased demand for wealth is not met entirely by rising transfer wealth, and instead is met at least in part by asset accumulation at home or abroad, then population aging will raise the level of per capita assets, and perhaps the level of capital per worker and wages. The outcome depends on the culture and institutions of the country, including the availability of reliable financial institutions that can serve as a vehicle for private saving. Public policy should seek to establish an appropriate balance between funded programs and unfunded transfer programs for support of the elderly, where this appropriate mix will surely vary from country to country. It seems clear that some countries have gone to far in the direction of unfunded transfer programs, and other have gone to far in the direction of pure funded public or private programs.

To the extent that age at retirement rises, as is indeed likely to happen in many countries, the support ratio will decline less, and the impetus to increased asset accumulation will also be reduced.

The low or declining fertility that is largely responsible for population aging also promotes greater investment in the human capital of children. A smaller labor force will also be a more highly educated and healthier labor force, and a more productive one, even aside from possible positive spill-over effects of a more educated population. Public policy should facilitate these investments in human capital, and seek to protect them from being crowded out by the fiscal pressures that population aging will bring. Of course, there must be limits to how far societies can go in this direction, substituting human capital per worker for numbers of workers, but it does not appear that any country has yet reached those limits.

During a middle stage of the demographic transition, a favorable trend in support ratios relaxes public and private budget constraints, giving rise to the demographic dividend.

The analysis reported here suggests that much of this dividend has been invested in human capital, and that depending on institutional arrangements, an additional share may be invested in assets. We have suggested that normal optimizing responses by individuals will go in these directions. Public policy should remove institutional obstacles to these individual responses, for example by fostering the development of financial institutions. As populations age and support ratios decline, the accumulation of physical assets may continue to raise capital intensity and productivity. In some ways population aging is certainly costly, and these are the most visible consequences and receive the most attention. But there are other consequences, less visible, that work in the opposite direction, and that should alleviate our concerns about population aging.

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Table 1. Change in the Support Ratio Added 1% More Annually to Growth from 1970 to 2010 than it Will 2010 to 2050 (Excluding Uruguay)

	Brazil	Chile	Costa Rica	Mexico	Uruguay
SR(2010)/SR(1970)	1.278	1.250	1.375	1.342	0.986
Gr Rate of SR (%)	0.6	0. 6	0. 8	0. 7	0. 0
SR(2050)/SR(2010)	0.940	0.895	0.937	0.944	0.977
Gr Rate of SR (%)	-0.2	-0.3	-0.2	-0.1	-0.1
2^{nd} Gr - 1^{st} Gr (%)	-0.8	-0.8	-1.0	-0.9	-0.0

Note: Calculated from the data plotted in Figure 4. The changed impacts of the support ratios are slightly larger if we measure trough-peak-trough changes for each country instead of these standard dates.

Figure 1. The demographic transition in Mexico, 1900 to 2010, and projected to 2100.

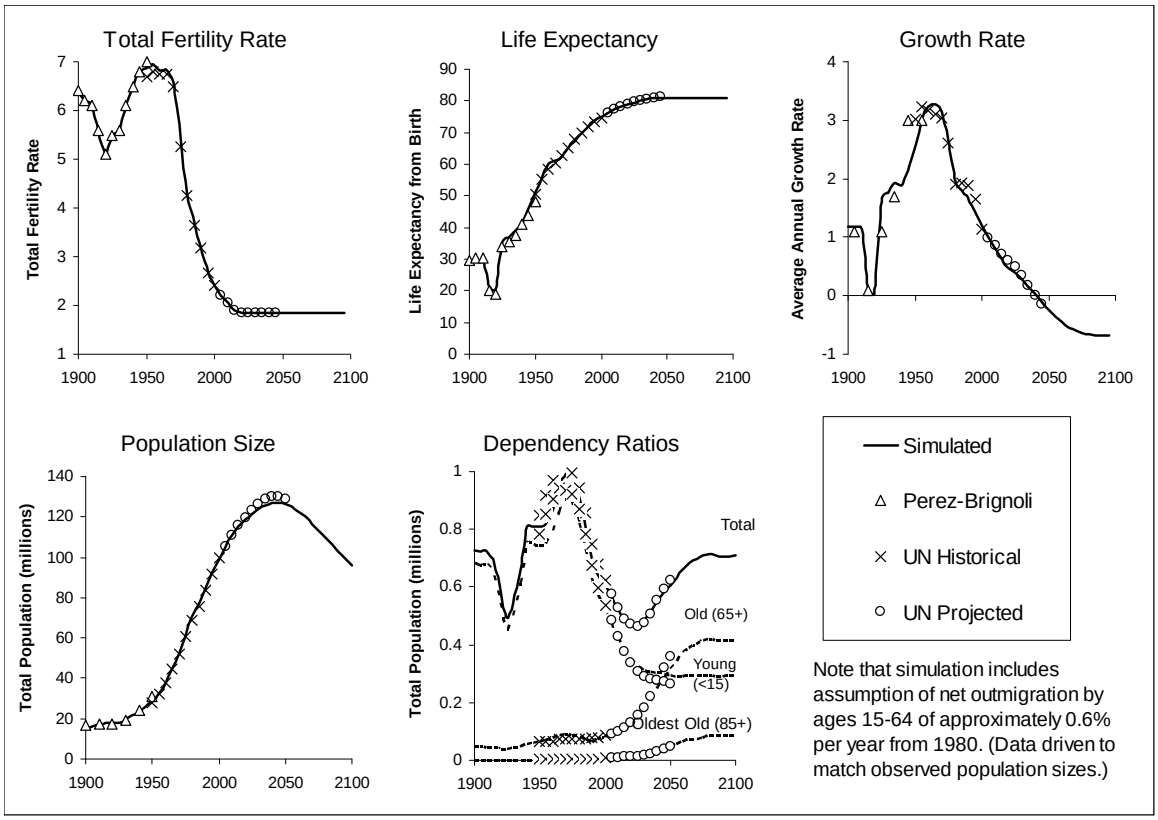


Figure 2.

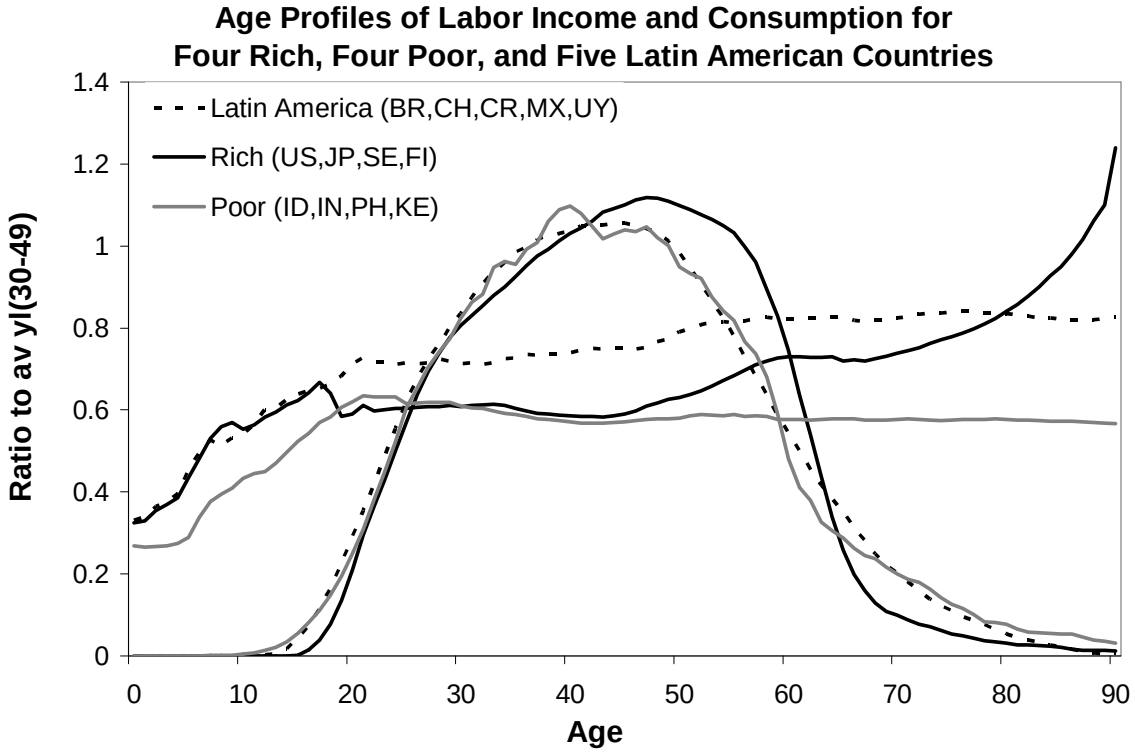

Age Profiles of Labor Income and Consumption for
Four Rich, Four Poor, and Five Latin American Countries
Latin America (BR,CH,CR,MX,UY)
Rich (US,JP,SE,FI)
Poor (ID,IN,PH,KE)
Ratio to av yl(30-49)
Age
0
0.2
0.4
0.6
0.8
1
1.2
1.4
0
10
20
30
40
50
60
70
80
90

Figure 3.

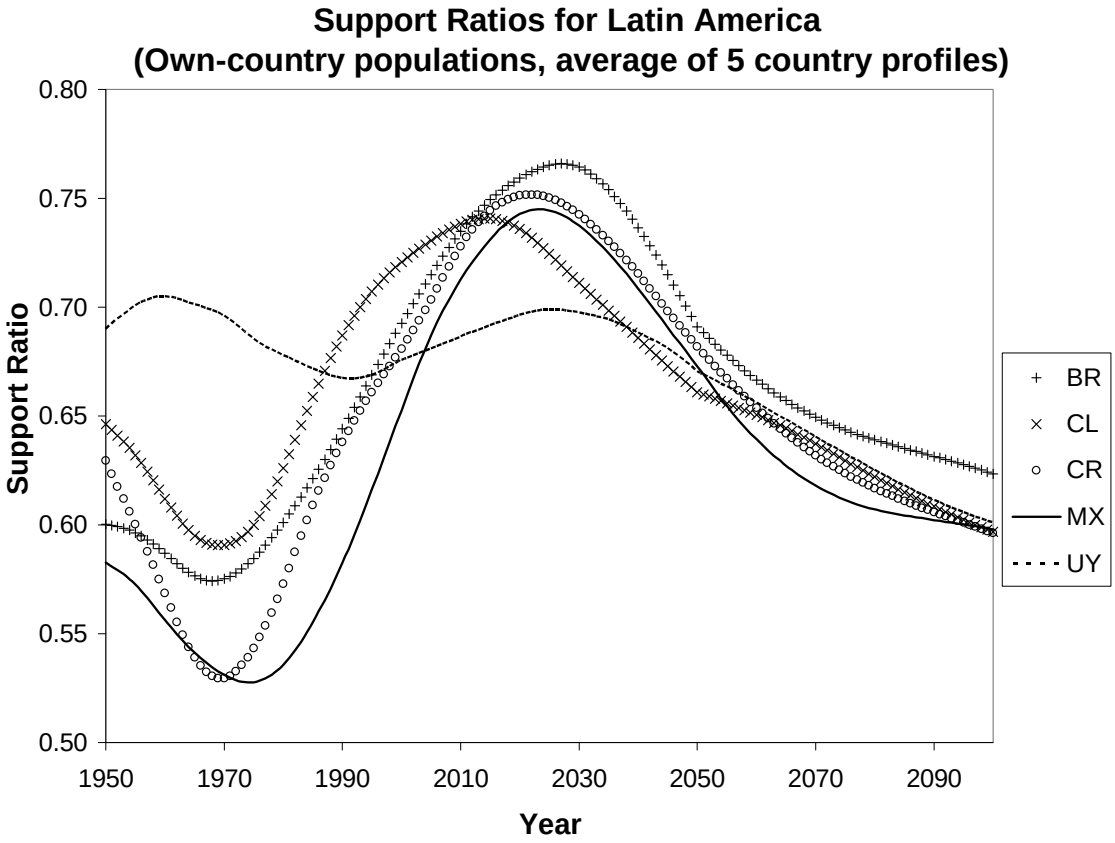
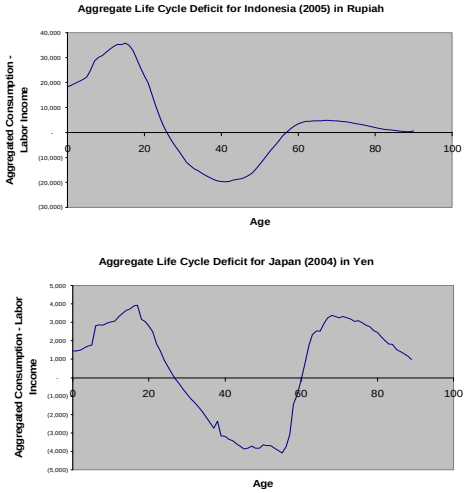

Support Ratios for Latin America
(Own-country populations, average of 5 country profiles)
Support Ratio
0.80
0.75
0.70
0.65
0.60
0.55
0.50
1950
1970
1990
2010
2030
2050
2070
2090
Year
BR
CL
CR
MX
UY

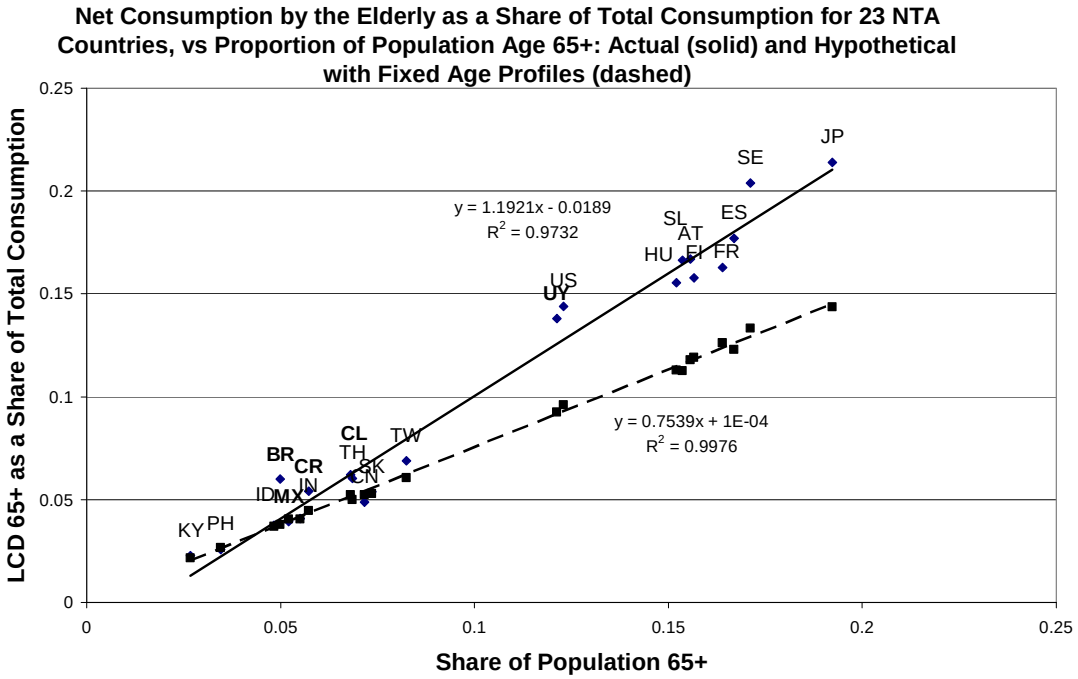
Figure 4

Here are the aggregate flows: population by age times per capita age profiles



Indonesia NTA Maliki; Japan NTA Ogawa

Figure 5. Population Aging Drives the Demand for Wealth for Old Age Consumption. Consumption 65+ net of labor income, as a share of aggregated consumption, in relation to the percent of population 65+. Upper line is actual population and age profiles. Lower line shows the effect of actual population, but using average age profiles of four poor countries.



Note: Actual is aggregate life cycle deficit for ages 65 and over divided by aggregate consumption. Hypothetical is based on actual population age distributions but uses the life cycle deficit age profile average for four poor countries, as in Figure 2.

Fitted_vs_Actual_Oct25_Revised.RDLSantiago

Figure 6. Share of Lifecycle Deficit of those 65 and Older Funded by Asset-based Flows, Public Transfers, and Familial Transfers, NTA Countries, 1998-2004.

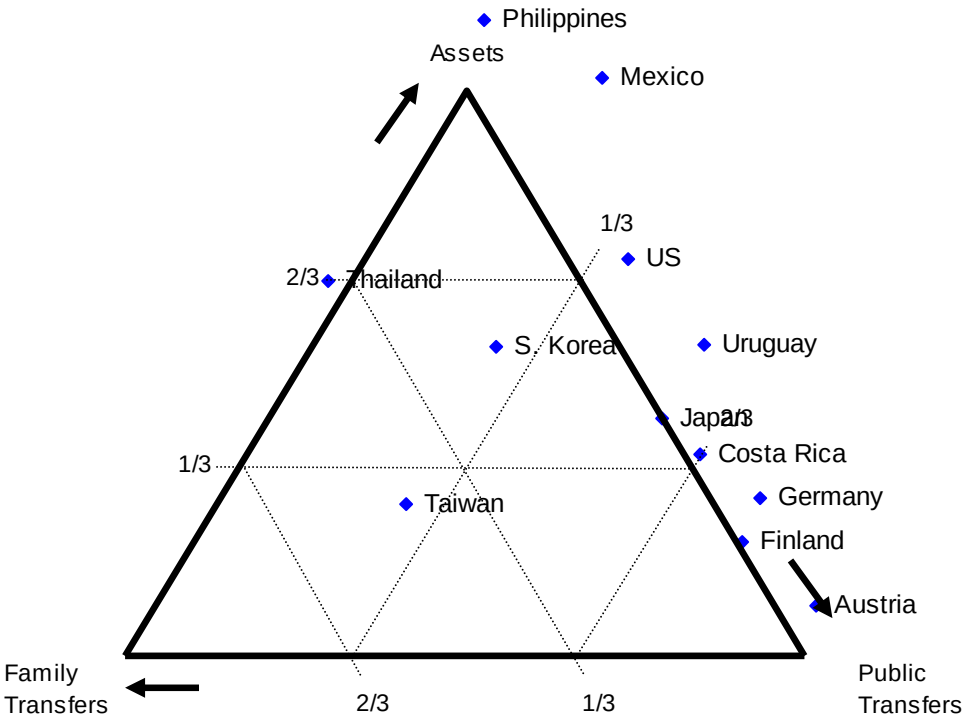
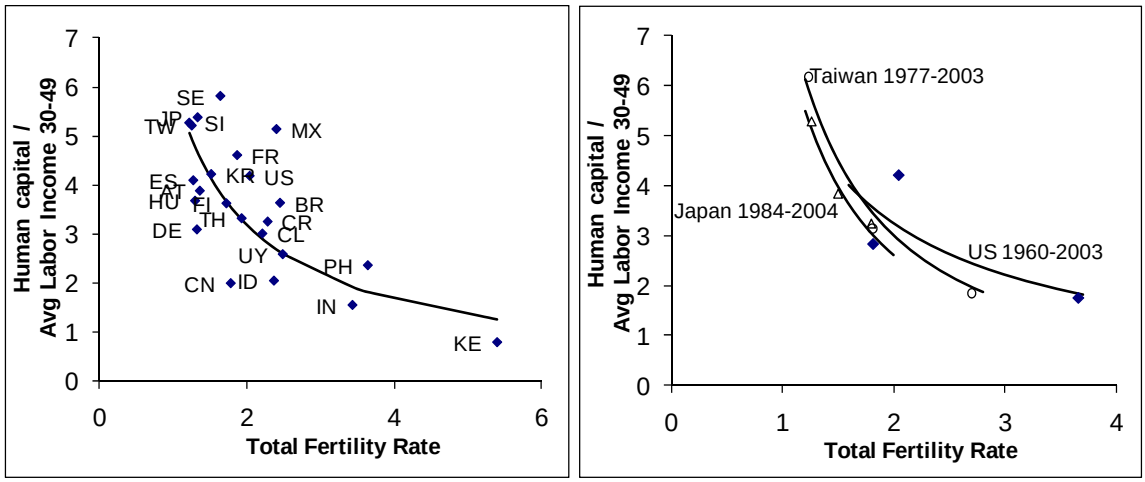


Figure 7. The relation of human capital investment per child to fertility in a cross-section of countries and in three countries over time, based on NTA data



Note: Human capital spending is the sum of average age specific public and private spending per child for health and education, summed over ages 0-17 for health, and 0-26 for education. The total is divided by the average labor income for each country and period for ages 30-49. The total fertility rate is for the 5 year period closest to the year of the human capital estimate.

[1] Pérez Brignoli (2009) presents plots of data but not the numbers themselves, so the numbers I use are inexact.

[2]. The child weights rise linearly from .4 of a prime age adults at birth to 1.0 at age 20, and are constant thereafter.