SOCIAL SECURITY AND THE CHALLENGE
OF DEMOGRAPHIC CHANGE

Population dynamics: Social security, markets, and families

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Abstract Upward intergenerational flows — from the working ages to old age — are increasing substantially in the advanced industrialized countries and are much larger than in developing countries. Population ageing is the most important factor leading to this change. Thus, in the absence of a major demographic shift (e.g. a return to high fertility), an increase in upward flows is inevitable. Even so, three other important factors will influence the magnitudes of upward flows. First, labour income varies at older ages due to differences in average age at retirement, productivity, unemployment, and hours worked. Second, the age patterns of consumption at older ages vary primarily due to differences in spending on health. Third, spending on human capital (i.e. spending on child health and education) varies. Human capital spending competes with spending on the elderly, but it also increases the productivity of subsequent generations of workers and the resources available to support consumption in old age. All contemporary societies rely on a variety of institutions and economic mechanisms to shift economic resources from the working ages to the dependent ages — the young and the old. Three institutions dominate intergenerational flows: governments which implement social security, education, and other public transfer programmes; markets which are key to the accumulation of assets (e.g. funded pensions and housing); and families which provide economic support to children in all societies and to the

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elderly in many. The objectives of this article are, first, to describe how population ageing and other changes influence the direction and magnitude of intergenerational flows; and, second, to contrast the institutional approaches to intergenerational flows as they are practiced around the world. The article relies extensively on National Transfer Accounts (NTA), a system for measuring economic flows across age in a manner consistent with the United Nations' System of National Accounts. These accounts are currently being constructed by research teams located in 33 countries on six continents representing wide variations in the level of development, demographics, and policies regarding intergenerational transfers.

Keywords social security scheme, old age risk, demographic aspect, population dynamics, international

Introduction

Populations around the world are ageing and, in some cases, quite rapidly. The implications for standards of living and social security will be profound as the flow of economic resources to the elderly matches the growth in their numbers. This is an unprecedented change. In the past, intergenerational flows in all societies were predominantly flows to children. In traditional settings few survived to old age and those who did could not necessarily count on their families for support. Members of hunting and gathering societies produced as much as they consumed until the end of their life (Lee, 2003). Retirement was not an option. The development of financial markets and public social security programmes have enabled extended periods of retirement at the end of life. Individuals are now able, through careful planning or through the support of public systems, to consume much more than they produce through continued labour. The emergence of modern, and costly, medicine has played its own role by accelerating the growth of consumption by the elderly. These fundamental changes in the economic lifecycle when combined with changes in population age structure represent one of the most important long-term challenges faced by contemporary societies.

The objective of this article is to draw on international experience in order to address several important questions about population ageing and social security. First, we consider how population ageing is influencing the intergenerational flow of economic resources. To this point in time, population ageing has been a powerful force as compared to recent changes in the economic lifecycle. Efforts to control the

rise of health care costs or to encourage later retirement are important policy initiatives, but are unlikely to reverse or substantially slow the effects of population ageing.

Second we consider how societies are currently meeting the economic needs of their growing elderly populations. In principal, the elderly can fill the gap between what they consume and what they earn in three ways. They can rely on their families, on public transfer systems, including public pension and health care programmes, or on assets that have been inherited or accumulated during their working years. Practice varies considerably from country to country. The industrialized countries, particularly in Europe, and many Latin American countries rely heavily on public transfers. The elderly living in Asian countries are more likely to draw on familial resources.

One of the main concerns of many observers is that population ageing is leading to generational inequities possibly under the influence of large, politically active groups of elderly. There is no doubt that in many countries, especially Latin America and Europe, that public spending per senior substantially exceeds public spending per child. Simple comparisons of per capita spending have limitations, however. We provide a more comprehensive assessment of intergenerational equity. Of particular importance is to consider both public and private intergenerational transfers. This more comprehensive approach shows that in most countries for which estimates are available intergenerational transfers favour children over the elderly and future generations over the current population. However, in countries with large public transfer systems, private transfers to children are insufficient to offset the growth in transfers to the elderly and the burden imposed on future generations. A very important qualification, however, is that estimates of bequests are not available. It is likely that intergenerational transfers may continue to favour future generations once bequests are incorporated.

In the absence of reform, public transfers will increase much more rapidly than national income as a consequence of population ageing. The implication has been treated in considerable detail elsewhere and is discussed only briefly here. In the absence of growth-enhancing measures, population ageing will lead to slower economic growth and possibly a decline in standards of living. The reason for this is straight-forward — as populations age the number of workers will decline relative to the number of consumers. Essentially there are three possible strategies for dealing with this problem. One is to achieve a radical change in the economic lifecycle that would involve some combination of higher earnings and lower consumption at the older ages. The second strategy is to raise the productivity of the workforce by greater investment in human capital. The third strategy is to raise asset income and wages by encouraging higher rates of saving and investment. Unless the rapid growth of transfer systems is curtailed, however, these strategies are unlikely to succeed.

Population ageing and the economic lifecycle

National populations around the world are experiencing very substantial changes in their age structures (see Bloom and McKinnon, and Harper, in this issue). In the advanced industrial countries of the world, an increase in the share of the older population is the dominant trend. But many middle-income countries and even a few lower-income countries will also experience substantial population ageing. For most, the increase in the share of the older population will come primarily at the expense of the population in the working ages. Thus, countries will experience increases in both their old-age and total dependency ratios (see the Appendix to this issue).

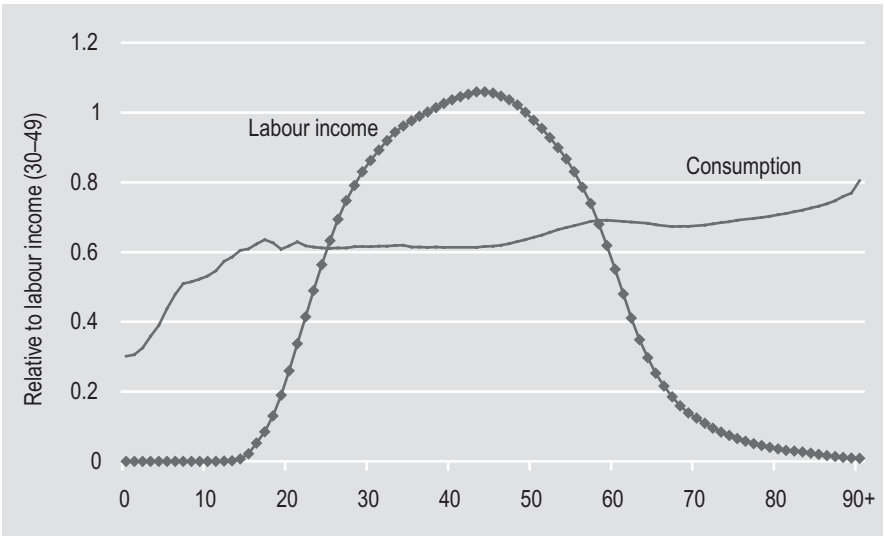
Looking toward to the future from our current position yields a somewhat distorted picture. The rise in the total dependency ratio to come follows what has been an unprecedented decline. As part of the demographic transition, countries have experienced a decline in fertility rates that has led to a fall in both the youth and total dependency ratios. The rise in dependency we are beginning to experience is a direct consequence of low fertility and the entrance to the workforce of small cohorts. Gains in life expectancy are playing a role in population ageing, but it is primarily the decline to low fertility in the past that is leading to populations that are increasingly grey.

Why are these changes in population age structure so important? Fundamental to any answer is the striking and unique economic lifecycle that characterizes contemporary human society. Over extended periods at the beginning and at the end of life, modern humans consume a great deal more than they produce through their labour. This is a great hallmark of our success. The extended period of childhood has been essential to unprecedented and valuable investment in the human capital of the next generation of parents, workers and taxpayers. We have also managed extended periods of retirement during which time can be spent in leisure or in productive but uncompensated pursuits. Of course, many endure significant periods of ill health and disability at the end of life dependent on a host of social and economic institutions.

The period during which people actually produce more through their labour than they consume is stunningly short — little more than 30 years. On average people do not realize a lifecycle surplus, consuming less than they produce through their labour, until they reach their mid-twenties. And by the time they reach their late 50s or early 60s they are no longer in a surplus position.

The broad outlines of the economic lifecycle are similar across a wide range of countries. To emphasize these we have constructed average age profiles of labour income and consumption using estimates for 15 countries (Figure 1). Labour income and consumption are very inclusive. Labour income includes wages and salaries earned by employees along with their fringe benefits, as well as the value of

Figure 1. *Per capita labour income and consumption age profiles, relative to average labour income of persons aged 30-49 (average of estimates for 15 countries)*



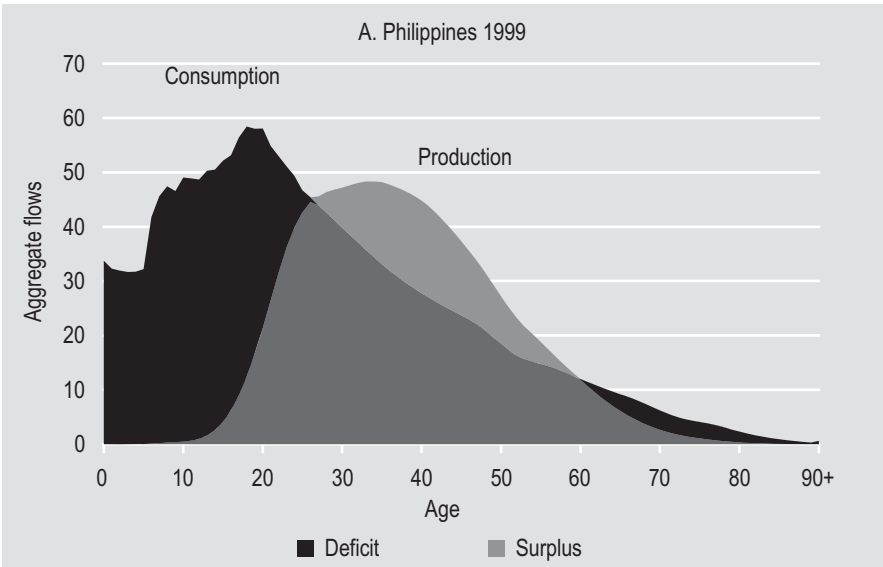
Note: The 15 countries are Austria, Chile, China, Costa Rica, Finland, Hungary, Japan, Mexico, South Korea, Slovenia, Sweden, Taiwan (China), Thailand, United States and Uruguay.
Source: NTA database <http://www.ntaccounts.org>.

labour of those who are self-employed. Consumption includes both private consumption and public consumption that is allocated to individuals. All values are expressed relative to the average labour income of persons aged 30-49 to facilitate comparison across countries with very different development levels. The value of about 0.6 for prime-age adults means that they are consuming about 60 per cent of what they are producing through their labour (Lee, Lee and Mason, 2008; Mason et al., 2009).

The per capita economic lifecycle reflects many behavioural and non-behavioural factors that influence the relationship between an individual's age, on the one hand, and consumption and labour income, on the other. Average labour income at each age depends on hours worked, labour force participation, the age profile of wages and the many cultural, political, social, and economic factors that influence each of these elements of labour income. In a similar fashion, average consumption at each age is influenced by historical events, by preferences, by prices including interest rates, by political systems, and by many other forces.

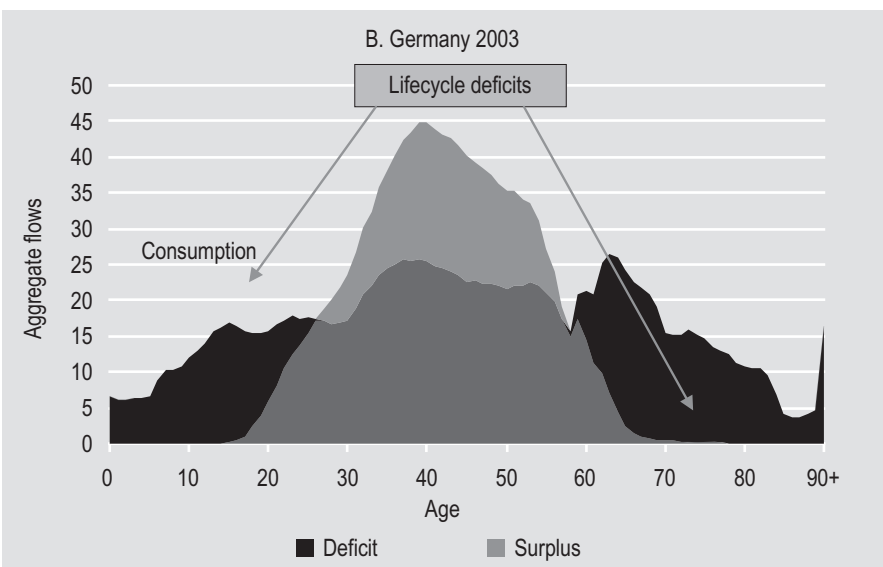
The challenge that population ageing represents comes into sharper focus when we consider that aggregate profiles are determined by the per capita profiles and population age structures. In young populations, the lifecycle deficit is very large at young ages and relatively small at old ages, as can be seen in the case of the

Figure 2A. *Aggregate consumption and labour income by age, Philippines 1999 (billions of pesos)*



Source: Racelis and Salas (forthcoming).

Figure 2B. *Aggregate consumption and labour income by age, Germany 2003 (billions of euros)*



Source: Kluge (forthcoming).

Philippines in Figure 2A. In older populations, the lifecycle deficits are substantially larger relative to the child deficits, as the case of Germany illustrates (Figure 2B). Population ageing is in its early stages and, thus, old-age deficits will grow substantially unless consumption and labour income profiles change radically.

Reflection on the economic lifecycle and population ageing inevitably raises important questions. First, will the lifecycle deficit, the gap between what is consumed and what is produced, at old ages continue to increase as populations age? Or, are there likely to be adjustments in policies and behaviour as reflected in the per capita lifecycle profiles that offset the changes in population age structure? Second, what are the options for funding the old-age deficit and are these approaches sustainable in the face of population ageing? Third, are the resources flowing in an equitable manner or favouring current over future generations? Fourth, will population ageing inevitably slow economic growth or can changes in public policies help sustain higher levels of consumption?

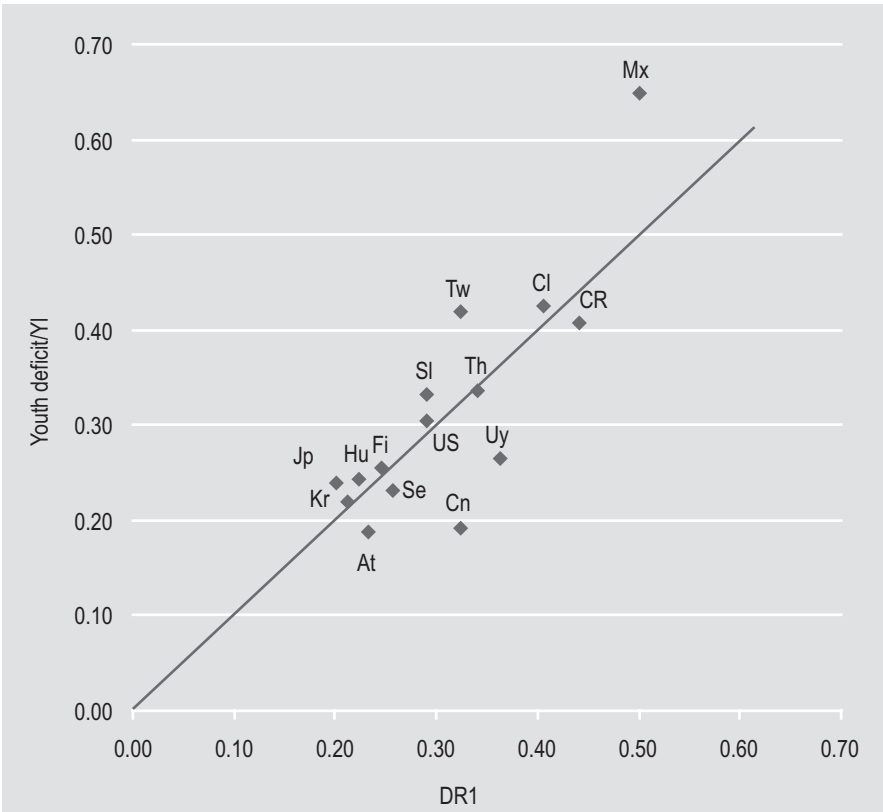
Population ageing and the claim on economic resources by the elderly

Population age structure does not exclusively determine the aggregate flow of economic resources across generations. Improvements in health may raise the productivity and labour force participation of those in their sixties and seventies. Changes in tax and pension policy may increase the incentives to delay retirement. Efforts to control the costs of health care and long-term care may slow the growth of consumption late in life. The importance of these and other changes are difficult to predict especially because the population ageing we will experience over the coming decades is without precedent. These issues are important and we will discuss them more extensively below, but based on experience to date population ageing has a very powerful effect that may overwhelm efforts to influence the economic lifecycle.

One simple way to judge the importance of population age structure is to compare the aggregate lifecycle deficits of countries with different age structures. In Figure 3, the aggregate lifecycle deficit for youth as a percentage of aggregate labour income (YI) is graphed against the youth dependency ratio DR1.[1] The range in the

1. DR1 is calculated as the weighted number of young dependants relative to the weighted number of working-age adults. The weights for children are equal to the average per capita lifecycle deficit while the weights for working-age adults are equal to the average per capita labour income values shown in Figure 1. The weights provide a continuous and more refined measure of dependency that does not rely on an arbitrary age cutoff, e.g. defining dependants to be 0-14 years of age and working-age adults as aged 15-59 or aged 15-64. The same weights are used for all countries while the population age structure is set to the actual value.

Figure 3. *Relationship between age structure and aggregate youth deficit, selected countries for a recent year*

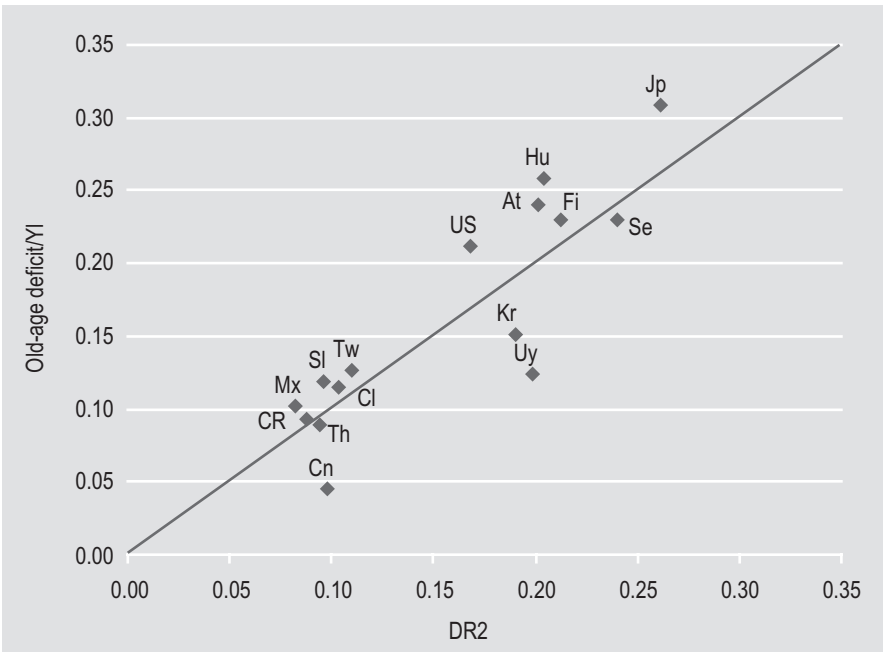


Source: NTA database <http://www.ntaccounts.org>.

youth deficit — from 65 per cent of total labour income in Mexico to 19 per cent of total labour income in Austria — is considerable. The relationship between age structure (DR1) and the youth deficit is strong with the variation in age structure explaining about three-quarters of the variation in the youth deficit.

The aggregate lifecycle deficit at old age relative to labour income (YI) is plotted against the old-age dependency ratio DR2 in Figure 4. Again there is very substantial variation in the size of the deficit across countries ranging from 31 per cent of total labour income in Japan to 9 per cent of total labour income in Costa Rica. Again, the old-age deficit is closely linked to changes in age structure with 73 per cent of the variance explained by variation in the age structure of the population (DR2). Note that the age effect being quantified here is the pure age composition effect. Age structure may also influence the per capita age profiles of consumption or labour income, but that possibility is not being considered at this point.

Figure 4. *Relationship between age structure and aggregate old-age deficit, selected countries for a recent year*



Source: NTA database <http://www.ntaccounts.org>.

The issue of greatest import to policy-makers concerned with population ageing is the likely magnitudes of the lifecycle deficits in the future. The potential effect of population ageing can be readily assessed using the dependency ratios as calculated here and presented in Table 1. The values give the lifecycle deficit at old age as a share of total labour income and the combined lifecycle deficit at young and old ages as a share of total labour income holding the per capita economic lifecycle constant and allowing population age structure only to vary. Among the countries shown, ageing will have the most severe effects in Japan followed by Germany. But note that the old-age dependency ratio more than triples in the People's Republic of China (hereafter, China) and triples in Brazil between 2010 and 2050. France and the United States are both ageing considerably, but less so than Japan, Germany, and other low-fertility industrialized countries. In the absence of enormous changes in work and/or consumption patterns at old age, the flow of resources to the elderly will be enormous in the future.

In some instances, the total dependency ratio rises considerably less than the old-age dependency ratio because of declines in the child dependency ratio. This is particularly the case in India and Nigeria, where the total dependency ratio declines

Table 1. *Old-age and total dependency ratios, selected countries in 2010 and 2050*

Country	Old-age dependency		Total dependency	
	2010	**2050**	**2010**	**2050**
Japan	0.31	0.64	0.51	0.84
Brazil	0.10	0.31	0.47	0.53
China	0.11	0.35	0.39	0.58
India	0.08	0.18	0.55	0.43
France	0.24	0.43	0.51	0.69
Germany	0.26	0.53	0.45	0.74
Nigeria	0.06	0.09	0.82	0.49
United States	0.18	0.32	0.47	0.58

Note: Dependency ratios calculated using standard age profiles of lifecycle deficit and labour income and population projections from the ESA (2009).

substantially, and Brazil where it increases modestly. But in other countries, the rise in the old-age dependency ratio is not offset to any considerable degree by the decline in the child dependency ratio. Japan represents an extreme case. If Japan's per capita lifecycle deficit profile conformed to the average, the aggregate lifecycle deficit of children and elderly combined would reach over 80 per cent of total labour income.[2]

The importance of age structure in determining intergenerational flows is incontrovertible, but other factors are important, as well. In Figure 4 we see that in the United States and Hungary the old-age deficit is 25 per cent above the standard, in Uruguay the old-age deficit is 40 per cent below the standard, and in China the old-age deficit is less than half the standard. Clearly there are important differences in the age profiles of consumption and labour income that will influence how rapidly intergenerational flows to the elderly increase and how rapidly intergenerational flows to children decrease as populations age.

Changes in the per capita economic lifecycle may offset, to some extent, changes in population age structure. But comparing across young and old countries does not suggest that favourable changes in the economic lifecycle can be counted on. Figure 5 presents per capita labour income and consumption profiles for two groups of countries, young and old, for which estimates are available. Of the 15

2. This is not a likely outcome as the profiles almost surely will shift in response to population ageing. This is the outcome only in the unlikely event that there were no adjustment in consumption and labour income.

countries for which estimates are presented in Figures 3 and 4, seven have lower old-age dependency ratios (DR2) than the United States — Chile, China, Costa Rica, Mexico, Republic of Korea (hereafter, South Korea), Taiwan (China), and Thailand. We classify these as young countries. The United States and the other seven countries, Austria, Finland, Hungary, Japan, Slovenia, Sweden, and Uruguay, are classified as old countries.

There are interesting differences between these two groups of countries, but before we discuss them two things should be kept in mind. The results should not be taken as representative of old and young countries, in general. The values are based on only a handful of countries for which data are available, but they may not be representative. Second, there is no reason to suppose that the differences between these two groups are a consequence of age structure per se. The old countries are more likely to be rich, industrial, Western countries. Many other factors may account for the differences in the economic lifecycles.

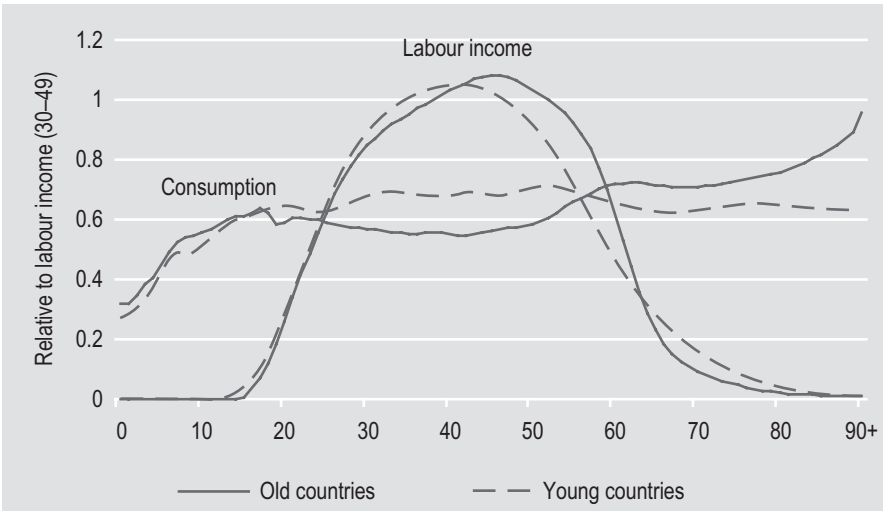
The young country group has labour income profiles that are slightly higher during the teen years, lower during the 40s and 50s, and higher at older ages. Labour income is compressed into a short portion of the life span in the old country group. The young country group has a consumption profile that is quite flat at all adult ages. But in the older country group consumption rises steeply at older ages. Except for adults in their late fifties and early sixties, the per capita lifecycle deficits are smaller in the young population than in the old population.

The most important feature of Figure 5 is that the per capita lifecycle deficit at old ages is greater in the older group of countries than in the younger group of countries. For the most part this is a consequence of high rates of consumption at old ages driven by high spending on health and long-term care. Lower labour income in the older countries also contributes to the high per capita deficit but the labour income differences are smaller than the consumption differences.

The differences in per capita profiles reinforce the effects of population ageing on the total and old-age deficits. This is readily assessed by calculating dependency ratios in 2050 using the same methods employed to construct Table 1. The values in Table 2 tell us the ratio of the old-age lifecycle deficit and the total lifecycle deficit relative to total labour income given the age structure in 2050 and three alternative per capita profiles of consumption and labour income.

The effect of varying the economic lifecycles is largest in Japan because it is the oldest country and the differences in the lifecycle are greatest at the oldest ages. Given the old country lifecycle pattern, Japan's old-age lifecycle deficit would be 25 per cent greater than would be the case given the young country lifecycle pattern. The total lifecycle deficit would be greater by almost 20 per cent. The effects are also

Figure 5. *Per capita consumption and labour income by age, all values normalized on per capita labour income for persons aged 30-49*



Notes: Values are simple averages of age profiles for seven young countries and eight old countries. See text for names of countries.

Table 2. *Old-age and total dependency ratios, 2050, alternative lifecycles*

Country	Old-age dependency ratio			Total dependency ratio		
	Fifteen country lifecycle	**Young country lifecycle**	**Old country lifecycle**	**Fifteen country lifecycle**	**Young country lifecycle**	**Old country lifecycle**
Japan	0.64	0.56	0.71	0.84	0.76	0.91
Brazil	0.31	0.29	0.34	0.53	0.50	0.56
China	0.35	0.32	0.38	0.58	0.55	0.61
India	0.18	0.17	0.20	0.43	0.42	0.45
France	0.43	0.38	0.47	0.69	0.64	0.74
Germany	0.53	0.47	0.58	0.74	0.68	0.79
Nigeria	0.09	0.09	0.10	0.49	0.47	0.50
United States	0.32	0.29	0.35	0.58	0.54	0.61

Notes: The old-age and total dependency ratios are constructed using observed age patterns of production and consumption and population projections from the ESA (2009). Three different age profiles are used to construct the dependency ratios. The Fifteen country lifecycle dependency ratios are based on average profiles of production and consumption for the 15 countries for which profiles are available. The Young country lifecycle is based on age profiles for the seven youngest countries of these 15 — Chile, China, Costa Rica, Mexico, South Korea, Taiwan (China), and Thailand. The Old country lifecycle is based on age profiles for the eight oldest countries — Austria, Finland, Hungary, Japan, Slovenia, Sweden, the United States and Uruguay.

substantial for other countries with relatively old populations, e.g. France, Germany, and the United States. For a young country like Nigeria the effects are relatively modest.

The key point here is that the advanced industrialized countries have relatively low labour income and high consumption at older ages. Combining these features with population ageing implies a very substantial increase in the aggregate gap between what countries are producing through their labour and, judging from current patterns, what they would like to consume.

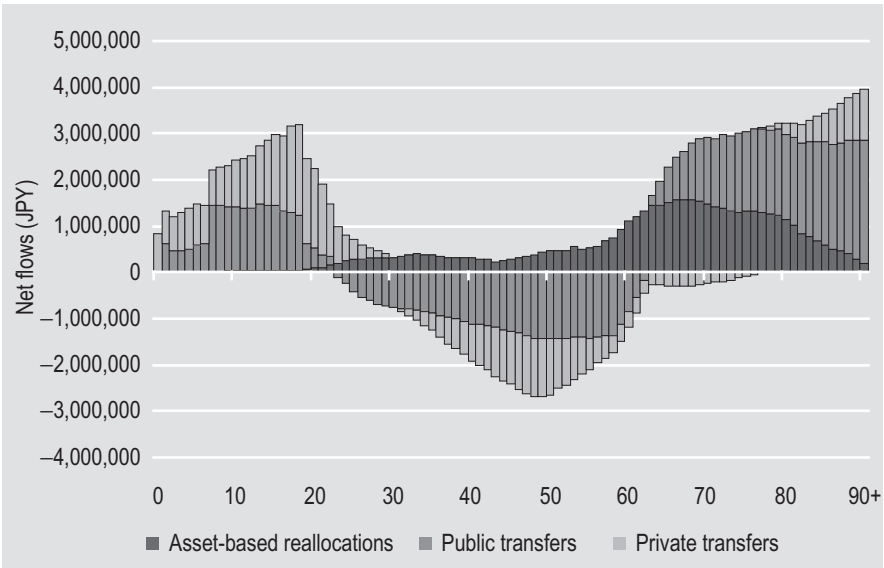
Systems of support for children and the elderly

To maintain consumption well in excess of labour income over extended periods of life, countries rely on three important systems of support (Mason et al., 2009). The first is the family — the economic support that parents and grandparents provide to children and that adult children provide to elderly parents. The second is the financial system and assets, e.g. a home, personal savings, pension funds, and so forth. Assets may be inherited or accumulated during the working years. Lifecycle deficits can be funded by using asset income or by disposing of assets during times of need. The third system of support consists of the public sector, predominantly social insurance programmes that fund pensions, long-term care, and health care for older adults and education and health programmes that benefit children. But there are, of course, many other public programmes that provide support to the young and to the old.

Per capita net economic flows from these three systems are shown for Japan in 2004 in Figure 6. Flows to both children and the elderly are shown here to emphasize that transfers go in both directions — upward to the elderly and downward to the young. The young depended heavily on a combination of public and private transfers with private transfers somewhat more important. The support system for older adults in Japan varied considerably with their age. Those in their 60s relied primarily on assets while those in their 70s and 80s relied primarily on public transfers. Those younger than age 78 gave more to their descendants than they received, while familial transfers were more important as a source of support for those in their mid- to late-80s or older. As we shall see, the old-age support system varies considerably from country to country.

Two features of the support system in Japan warrant emphasis. The first is the substantial difference in the composition of transfers to the elderly versus transfers to the young. In Japan, per capita familial transfers to the young are much more important than per capita public transfers. For the old, the opposite is the case with public transfers dominating. The second feature to bear in mind is the importance of assets for the elderly. Those in their 60s and 70s are relying heavily on flows from their accumulated assets.

Figure 6. *Support system: Per capita net flows by age (JPY), Japan, 2004*



Note: Net flows sum to per capita lifecycle deficit.
Source: Ogawa et al. (2009).

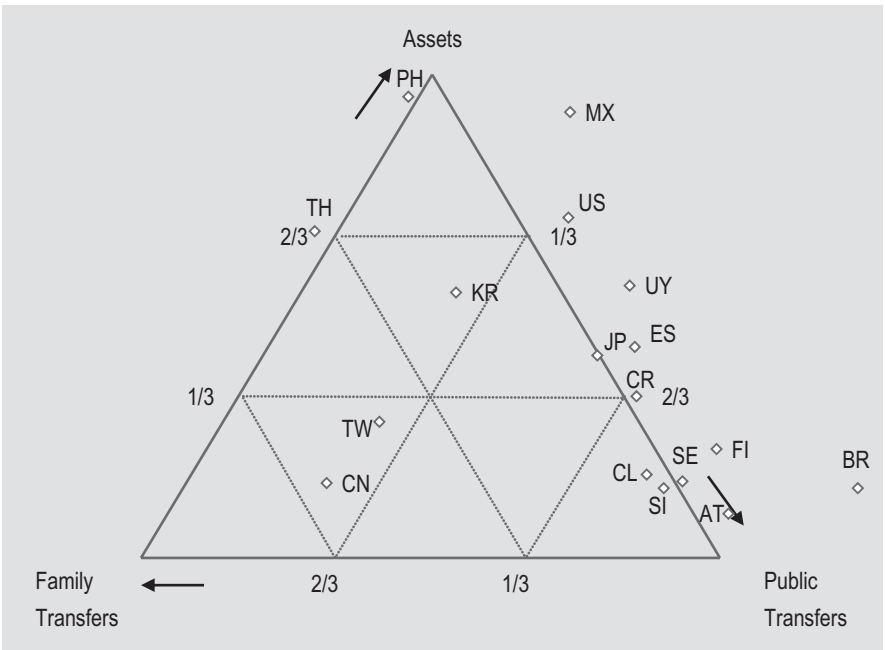
The old-age support system: A comparative perspective

Countries vary greatly in the systems they employ to fund the old-age lifecycle deficit. To show this, we compute public transfers, private familial transfers, and asset-based reallocations as a "share" of the lifecycle deficit of those aged 65 or older.[3] The shares are conveniently represented using a triangle graph that requires some explanation. Any of the three vertices of the triangle represents exclusive reliance on one of the three sources of support with the other two being zero. Along the side of the triangle, one source is zero while the other two vary. Movement along one of the gridline implies that one source is constant at 1/3 or 2/3 of the lifecycle deficit while the other two vary. Values charted outside the triangle indicate that one or more of the components is negative (Figure 7).

Net familial transfers are an important source of support for the elderly in only four economies: China, South Korea, Taiwan (China) and Thailand. The elderly in

3. Note that the shares must sum to one by definition, but they need not be positive. Negative transfer shares indicate that the elderly are giving more than they are receiving. If the elderly are saving all of their asset income plus some of their labour income, the share for asset-based flows will be negative, but we do not observe this outcome for any country.

Figure 7. *Support systems for persons aged 65 or older, measured as shares of the lifecycle deficit, selected countries for a recent year*



Note: Two-digit country codes conform to ISO standards <http://www.iso.org/iso/english_country_names_and_code_elements>.
Source: NTA database <http://www.ntaccounts.org>.

China rely to the greatest extent on their families with a little less than 2/3 of the lifecycle deficit funded by net family transfers. In Taiwan (China) and Thailand, net family transfers are about 1/3 of the lifecycle deficit and in South Korea the value is roughly 20 per cent. In many of the countries, net familial transfers are close to zero or relatively small (the Philippines, Japan, Costa Rica, Chile, Slovenia, Spain, Sweden, and the United States). In a few cases, net familial transfers are negative and relatively large (Brazil, Mexico, and Uruguay).

Net public transfers vary widely in importance. In the Philippines and Thailand, net public transfers are essentially zero. Net public transfers fund roughly 1/3 of the lifecycle deficit in Mexico, the United States, South Korea, Taiwan (China), and China; one-half in Uruguay; and 2/3 in Japan, Spain, and Costa Rica. Well over 2/3 of the lifecycle deficit of those aged 65 or older is funded by public transfers in Chile, Finland, Slovenia, Sweden, and Austria. In Brazil, net public transfers are about 1/3 larger than the lifecycle deficit!

Assets are most heavily relied upon in the Philippines, Mexico, Thailand, and the United States. They are relied on to a much smaller degree in China and Taiwan

(China), where family transfers are important, and in Finland, Chile, Sweden, Slovenia, Brazil, and Austria where public transfers dominate.

There are interesting regional patterns in the support system. Public transfer systems are most important in Europe and Latin America — especially Brazil — and least important in Mexico and developing Asia. Among industrialized countries, public transfers to the elderly are less important in Japan and the United States as compared with European economies.

If we look at age detail rather than average values for all aged 65 or older combined, a different picture about the role of familial transfers emerges. There are two kinds of countries more or less. In one kind, illustrated by South Korea 2000, the importance of public transfers does not vary substantially with age but familial transfers increase dramatically while asset-based reallocations decline with age. In the second case, the United States 2003 is a good example, familial transfers are relatively constant (and not very important) at every age, but as age increases public transfers rise and asset-based reallocations decline (Figure 8, Panel A). For the most part, the first pattern is characteristic of Asia and some Latin American countries (Mexico, Costa Rica) but not others (Uruguay, Chile). The second pattern is characteristic of Western industrialized countries (Figure 8, Panels B, C, and D).

What is driving this? In almost every country, the importance of asset-based reallocations decline with age because the very old have lower assets and asset income. This does not appear to be a consequence of the elderly spending down their assets. In none of the countries do we find dis-saving among the elderly at any age. But the elderly may have fewer assets because i) they have transferred assets to their children, and ii) they accumulated less over their working lives because of low labour income relative to younger adults. The latter phenomenon is particularly important in countries that have experienced very rapid rates of economic growth over extended periods of time. A special feature of some transition economies, e.g. Hungary, Slovenia, and China, is that many elderly could not accumulate assets because private ownership was not allowed.

A second important force is health spending and long-term care. In the industrialized countries, public transfers devoted to these items increase dramatically with age and, because of the transfer systems in place, public transfers become increasingly important at older ages.

An important point here is the extent to which familial transfers filled in the gap for the very old. (Keep in mind that consumption profiles are relatively flat.) Neither public transfers nor asset-based reallocations could have maintained an equitable standard of living across all ages. Familial transfers were critical to this outcome. As higher standards of living are reached and rates of economic growth have slowed in some countries, the generational differences may be much smaller and familial transfers may become less important. But in very high growth economies, such as

Figure 8. *Funding the lifecycle deficit of the elderly*

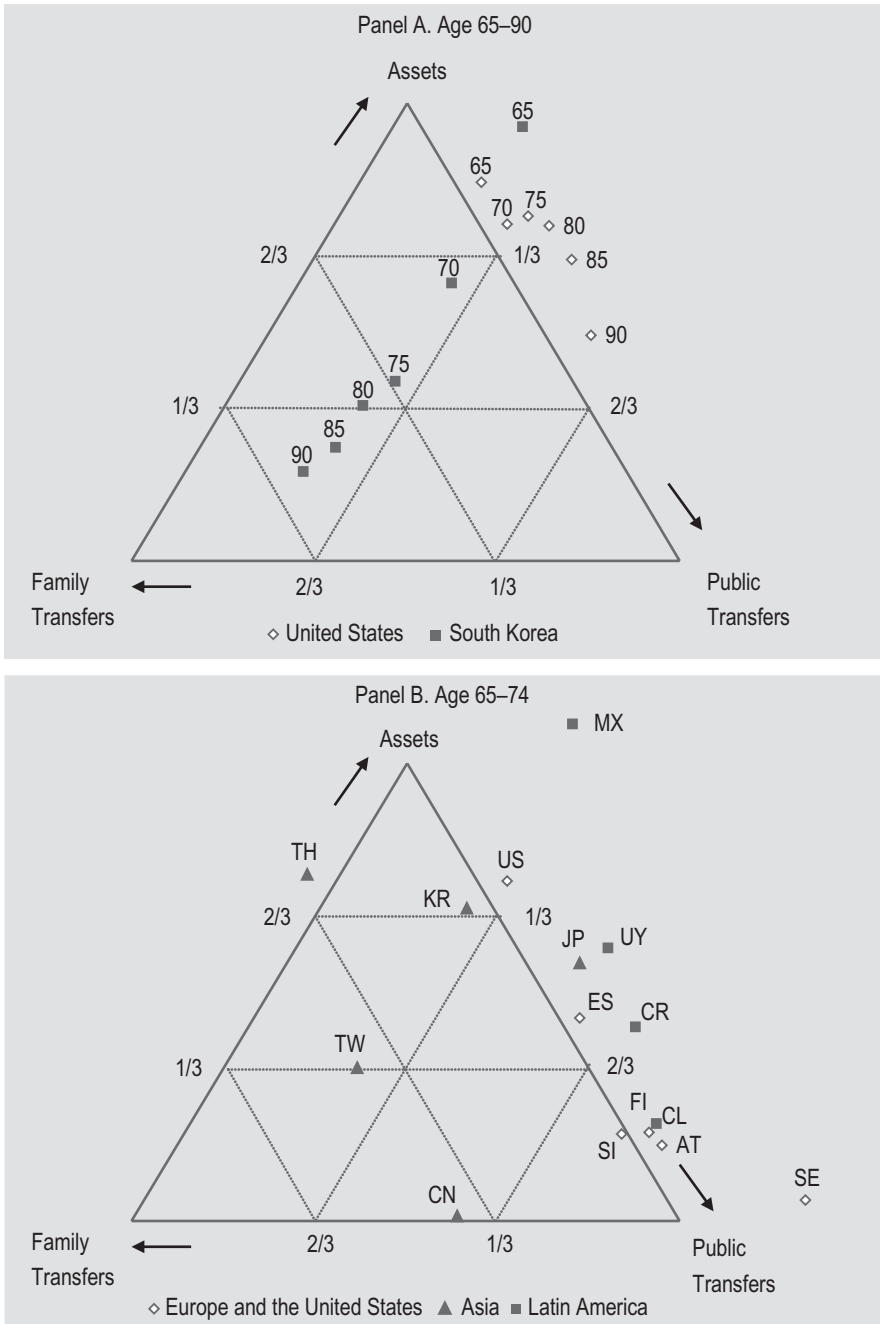
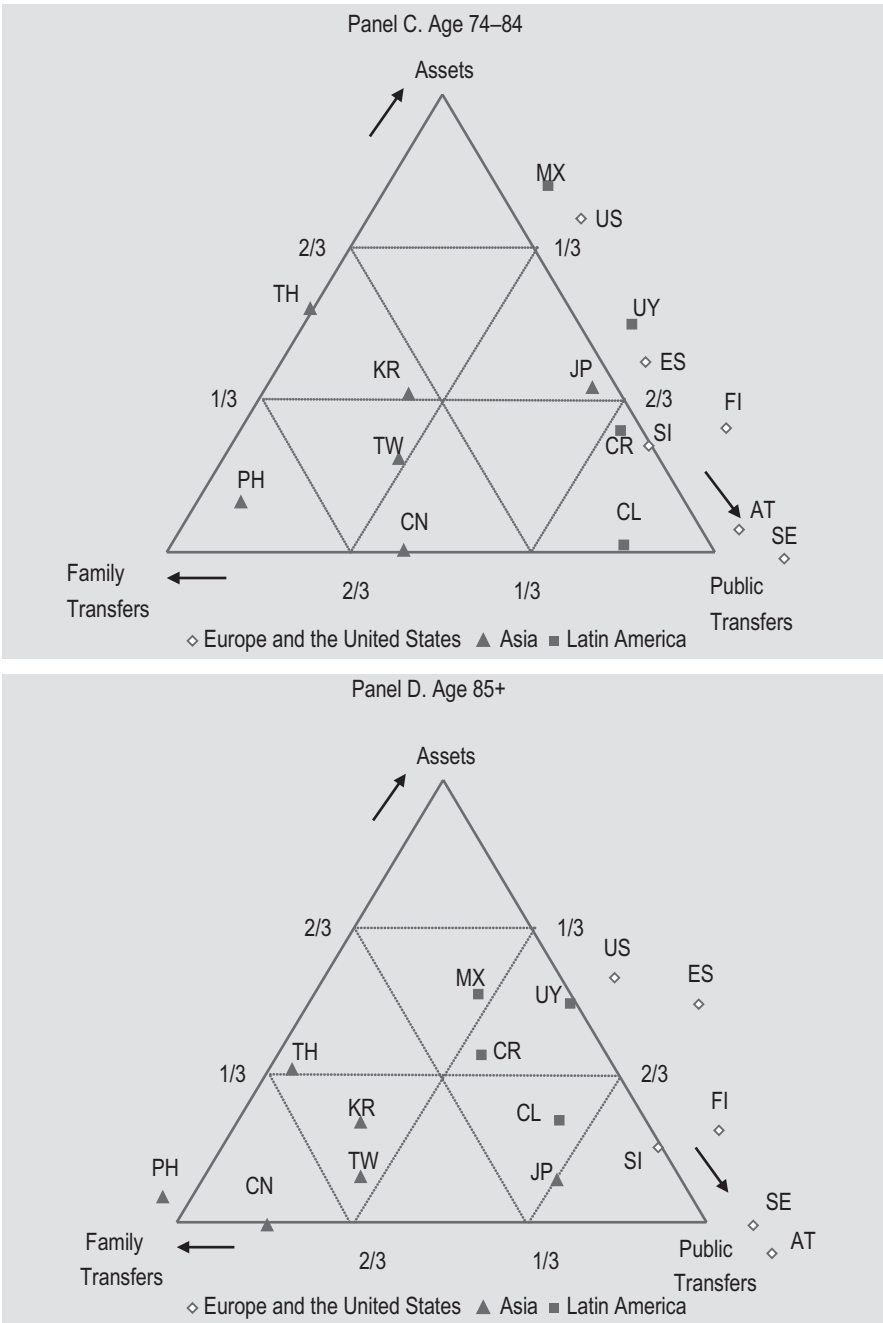


Figure 8. *Continued*



Source: Calculated by the authors using the NTA database <http://www.ntaccounts.org>.

China and India, familial transfers may continue to be very important in reducing generational inequity.

Public transfers to the elderly

One of the most striking features of the support system for the elderly is the wide variation in the importance of net public transfers across countries. Net public transfers is a comprehensive measure of the net flow of economic resources to the elderly through public programmes. As such it includes cash transfers, e.g. public pensions, and in-kind transfers, e.g. publicly funded health care. But in-kind transfers also include each age group's pro rata share of public consumption that presumably benefits all members of society including national defence, public diplomacy, and other pure public goods.

There is another important difference between net public transfers and other measures of the size of public transfers. The elderly not only receive public transfers, but they also fund public transfers by paying taxes. Many social security programmes are funded by taxing labour income and, hence, fall rather directly on those in the working ages. However, to a varying degree the elderly pay taxes on consumption, income, wealth, labour income to the extent that they continue to work, and public transfer inflows. Taxes on public transfer inflows vary across countries but also vary depending on whether the transfers are cash or in-kind. In the United States, for example, health transfers are largely untaxed while pension benefits are taxed for the most part.

Important differences in the public transfer system are highlighted in Table 3, which reports net public transfers and public transfer inflows by sector (health, pensions, and other). These values have been normalized on the per capita labour income of persons aged 30-49. This facilitates comparison across countries and also has a ready interpretation. A value of 1.0, for example, would indicate a transfer equal to the annual labour income of an individual at the prime of his or her working life (aged 30-49). This is the pre-tax labour income and includes all benefits and self-employment labour income, in addition to salaries and wages.

In two countries, public transfer inflows actually exceed 1.0. In Sweden the mean public transfer inflows received by those aged 65 or older are 111 per cent of the per capita labour income of persons aged 30-49. In Brazil mean public transfer inflows received by those aged 65 or older are 120 per cent of the per capita labour income of persons aged 30-49. When we incorporate that public transfer outflows from the elderly to obtain net public transfers, the values drop to 78 per cent for Sweden and 86 per cent for Brazil. These are remarkably high values that are possible when the working-age population is substantially larger than the population aged 65 or older. But clearly net public transfers in this range cannot be sustained as the populations of Sweden and Brazil age.

Table 3. *Public transfers, average for population age 65+, normalized on*

Region/Country	Net public transfer	Public transfer inflow			
		Total	Health	Pensions	Other
Europe and United States					
Austria	na	0.79	0.15	0.54	0.10
Spain	0.36	0.55	0.12	0.35	0.08
Finland	0.57	0.75	0.12	0.45	0.18
Sweden	0.78	1.11	0.36	0.63	0.11
Slovenia	0.46	0.59	0.17	0.35	0.07
United States	0.31	0.55	0.21	0.22	0.11
East Asia					
Japan	0.44	0.67	0.20	0.35	0.12
Korea, Republic of	0.16	0.28	0.05	0.08	0.15
Taiwan (China)	0.16	0.31	0.07	0.01	0.23
Latin America					
Brazil	0.87	1.20	0.09	1.00	0.11
Chile	0.48	0.59	0.06	0.47	0.06
Costa Rica	0.41	0.53	0.12	0.29	0.12
Mexico	0.17	0.32	0.06	0.10	0.16
Uruguay	0.37	0.50	0.04	0.39	0.07
Southeast Asia					
Indonesia	0.03	0.06	0.02	0.00	0.05
Philippines	–0.01	0.25	0.01	0.16	0.07
Thailand	–0.02	0.13	0.03	0.00	0.10

Notes: All values are expressed relative to the average labour income of persons aged 30-49. Net public transfer inflows are equal to public transfer inflows less outflows.
Source: NTA database <http://www.ntaccounts.org>.

The regional diversity in support systems noted above is also very evident in net public transfers in Table 3. Net public transfers are high in Europe, Japan, and in Latin America with the exception of Mexico. Net public transfers are quite low in the United States as compared with other industrialized countries, but net public

transfers to the elderly are also low in Spain.[4] In Mexico and East Asia, Japan aside, net public transfers are much smaller and in Southeast Asia they are close to zero.

One interesting feature of Latin America is that net public transfers are relatively high as compared with public transfer inflows except in Mexico. Net transfers range from 72 per cent of public transfer inflows in Brazil to 82 per cent of public transfer inflows in Chile. In Europe the values range from 64 per cent in Spain to 78 per cent in Slovenia. By comparison, net transfers are 65 per cent of transfer inflows in Japan and only 57 per cent in the United States. Properly assessing the importance of intergenerational transfers to the elderly requires information about the extent to which the elderly themselves are funding public transfers.

To a considerable degree, public transfers are high because public pensions are high. In some Latin American countries, public pensions are close to 80 per cent of public transfer inflows. In European countries public pensions are closer to 60 to 70 per cent of public transfer inflows, while in the United States public pension inflows are only 40 per cent of public transfer inflows. Health care bears a more complex relationship to public transfers. In many countries, the public sector funds all or a large portion of health care costs. Hence, health transfers tend to be more important in richer countries where spending on health, in general, is higher. The United States is again somewhat atypical with its very high spending on health care. Note, however, that spending in Sweden is even higher because of public spending on long-term care which is included in the figure.

Transfers and intergenerational equity

Intergenerational equity is an important issue that frames much of the public debate about social security and other public programmes that tax one generation for the benefit of another. Some observers are concerned about the amount of public resources directed at children as compared to those directed at the elderly. Other observers emphasize a concern that public programmes benefit current generations at the expense of future generations. These concepts are closely linked because downward intergenerational transfers benefit children and future generations while upward intergenerational transfers that benefit the elderly impose a cost on future generations.

A simple approach to assessing intergenerational equity is to compare current public spending on the elderly and on children. This is a useful starting point, but such an approach has limitations and refinements are possible.

First, generations vary both in what they receive and what they give. Taxes paid by the elderly are generally higher than those paid by children. Thus, benefits

4. Net public transfers as a share of the lifecycle deficit is much higher in Spain than in the United States, because the lifecycle deficit in the United States is much higher than in Spain.

provided to the elderly overstate their net transfers and exaggerate the extent to which economic resources are being redirected to the elderly as compared with the young. This problem is remedied by comparing net transfers.

Second, needs vary by age. If the goal is to insure that individuals achieve some basic standard of living, net transfers will vary so as to reflect that variation in need. This point seems obvious when we consider the need for food and clothing, for example, but less so in the case of health care. In rich societies high levels of spending on health care for the elderly may be viewed as part of providing for basic needs. Thus, if the goal of public programmes is to meet some basic standard, net transfers may vary considerably with age and intergenerational equity can be assessed, for example, by comparing poverty rates across age groups or in similar ways (Preston, 1984; Turra, Queiroz and Araujo, 2009).

Third, many public programmes involve a form of saving or investment. Education is an obvious example. At the most basic level we invest in children because of the returns, both monetary and otherwise, that are realized over the remainder of their lives. Some of the benefits accrue to those receiving the investment and some spill over to society at large. Equity considerations imply that those who benefit from publicly-funded human capital investment when young should repay that investment through higher taxes as adults. But equity considerations would not suggest that money spent on education should be matched by money spent on the elderly.[5] Public pensions can be viewed through a similar lens. Contributions to pure transfer systems (pay-as-you-go pensions) are not saving or investment, but they are a form of forced pseudo-saving with contributions during the working years repaid through pension payments during retirement. Of particular interest on equity grounds is whether each generation is receiving pension payments that are consistent with pension contributions.

All intergenerational transfer programmes are characterized by this important feature — that transfers received are separated by many years from transfers made. This has implications for assessing the economic value of a particular transfer system for any cohort, and implications for the extent to which costs or benefits are being shifted to future generations. With public education programmes and other downward transfer systems, future generations will benefit from transfers they will receive from members of the current population. With public pensions and other upward transfer systems, future generations will bear some of the cost of funding benefits that will be received by the current population. Thus, the costs and benefits shifted to future generations depend on the lag between payment and receipt of transfers, as well as the annual flow for each transfer programme.

A comprehensive measure of the resources shifted from future generations to current generations is transfer wealth. This is simply the present value of all

5. But see Becker and Murphy (1988) and Bommier et al. (2004) on this point.

transfers that those currently alive will receive from those not yet born less transfers that those currently alive will pay to those not yet born. Downward transfers, those to children, create negative transfer wealth — the obligation of the current population to future generations — while upward transfers, those to the elderly, create positive transfer wealth — the obligation of future generations to the current population. Under special circumstances, transfer wealth is equal to the product of the annual flow and the age span of the transfer systems, i.e. the average age at which benefits are received less the average age at which benefits are paid (by taxpayers) (Lee, 1994; Willis, 1988). Under more general circumstances, the product of the annual flow and the age span is an approximation of the extent to which transfer systems are burdening or benefiting future generations.

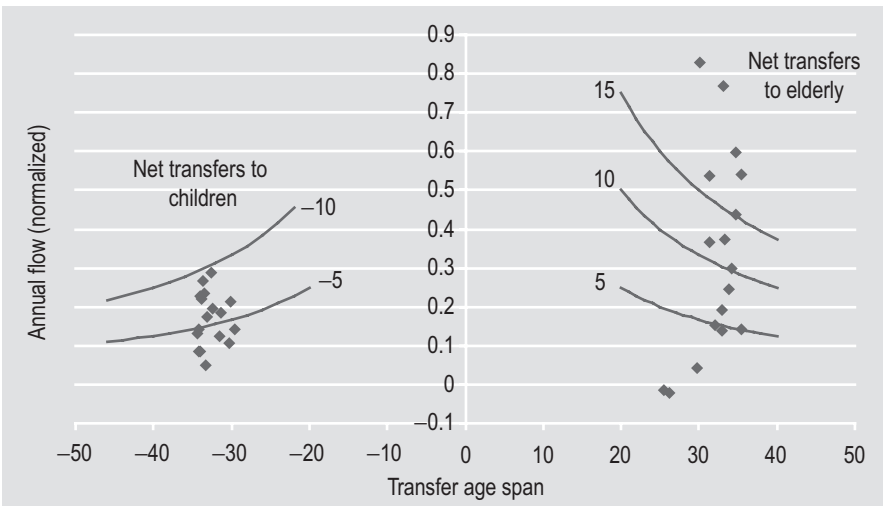
A final issue is the role of private transfers. As we have seen in the case of Japan (Figure 6) private transfers are dominated by transfers to children. In some countries, private transfers to the elderly are also important, but in many Western countries this is not the case. Clearly a comprehensive understanding of intergenerational transfers requires that both public and private transfer be considered.

The analysis presented here is based on National Transfer Account estimates of public and private transfers for 15 high- and middle-income countries. Calculations are based on per capita age profiles of net public and private transfers to children (0-19 years of age) and to the elderly (aged 60 or older) in a recent year that varies from country to country depending on data availability. To control for differences in age structure, we have calculated values using the stationary age structure consistent with survival rates for the United States population in 2000. Annual flows have been normalized by dividing by the average labour income of persons aged 30-49 in order to facilitate comparison across countries with very different levels of income. The mean age of inflows is calculated using net inflows as weights for those aged 0-19 and aged 60 or older. The mean age of outflows is calculated using the net outflows as weights for those aged 25-59. Transfer wealth is calculated as the product of the annual flow and the difference between the mean age of inflow and the mean age of outflow.

Net public transfers to children and to the elderly are summarized in Figure 9 with values by country presented below in Table 4. Annual net public transfers to children range from a little less than 30 per cent of the per capita labour income for those aged 30-49 (Japan) to less than 5 per cent (China). The variation in the age span of transfers is modest, ranging from just under 30 years to somewhat more than 34 years. Per capita transfer wealth, the estimated obligation to future generations, varies from about −2 to almost −10 times per capita labour income of persons aged 30-49, as represented by the isoquants.

Net public transfers to the elderly vary a great deal. In some countries, the annual flow is close to zero or even negative, while in others it exceeds 75 per cent of the labour income of an adult aged 30-49. The age gap is also more variable, ranging

Figure 9. *Summary of net public transfers to children and the elderly, 15 high- and middle-income countries*



Note: All values are calculated using single-year of age estimates of transfer inflows and outflows and a stationary population age distribution consistent with United States 2000 survival rates. Net transfers and the mean age of inflows are calculated using net transfers to the elderly and to the young. The mean age of outflows is the mean age of net transfers for persons aged 25-59. The transfer span is the mean age of inflow less the mean age of outflow. Transfer wealth is the product of the transfer age span and the annual flow and is represented by the isoquants. *Source:* Constructed by the authors using estimates from the NTA database <http://www.ntaccounts.org>.

from 25 to 35 years. Estimated transfer wealth — the burden the current generation is imposing on future generations — ranges from essentially zero (China, Philippines, and Thailand) in a few countries, up to a high of 25 (Austria and Brazil).

Averaging over the 15 countries, net public transfers to the elderly, whether measured using the annual flow or transfer wealth, are twice net public transfers to children. Combining transfers to children and to the elderly, the "average" public transfer system is burdening future generations by a substantial amount — about five-years' worth of average labour income for a prime-age adult. The variation across countries is considerable, however. In the Philippines and Thailand the public transfer system favours future generations. In China, South Korea, Taiwan (China), and the United States combined transfer wealth is less than one-year's worth of prime-age adult labour income. In Europe and Latin America the public burden on future generations is substantial and particularly so in Brazil, where combined transfer wealth is almost 18-years' worth of prime-age adult labour income.

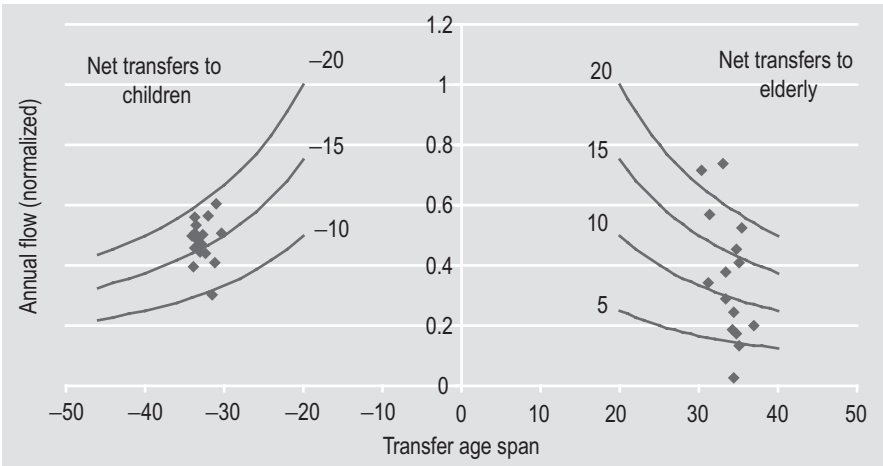
The picture changes dramatically when private transfers are combined with public transfers (Figure 10). Net combined transfers to children are substantially higher than net public transfers. On average the annual flow is 0.47 for combined

Table 4. *Summary of intergenerational transfers for 15 high- and middle-income countries*

	Children (0-19)			Elderly (60+)		
	Age span	Annual flow	Transfer wealth	Age span	Annual flow	Transfer wealth
	Public transfers					
Austria 2000	–33.5	0.23	–7.8	33.0	0.77	25.4
Brazil 1996	–31.5	0.12	–3.9	30.2	0.83	25.1
China 1995	–33.3	0.05	–1.7	29.7	0.04	1.3
Costa Rica 2004	–30.3	0.11	–3.2	31.3	0.37	11.4
Hungary 2005	–32.4	0.19	–6.3	31.3	0.54	16.8
Japan 2004	–33.6	0.27	–8.9	33.4	0.37	12.4
Philippines 1999	–34.1	0.08	–2.8	25.5	–0.01	–0.4
Slovenia 2004	–30.1	0.21	–6.4	34.8	0.44	15.3
South Korea 2000	–29.6	0.14	–4.2	32.9	0.14	4.6
Spain 2000	–33.1	0.17	–5.8	34.2	0.30	10.2
Sweden 2003	–34.0	0.23	–7.7	34.7	0.60	20.8
Taiwan (China) 1998	–31.3	0.19	–5.8	35.4	0.14	5.0
Thailand 2004	–34.3	0.23	–4.5	26.2	–0.02	–0.6
Uruguay 2006	–34.3	0.09	–2.9	32.9	0.19	6.4
United States 2003	–33.8	0.22	–7.5	33.9	0.25	8.4
Average	–32.6	0.16	–5.3	32.0	0.33	10.8
	Public and private transfers combined					
Austria 2000	–32.4	0.44	–14.2	33.0	0.74	24.3
Brazil 1996	–34.0	0.50	–17.0	30.4	0.71	21.7
China 1995	–31.5	0.30	–9.5	36.9	0.20	7.4
Costa Rica 2004	–33.1	0.45	–14.8	31.2	0.34	10.7
Hungary 2005	–31.2	0.41	–12.7	31.3	0.57	17.8
Japan 2004	–33.8	0.56	–19.0	33.3	0.38	12.6
Philippines 1999	–33.7	0.46	–15.4	34.4	0.03	0.9
Slovenia 2004	–30.4	0.51	–15.4	34.8	0.45	15.7
South Korea 2000	–32.8	0.50	–16.5	33.3	0.29	9.7
Spain 2000	–33.6	0.53	–17.9	34.4	0.25	8.5
Sweden 2003	–33.5	0.49	–16.3	35.4	0.53	18.6
Taiwan (China) 1998	–31.1	0.60	–18.7	35.1	0.41	14.4
Thailand 2004	–32.9	0.47	–15.5	34.3	0.19	6.3
Uruguay 2006	–33.9	0.40	–13.4	35.0	0.14	4.7
United States 2003	–33.8	0.51	–17.1	35.0	0.17	6.1
Average	–32.8	0.47	–15.6	33.8	0.36	12.0

Notes: All values are synthetic cohort estimates based on US2000 survival rates for both sexes combined. Transfer age span is the difference between the average age that transfers are received and the average age that they are given. Annual flow is net inflow to children and the elderly normalized on per capita labour income 30-49. Transfer wealth is the product of the transfer age span and the annual flow. See text for further discussion.
Source: Estimated by authors using the NTA database <http://www.ntaccounts.org>.

Figure 10. *Summary of net public and private transfers to children and the elderly, 15 high- and middle-income countries*



Note: See notes for Figure 9.

transfers as compared with 0.16 for public transfers alone. Transfer wealth is –15.6 for combined transfers as compared with –5.3 for public transfers; the obligation of the current generations to future generations of children is very substantial. To a modest degree public and private transfers to children are substitutes — the simple correlation between public and private transfers is –0.38 and child transfer wealth is less variable than public child transfer wealth (as measured by the coefficient of variation, for example).

Net combined transfers to the elderly are modestly greater than net public transfers. Combined transfer wealth due to transfers to the elderly is 12.0 as compared with 10.8 for public transfer wealth. The correlation between public and private transfer wealth is stronger for the elderly (–0.65).

On average, total transfer wealth is negative and equal to –3.6-years' worth of prime adult labour income per person (–15.6+12.0). Given the current transfer profiles for public and private sectors combined, future generations will receive more from current generations than they are obligated to pay to current generations. Future generations will benefit primarily due to transfers from their parents and pay primarily through the higher taxes they will pay.

Transfer systems in four countries, Austria, Brazil, Hungary, and Sweden, impose burdens on future generations with Austria imposing the greatest burden by a substantial margin. In Slovenia, total transfer wealth is less than one-year's worth of labour income. Brazil is an interesting case in that private transfers to children are so substantial and offset to a considerable degree the enormous public transfers to the elderly.

In the other ten countries transfer wealth is negative, i.e. future generations will be the beneficiaries of transfers from current generations, if current transfer profiles persist. The largest transfers to future generations are found in the Philippines, the United States, Spain, Thailand, and Uruguay, in that order.

Large net public transfers to the elderly do not necessarily burden future generations. They may be balanced by large public or private transfers to children. To some extent that balancing occurs, but it is incomplete. In general, countries with large net public transfers to the elderly typically are burdening future generations through their transfer systems. These systems can be reformed to reduce, to eliminate, or to reverse this generational bias. In some cases, reforms have already been enacted but have not yet begun to influence the generational flow of resources.

A final consideration in realizing a comprehensive assessment of generational equity is that the estimates presented here do not include bequests. Transfers to the elderly may be saved and bequeathed to their descendants. To the extent that the elderly behave in this way, the effects of large public transfer programmes on intergenerational equity will be moderated and possibly eliminated or reversed.

Economic growth

The welfare of future generations depends on the extent to which we burden them through our transfer systems, as discussed in the preceding section, but also on continued economic progress. Population ageing and ageing-related policies have important implications for economic growth (Cutler et al., 1990). The number of workers will grow more slowly than the population in coming decades, reversing the favourable trend often referred to as the demographic dividend (Bloom and Canning, 2001; Bloom and Williamson, 1998; Mason, 2001; Mason and Lee, 2007). The economic support ratio has been increasing in many countries, but now it is beginning a long decline.[6] It is possible that the decline in the support ratio will be more modest than appears likely. Childbearing could rebound as a consequence of behavioural changes or pro-natalist policies. The economic lifecycle could go through a radical restructuring along the lines discussed above. But based on experience to date, it appears likely that the economic support ratio will decline for the foreseeable future.

Whether economic progress slows or standards of living actually decline will depend on a variety of forces — political stability, technological innovation, and environmental policy, for example. But policies related to intergenerational transfers and social security will play an important role, as well. The important issues have been discussed extensively and will only be briefly described here.

6. The economic support ratio is defined as the number of workers adjusted for age differences in productivity divided by the population adjusted for age differences in needs.

First, heavy reliance on public transfer systems will require substantially higher taxes undermining work incentives both for those nearing retirement but also for young and middle-aged adults (Gruber and Wise, 2001; Gruber and Wise, 1999). Second, heavy reliance on either public or private transfers to fund retirement needs undermines saving incentives. In countries where the elderly are relying on assets to fund their retirement, population ageing will lead to an increase in aggregate assets, greater asset income and higher wages (Feldstein, 1974; Kinugasa and Mason, 2007; Lee, Mason and Miller, 2003). Third, if low fertility is matched by substantial increases in human capital investment — as appears to be the case in many countries — the aggregate productivity of the labour force may continue to grow even though the number of workers does not (Becker and Barro, 1988; Lee and Mason, 2009). By substituting quality for quantity the adverse economic circumstances of population ageing can be largely offset.

The evidence argues for reform of social security systems that are so large that they are unsustainable, competing with children and future generations for public resources, and undermining incentives to work and to save. But more moderately sized social security systems are sustainable, consistent with generational equity, and compatible with continued economic growth.

Conclusions

Population ageing is a widespread and powerful force that is certain to shape an unprecedented and fundamental shift in intergenerational flows. In the past, the flows were predominantly downward from adults to children, but in the future the flows will be predominantly in the upward direction — from prime-age adults to the elderly. This reversal is primarily a consequence of sheer numbers — more resources are flowing to the elderly because there are more elderly. But an important supporting role has been played by changes in the economic lifecycle. Per capita consumption by the elderly is higher while their per capita labour income is lower in old as compared with younger countries. The differences are clear in cross-country comparisons, but also in long-term trends in the industrialized countries.

Radical changes in the economic lifecycle may come. Improving health and changes in policy may encourage people to extend their working years. Growth in health care spending, heavily concentrated at older ages, may yet be reined in. However, intergenerational flows to the elderly appear certain to increase.

The public sector is playing a dominant role in some parts of the world, notably Europe and parts of Latin America. Familial transfers are important to the elderly in some Asian countries, but they are declining in their importance. In a number of countries, the elderly are relying heavily on assets to fund their retirement rather than on public or private transfers.

A matter of grave concern is that public transfer programmes are a source of intergenerational inequity. In most countries, the public sector does favour the elderly over the young and the current population over future generations. This is balanced, however, by large private transfers that favour the young. In some countries, however, public transfer systems are sufficiently large that they dominate private transfers creating a system in which the current population is maintaining standards of living by claiming the resources of future generations. Once bequests are considered, however, it is quite likely that all intergenerational flows combined will favour future generations although less so than in the past.

If population ageing undermines economic growth, standards of living for future generations will also be compromised. Labour forces will grow more slowly than consumers in ageing countries putting downward pressure on economic growth. There are ample opportunities, however, to counter these forces by encouraging greater work effort, higher rates of saving and investment, and greater investment in human capital. Success cannot be realized, however, by increased reliance on social and economic institutions created in a different time. Continued prosperity requires adaptation to our changing demographic circumstances.

Bibliography

Becker, G. S.; Barro, R. J. 1988. "A reformulation of the economic theory of fertility", in *Quarterly Journal of Economics*, Vol. 103, No. 1.

Becker, G. S.; Murphy, K. M. 1988. "The family and the State", in *Journal of Law & Economics*, Vol. 31, April.

Bloom, D. E.; Canning, D. 2001. "Cumulative causality, economic growth, and the demographic transition", in N. Birdsall, A. C. Kelley and S. W. Sinding (eds.), *Population matters: Demographic change, economic growth, and poverty in the developing world*. Oxford, Oxford University Press.

Bloom, D. E.; Williamson, J. G. 1998. "Demographic transitions and economic miracles in emerging Asia", in *World Bank Economic Review*, Vol. 12, No. 3.

Bommier, A. et al. 2004. *The development of public transfers in the US: Historical generational accounts for education, social security, and medicare* (Annual Meeting of the Population Association of America). Boston, MA.

Cutler, D. M. et al. 1990. "An aging society: Opportunity or challenge?", in *Brookings Papers on Economic Activity*, No. 1.

ESA. 2009. *World population prospects: The 2008 revision*. New York, NY, United Nations Department of Economic and Social Affairs — Population Division. <http://www.un.org/esa/population/unpop.htm> (accessed on 16.06.2010).

Feldstein, M. 1974. "Social security, induced retirement, and aggregate capital accumulation", in *Journal of Political Economy*, Vol. 82, No. 5.

Gruber, J.; Wise, D. 1999. *Social security and retirement around the world*. Chicago, IL, University of Chicago Press.

Gruber, J.; Wise, D. 2001. *An international perspective on policies for an aging society* (NBER working paper, No. 8103). Cambridge, MA, National Bureau of Economic Research.

Kinugasa, T.; Mason, A. 2007. "Why nations become wealthy: The effects of adult longevity on saving", in *World Development*, Vol. 35, No. 1.

Kluge, F. A. (forthcoming). "Labor income and consumption profiles in Germany", in R. Lee and A. Mason (eds.), *Population aging and the generational economy: A global perspective*. Cheltenham, E. Elgar.

Lee, R. 2003. "Demographic change, welfare, and intergenerational transfers: A global overview", in *GENUS*, Vol. 60, No. 3/4.

Lee, R.; Mason, A. 2009. "Low fertility, human capital, and macroeconomics", in *European Journal on Population*, Vol. 26, No. 2.

Lee, R.; Mason, A.; Miller, T. 2003. "From transfers to individual responsibility: Implications for savings and capital accumulation in Taiwan and the United States", in *Scandinavian Journal of Economics*, Vol. 105, No. 3.

Lee, R. D. 1994. "The formal demography of population aging, transfers, and the economic life cycle", in L. G. Martin and S. H. Preston (eds.), *Demography of aging*. Washington, DC, National Academy Press.

Lee, R. D.; Lee, S.-H.; Mason, A. 2008. "Charting the economic lifecycle", in A. Prskawetz, D. E. Bloom and W. Lutz (eds.), *Population aging, human capital accumulation, and productivity growth* (suppl. to Population and Development Review, No. 33). New York, NY, Population Council.

Mason, A. 2001. *Population change and economic development in East Asia: Challenges met, opportunities seized*. Palo Alto, CA, Stanford University Press.

Mason, A.; Lee, R. 2007. "Transfers, capital, and consumption over the demographic transition", in R. Clark, N. Ogawa and A. Mason (eds.), *Population aging, intergenerational transfers and the macroeconomy*. Cheltenham, E. Elgar.

Mason, A. et al. 2009. "Population aging and intergenerational transfers: Introducing age into national accounts", in D. Wise (ed.), *Developments in the economics of aging*. Chicago, IL, University of Chicago Press.

Ogawa, N. et al. 2009. "Declining fertility and the rising cost of children: What can NTA say about low fertility in Japan and other Asian Countries", *in Asian Population Studies*, Vol. 5, No. 3.

Preston, S. H. 1984. "Children and the elderly: Divergent paths for America's dependents", in *Demography*, Vol. 21, No. 4.

Racelis, R.; Salas, J. M. I. (forthcoming). "Changes in patterns of Philippine lifecycle consumption and labor income between 1994 and 2002", in R. Lee and A. Mason (eds.), *Population aging and the generational economy: A global perspective*. Cheltenham, E. Elgar.

Turra, C. M.; Queiroz, B. L.; Araujo, T. 2009. *Casting light on the idiosyncrasies of public transfers in Brazil* (Conference Report, Expert Group Meeting on Population Ageing, Intergenerational Transfers and Social Protection, CELADE and the UNDP, 20-21 October). Santiago.

Willis, R. J. 1988. "Life cycles, institutions and population growth: A theory of the equilibrium interest rate in an overlapping-generations model", in R. D. Lee, W. B. Arthur and G. Rodgers (eds.), *Economics of changing age distributions in developed countries*. Oxford, Oxford University Press.