Full Generational Accounts: What Do We Give to the Next Generation?

RONALD LEE
DAVID MCCARTHY
JAMES SEFTON
JOŽE SAMBT

EACH GENERATION SUPPORTS THE next and endows it with assets and human capital. Or so we like to think. But in rich industrial countries, increased public sector transfers to the elderly and rising public debt have redistributed income upward from young to old, while increased annuitization of assets, reverse mortgages, and longer life in retirement may have reduced asset transfers to younger generations through bequests and gifts. Public higher education, which was formerly a gift to the younger generation, has increasingly become a self-investment by the young, financed by loans. The unsustainability of public transfer programs is one aspect of the erosion of transfers to the young, but it is only a part. To be sure, there are also forces operating in the opposite direction, since lower fertility means greater levels of consumption, human capital investment, and bequests per child, both public and private, other things equal.

Analysis of National Transfer Accounts data suggests that in the past, income was on average redistributed from older to younger people in all societies, whereas today redistribution is approaching age neutrality in many countries and has actually reversed direction in others, going from younger to older as a result of population aging, reduced old-age labor supply, and the growth of public transfers to the elderly (Lee and Mason 2011: Chapter 4). Could it be that current generations no longer pass resources to the next, but rather deplete the family assets while enjoying an easy life funded by taxes levied on the young? The phrase "SKI trip" has entered the language, meaning "Spending the Kids' Inheritance" for elder consumption.

Standard Generational Accounting, or GA (Auerbach, Gokhale, and Kotlikoff 1991), addresses intergenerational aspects of the public sector. Given current tax and benefit rates by age, it asks how the net present value of benefits minus taxes for a newborn today compares to the prospects for

all future generations in total, given projected population aging and other changes. The goal is to quantify the unsustainability or inequity of current public programs in generational terms, with an emphasis on the big public transfers to the elderly (such as, in the US, Social Security pensions and Medicare health insurance).

Here we broaden the measure of GA to include all private transfers received by a generation over its lifetime, including consumption, education, health care, inter vivos transfers, and end-of-life bequests. It does not matter in this context whether or not bequests are intended. While GA compares current generations to future ones in a general way, here we assume a particular policy trajectory in which public taxes and expenditures are balanced on a yearly basis in the future. This is our concept of Full Generational Accounts, or FGA. Of course, it is not really complete because it does not include the transfer of institutions, natural resources, culture, technology, or even the investment of adult time in children. But it does aspire to include all goods and services that are part of standard National Accounts, and to include both private and public transfers.

The motivation and emphasis are somewhat different from those applicable to GA. We are interested in how much each generation provides for the next. Provision for subsequent generations requires that current generations refrain from consuming a share of their assets that can then be passed on to younger generations, and that they actively invest in the human capital of the young. GA focuses on the intergenerational inequities that result from the unsustainability of current public programs. FGA is concerned with this issue as well and calculates the adjustments to private transfers and to public programs that must be made to achieve sustainability and balance in the face of population aging, but without specifying a plan for repayment of the initial explicit public debt. In addition, FGA asks what the next generation will receive, on the assumption that adjustments are made to achieve sustainability of both public and private transfers. In future work, we also plan to assess past and future trends in FGA as well as differences across the full set of NTA countries.

These FGA and their composition are also of interest for various theories of fertility, old-age support, human capital investment, and bequests, as addressed in overlapping-generations models such as Becker and Barro (1988), Nerlove, Razin, and Sadka (1987) and Razin and Sadka (1995). In these theoretical analyses, altruistic parents optimize their investments in children's human capital, grant bequests to children, decide how much to consume themselves and how much to invest in assets, and participate in public PAYG (pay-as-you-go) pension schemes. The decomposed FGA provide estimates of all these quantities of interest, although not all will be reported here.

This article is a first attempt to estimate FGA. We construct the FGA for two countries, the United States and Taiwan. In the US, as in most other rich

industrial countries, education is very largely funded by the public sector. In Taiwan, as in many East Asian and developing countries, both the family and the public sector fund education. In the US, consumption in old age is funded largely through asset income and public transfers (Social Security, Medicare, and Medicaid for the poor), while the elderly make net transfers to younger family members. In Taiwan, as in some other Asian countries, a substantial share of old-age consumption is provided by the family, with asset income and public transfers making up the rest. In the US, retirement is relatively late and the elderly have high consumption relative to younger adults, while in Taiwan retirement is relatively early and the elderly consume amounts similar to other adults. (For all these points, see Lee and Mason 2011.) Fertility in the US is close to replacement level, while in Taiwan it has been closer to one birth per woman. For these reasons, the comparison of the two countries should be useful and informative. In future work, we intend to construct similar FGA for many more of the NTA countries, of which there are currently 50. It may also be possible to extend the concept to include intergenerational transfers of time, since National Time Transfer Accounts (NTTA) have already been calculated for many countries. In related work (McCarthy et al. 2016), similar ideas are used to calculate Generational Wealth Accounts. In addition to providing estimates of transfers between the living and the unborn, these calculations also provide detailed estimates of the human capital, real wealth, and public and private transfer wealth of all living generations, and the uses to which these are put, including bequests. The concept of Private Generational Accounts in McCarthy et al. (2016) treats labor income and consumption somewhat differently.

The FGA concept

Before we embark on estimation, let us clarify what we seek to measure. We can begin with the steady-state case, where the population is stable and the patterns of intergenerational transfers are unchanging over time. Let $\tau(x)$ be the overall pattern of net transfers, that is, the average at each age of transfers received minus transfers given; $\tau(x)$ can represent either the sum of all transfers or any one of many transfer subsystems such as Social Security taxes and benefits, or being raised by one's parents and then raising children oneself as an adult. A transfer subsystem includes both the transfers received at each age and the transfers made, as is the case for the examples given—Social Security and childrearing. We can also view end-of-life bequests in this way if we imagine that every bequest is actually given at the instant before death. For every bequest given there is one received, so they sum to zero, and constitute another transfer subsystem.

It is in the nature of transfers both overall and in each subsystem that they must sum to zero across the whole population (in a closed economy),

since a dollar given by one person is a dollar received by someone else.[1] This condition can be expressed in a useful equation. The stable population age distribution is proportional to $e^{-nx}l(x)$, where n is the stable population growth rate and $l(x)$ is the survivorship function from birth to age x. Multiplying this by net transfers at each age and summing gives the steady-state transfer balance condition:

$$\int_0^{\omega} e^{-nx} l\,(x)\,\tau\,(x)\,dx = 0$$

We can now ask: What is the net gift from current generations that a newborn can expect to receive over his or her lifetime? This is closely related to the question addressed by FGA.

The equation says that, discounted at the population growth rate n, the survival-weighted value at birth of all these net transfers received and given is zero. The equation can be interpreted longitudinally as well as cross-sectionally. Viewed cross-sectionally, it tells us that the sum of transfer inflows (that is, transfers received) and outflows (transfers given) must balance in the population. Viewed longitudinally, it tells us that, discounted at the population growth rate n, the survival-weighted value at birth of all these net transfers received and given is zero. We could generalize by adding productivity growth or per capita income growth at a rate λ. In this case, the steady state cross-sectional net transfer profile would rise over time at rate λ, so that a newborn of today would receive, at age x, a net transfer of $e^{\lambda x}\tau(x)$, where $\tau(x)$ refers to today's age profile of net transfers. Now with a discount rate of $n+\lambda$, which could be near the realistic "risk free" real rate of 2 or 3 percent, the present value of survival-weighted net transfers over the lifetime is zero. In other words, for this special steady-state case with a stable population and a repeating age pattern of net transfers (perhaps rising at a fixed rate λ), every generation receives and gives the same amount in transfers. If we were to base the FGA entirely on net transfers, then in this steady-state case our assumptions imply that the FGA would be zero (with a discount rate of $n+\lambda$).

There are many reasons why the steady-state example just given is not realistic, as enumerated below.

1. We have assumed a stable population, while the actual populations around us are full of change. In the US, cohort fertility has varied up and down by about one birth per woman over the past 70 years, and the period total fertility rate by about two births. When fertility is high, we might expect that both public and private transfers received per child would be lower, while the transfers made by adults to all their children as a group will be greater. Thus, baby boomers may have received less in transfers than did smaller generations, and in turn they may give more to each of their smaller number of children. Life expectancy at birth has risen from 47 years in 1900 to 79 today. This means that each child

has more surviving forebears to shower him with transfers, but also that his parents and grandparents will have more years to spend down the bequest that they had intended to leave to him. Immigration changes the picture in complicated ways. Our estimated net present values apply to the native-born population, but the effect of the immigrant population in each period on public program finances must be taken into account, which alters the needed balancing adjustments. Together these changes produce a rapidly aging population in the US and elsewhere, with more adults to transfer to each child, but also more elderly to receive either public or private support from working adults.

2. Public transfer patterns have changed dramatically over the past 50–60 years in the US (and similarly in other industrial countries) with the rise in secondary school enrollments, rising level of Social Security retirement benefits and coverage, the start of Medicare and Medicaid, and the rapid escalation of health care costs. These changes interact with population aging to require program adjustments in taxes and benefits to establish budget balance, adjustments that impinge in different ways on different generations. Population aging in particular is a powerful engine driving changes in transfer programs.

3. Private transfer systems are also subject to change. In Taiwan, demographic and economic changes have been deeper and even more rapid than in the US. In addition, old-age support in Taiwan has traditionally been a responsibility of the family, in sharp contrast to the US and other Western countries (as we know from NTA—Lee and Mason 2011). This family support system for the elderly is changing in Taiwan, particularly as Taiwan seeks to establish a public pension system. At the same time, as fertility has fallen and the importance of education has grown, familial expenditures on the health and education of each child have increased enormously, particularly in Taiwan and in developing countries where public education systems are relatively weak and supplementation by private spending is pervasive.

4. Aside from the demographic factors and the public and private transfer systems, economies themselves are changing in many ways, including the continued movement of women into the paid labor force and a slowdown in productivity growth.

5. Younger generations can be saddled not only with the excess (that is, "open system") implicit debt of unbalanced public transfer systems,[2] but also with explicit debts. A common institutional assumption is that individuals cannot impose negative private bequests on their children by making them responsible for parental debt, but that the public sector can indeed impose negative bequests on future generations, for example through foreign borrowing (Razin and Sadka 1995, p. 117), creating an external debt that must be repaid by future generations.

6. In actual applications, including ours, the discount rate is typically greater than $n+\lambda$, so the FGA would not be zero even in steady state.

Because of all these changes, the FGA can vary widely across generations within a country and across countries and can deviate far from the steady state zero value.

There are different ways we might summarize these age-time patterns of transfers. Standard GA reports the present value of net transfers (NPV) over the remaining lifetime of each generation in a given base year. Extending this approach to private transfers, we could simply calculate the NPV of total transfers, public and private, with a focus on the NPV evaluated for newborns in the base year or in any other year. We will call this FGA-N, for Full Generational Accounts of Net Transfers. From the previous discussion, we know that in steady state, when the population is stable and the transfer systems are unchanging, the FGA-N will be zero overall for a discount rate of $n+\lambda$ and for public and private systems separately, regardless of whether the public transfer system is generous (as in Sweden) or minimal, and whether the private transfer system is generous (as in Taiwan) or limited. Deviations of FGA-N from zero reflect transitional changes in demography, in the economy, or in public and private transfer systems, and perhaps in the discount rate chosen, but tell us little about the underlying generosity of the transfer systems. For this reason, FGA-N is most appropriate for addressing issues of intergenerational equity.

The preceding observation suggests a second measure, the PV of gross transfers received over the remaining lifetime, or FGA-G. This measure ignores any obligations to make transfers to others, and only counts the transfers received by each generation. Unlike FGA-N, it measures the generosity of public, private, and total transfers.

A third possibility is to measure public transfers as net, on the grounds that the tax payments that fund public transfers are legally mandated and are necessarily linked to the public benefits received, so only the net benefits should be counted. At the same time, recipients of private transfers can choose whether to bear children and make the requisite childrearing transfers to them, and can choose whether to make other private transfers as well. For this reason, it may be more instructive to count only the gross transfers received and not net out the gross transfers that individuals make to others, which are a matter of choice for them. Some might object that private transfers are governed by powerful socio-cultural norms and are no more voluntary than are tax payments. In any event, this approach leads to FGA-H, or a hybrid of net public and gross private transfers.

We present all three of these measures as alternative summaries of the age patterns and projections of transfers.

Methods

From National Transfer Accounts we have cross-sectional per capita age profiles for labor income, public benefits received and taxes paid, and private

transfers received and made, with disaggregation into expenditures for education, health, and other categories that are here combined. These cross-sectional profiles are inputs for pseudo-longitudinal calculations, in which we assume that the profiles for labor income and for transfers both made and received, public and private, rise at an assumed rate of productivity growth, 1.5 percent per year. This rate is close to that assumed by the US Social Security Administration for actuarial projections and seems consistent with trends in the US and not unreasonable for Taiwan over the long run. We also use a discount rate of 3 percent (real), which is intended to correspond to the risk-free rate of return in the US and is widely used in life cycle calculations. With assumed productivity growth at 1.5 percent and a discount rate of 3 percent, we effectively discount the cross-sectional age profiles at 1.5 percent (3 percent – 1.5 percent) with respect to age.

For public transfer accounts, we include all government expenditures such as for education, health care, pensions, long-term care, the military, and so on. The results for the public sector (i.e. standard Generational Accounts) were provided by researchers from Taiwan and the US and were prepared for another NTA project. In that project modifying the assumptions was allowed, to take into account specificity of the countries. Consequently, the results for the public sector are not fully comparable between the two countries, but we do not expect that this changes the main conclusions of our analysis. For private transfers we include consumption goods provided to children or the elderly by parents or adult children, such as housing, food, clothing, and recreation, as well as private expenditures for education and health care for children. We also include inter vivos transfers across ages among individuals in separate households. Some of the conceptual and practical difficulties of estimating and projecting the NTA flows and bequests are discussed in Appendices A and B. Estimation of the NTA age profiles is discussed in Lee and Mason (2011) and described in detail in United Nations (2012b).

All rich industrial countries have generous public systems of transfers to the elderly, particularly for pensions, health care, and long-term care. It is well established that in most or all of these countries, the public transfer systems are unsustainable in the face of projected population aging to mid-century and beyond. Less studied, however, are the implications of population aging for the private transfer systems in these countries. Current age patterns of transfers given and received can be unsustainable just like public ones in the face of changing population age distributions, particularly population aging.[3]

When assessing the sustainability of public or private transfer systems, we use current age profiles, modified in the future to reflect any legislated planned reforms. We first present measures of this sort which do not assume that there will be any public or private balancing in the future. However, when we assess what will actually be given to the next generations,

we construct realistic future transfer profiles by adjusting inflows and outflows to be equal each year, as they must be (when we view government or private debt as also an intergenerational transfer). We assume that balance is maintained half by means of raising taxes or transfers made, and half by reducing benefits or transfers received. While we do not evaluate the intergenerational burden of repaying the existing debt, we do not permit transfer systems to be in deficit in any future year. This means that the existing debt will grow at the rate of interest. If this equals the rate of growth of the economy, then the debt-to-National-Income ratio would be constant. However, we assume a discount rate of .03 and productivity growth of .015. We assume a population growth rate in the US of around .5 percent in the twenty-first century, while in Taiwan population growth is projected to turn negative in the 2020s. Therefore, under our assumptions the primary deficit is zero each year, while the debt will grow slightly faster than National Income, and it is assumed that this can continue for a long time.

This approach to projecting balanced transfer systems for the future is simple, but it does not address the problem of more general balance mentioned earlier, because changes in transfers will require other changes in consumption, saving, asset holdings, and bequest flows by age. In later work we will use the tau-model (Appendix A and Mason and Lee 2007) to derive fully balanced trajectories, but for now we will calculate approximate Full Generational Accounts using balancing transfer systems.

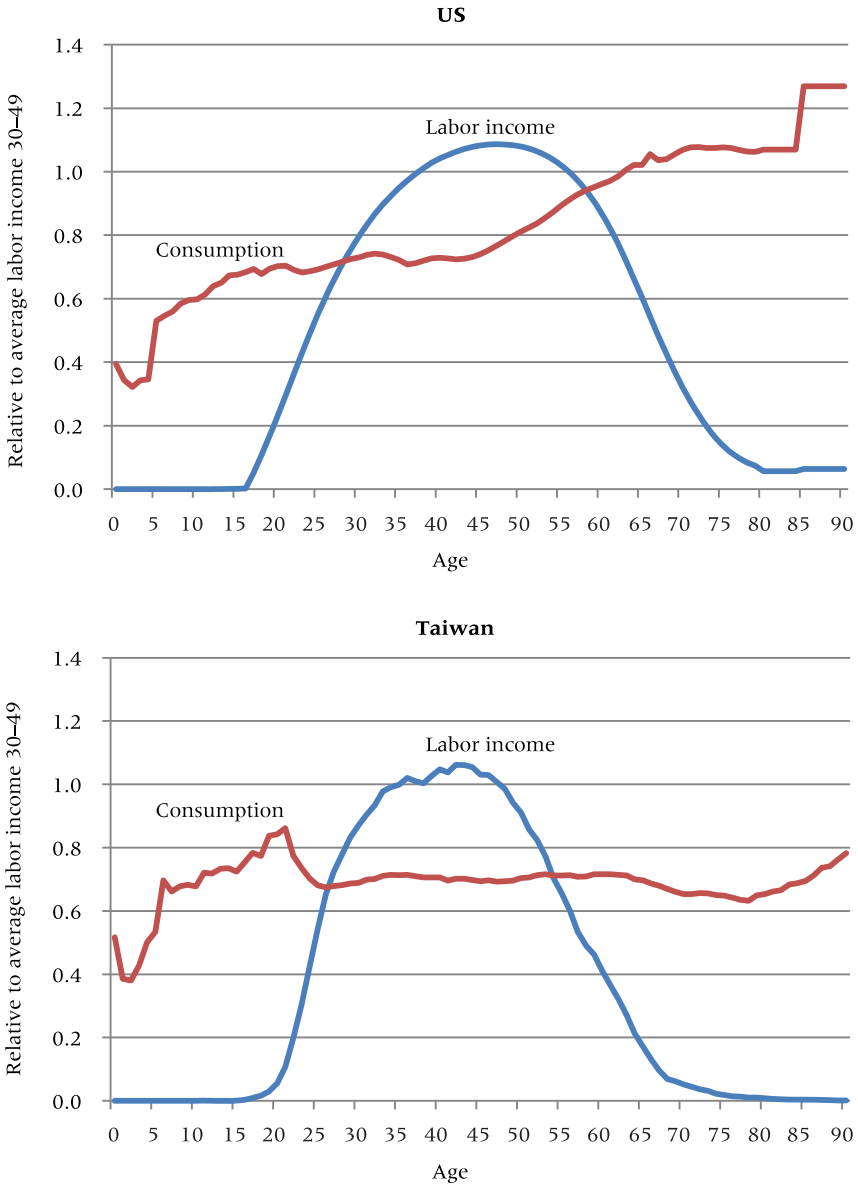
Consumption and labor income age profiles in the US and Taiwan

Although the age profiles of consumption and labor income are not used directly in the FGA, they provide a useful background before we turn to public and private transfers.

The concept of consumption in NTA includes both household consumption expenditures allocated to individual household members and public in-kind transfers received, such as public education, health care, long-term care, housing services, and food. Household expenditures on health care and education can be accurately attributed to individual members based on information in household surveys. The remainder of household consumption is allocated to individuals in proportion to consumption weights that are .4 for ages 0–4, and then rise linearly to 1.0 at age 20. Labor income in NTA is pre-tax wages and salaries plus fringe benefits, self-employment income, and unpaid family labor. For comparing variations by age in the US and Taiwan, we divide each of these age profiles by the unweighted average per capita labor income for ages 30–49 in each country.

The estimated age profiles of labor income and consumption are shown in Figure 1. In both countries, as expected, the young and the old consume

FIGURE 1 Age profiles of labor income and consumption for the US (year 2009) and Taiwan (year 2010), expressed relative to average labor income in each country at ages 30–49



SOURCE: NTA estimates. See Tung and Lai (2011) and Lee, Donehower, and Miller (2011).

far more than they earn. The gap at adult ages may be funded in part from asset income, but it is also funded through both public and private (familial) transfers, which are of central interest here. Some features of the labor income and consumption profiles merit mention. Labor income begins

at a younger age in the US and continues until older ages than in Taiwan. The delayed start of work in Taiwan may reflect the intense investment in children's human capital. Early withdrawal from the labor force may reflect Taiwan's rapid economic growth, which has given younger generations five or six times the lifetime labor income of their parents and may reduce the incentives of older people to work.

The high consumption by children in Taiwan again reflects heavy investment in their human capital. Taiwan's relatively flat consumption age profile in adult years reflects the high level of co-residence of older people with an adult child's family. This is in strong contrast to the US, where consumption rises sharply with age and the elderly mostly live in separate households and receive public pensions and health care and, on average, have asset income and perhaps occupational pensions.

Public and private transfer inflows and outflows in the US and Taiwan

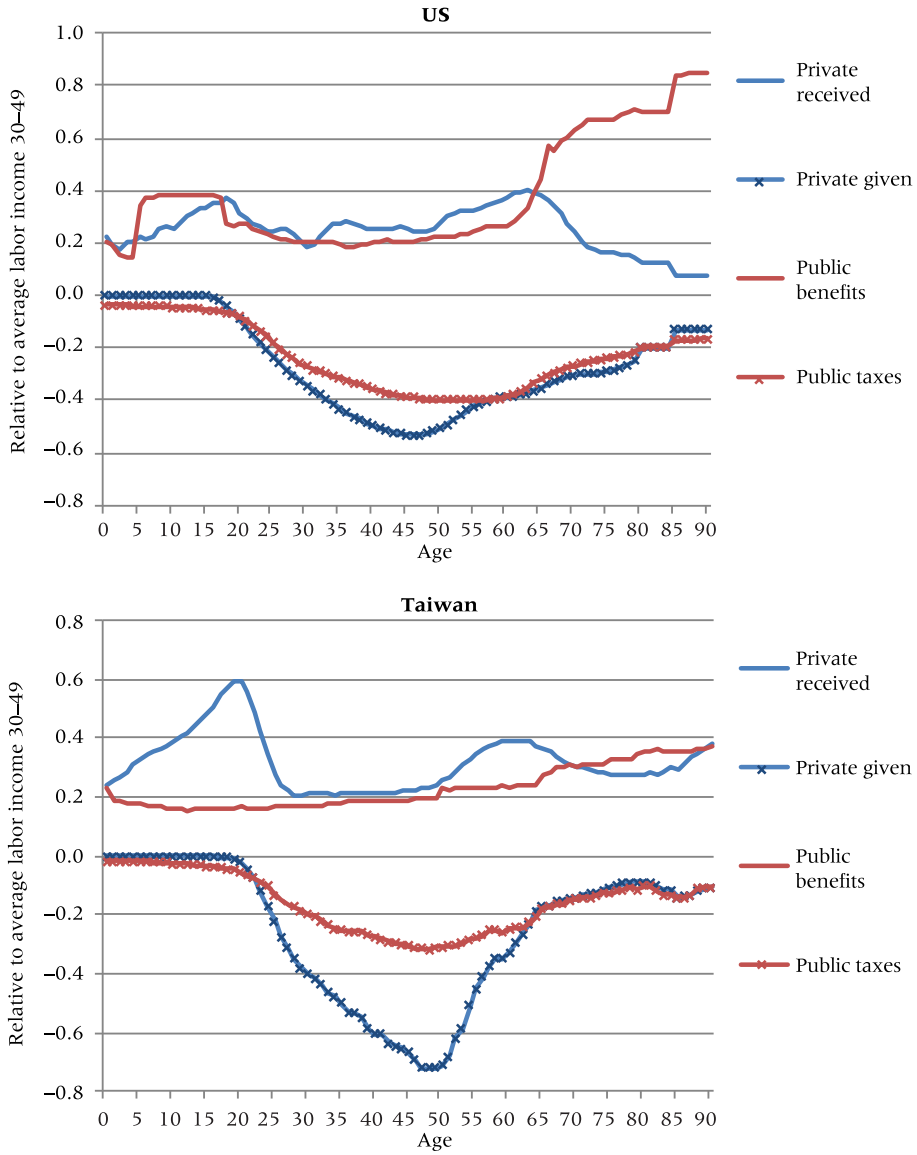
In most countries the public transfers received (public inflows) are lower during working age and higher during childhood and after retirement, especially in countries with a PAYG pension system. Taxes (public outflows) are predominantly paid by people in working ages, although sales and property taxes are paid by the elderly as well. Figure 2 shows the age profiles of private and public transfers made and received for the US and Taiwan, relative to the average per capita labor income at ages 30–49 in each country, with all data from NTA.

Comparison of these age profiles for the two countries reveals some important differences. Public transfers to children and to the elderly are roughly twice as great in the US as in Taiwan. Private transfers to children in Taiwan are greater than in the US, leaving total transfers per child roughly equal in the two countries. For the elderly, however, the higher private familial transfers in Taiwan still leave total transfers received by the elderly far lower than in the US, and the elderly in Taiwan have much lower consumption than in the US compared to younger adults. On the side of transfers given, tax payments are generally higher in the US while private transfers are generally higher in Taiwan, with roughly 100 percent of labor income transferred to others by adults in their 40s in both countries. Adults themselves can nonetheless consume by virtue of receiving public and private transfers amounting to about 40 percent of their labor income and also by consuming some of their asset income.

Sustainability

By multiplying the age profiles shown in Figure 2 times the projected population age distributions (United Nations 2012a), we calculate the future

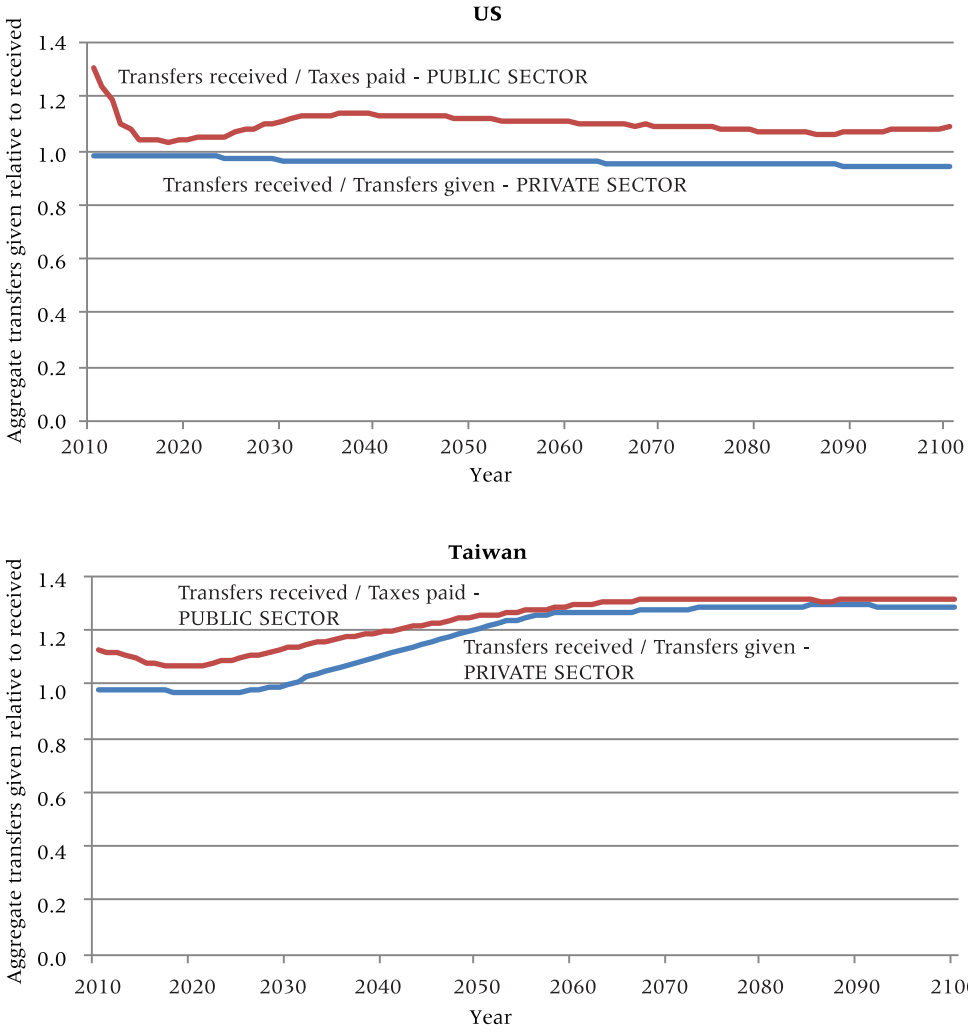
FIGURE 2 Per capita age profiles of private and public transfers received and given for the US and Taiwan, expressed relative to average labor income in each country at ages 30–49



SOURCE: NTA estimates. See Tung and Lai (2011) and Lee, Donehower, and Miller (2011).

trajectories of aggregate public inflows and outflows to reveal any imbalances that would result from the initial age profiles under population aging with no program adjustments. The results are shown in Figure 3. For the US public sector, as the population ages, the ratio of aggregate public benefits paid to taxes received would increase as the baby boom generation ages. The

FIGURE 3 Ratio of projected aggregate transfers received and given for the US and Taiwan if no adjustment, public and private sectors



SOURCE. Constructed from calculations described in the text and United Nations 2012a.

long-term outlook is unclear due to uncertainty about the rate of increase of health costs, but these projections show the situation slowly easing after 2040, although remaining in deficit. The public sector situation in Taiwan is more dire, with benefit costs coming to exceeding revenues by 30 percent after midcentury.

Population aging can also exert pressures on private transfers, although this is little noted. In Taiwan pressures on private transfers look very similar to those on public ones, although taking longer to develop. This would also be true for some other countries in Asia, particularly East

Asia. By contrast, population aging in the US will be beneficial for private transfers because the elderly are net givers, as they are in most rich industrial countries as well as in Latin America.

Overall, then, it appears that population aging will pose more serious challenges for transfer systems in Taiwan than in the US.

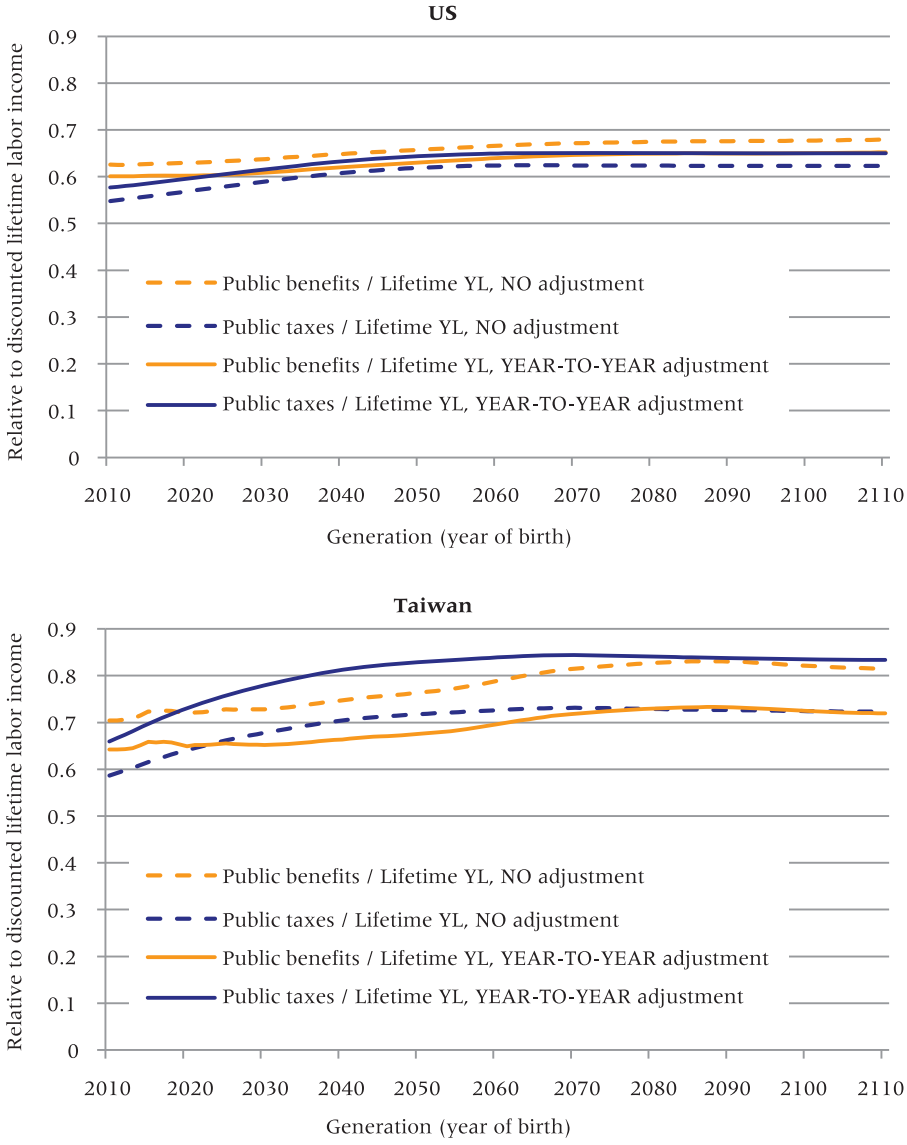
Discounted inflows and outflows

The imbalances for each calendar year in public and private transfer systems were shown in Figure 2, but for our purposes we re-express these on a generational basis. In the GA approach, all projected inflows (transfers received) and outflows (transfers made, or taxes) are discounted back to the base year, in our case 2010. Here, however, we discount these imbalances to the year of birth for all generations born from 2010 to 2110. For comparability, we show the results relative to the discounted value of lifetime labor income.[4] (This standardization for these stocks differs from the earlier standardization for the age profiles of flows in Figure 2, which were divided by the average flow of labor income at ages 30–49.) We assume that the shape of the relative age profiles of inflows and outflows remains the same, while the level shifts up by 1.5 percent per year, which is the assumed rate of productivity growth. We discount at 3 percent per year.

One of the standard indicators in the GA framework for long-term imbalance in the current public system is the immediate percentage permanent increase (or decrease) in all taxes or transfers that would be required to achieve intertemporal balance in the public sector in the long run. A large required immediate adjustment is usually discovered. Those results serve only to measure the size of the intertemporal imbalance without aspiring to be feasible. In contrast, we gradually adjust inflows and outflows to make them balance on a year-to-year basis, 50–50, through raising taxes and reducing benefits. Below, we present the public and private generational accounts both with and without these balancing adjustments so their effects can be assessed. Our goal is to analyze the impact of future adjustments in benefits and taxes on lifetime transfers given and received for individuals born during the next century.

Without any adjustments, the discounted public benefits of newborns over their lifetime exceed discounted public taxes for all generations born between 2010 and 2110 in both countries (Figure 4, dashed lines in upper and lower panels). There is moderate increase in these present values for those born later due to demographic factors such as increased longevity and changes in levels of migration. Public benefits and taxes are higher in Taiwan than in the US. The solid lines in Figure 4 show the results after the yearly adjustments for public transfers. In the US, population aging will

FIGURE 4 Present value (PV) at birth of public transfers and tax payments prior to and after adjustments to maintain fiscal balance year to year, US and Taiwan, as a percent of the PV of lifetime labor income (YL)



SOURCE: Constructed from calculations described in the text and United Nations 2012a.

require a long-term increase in public taxes of a few percent of lifetime labor income, and the discounted value at birth of public benefits will have to decline by a similar amount. The present values of lifetime taxes and benefits remain very close over the course of these adjustments. However,

for generations born between 2010 and 2020, the present value of benefits exceeds that of taxes, followed by a number of decades in which the present value of taxes slightly exceeds that of benefits, while after 2070 they are equal.

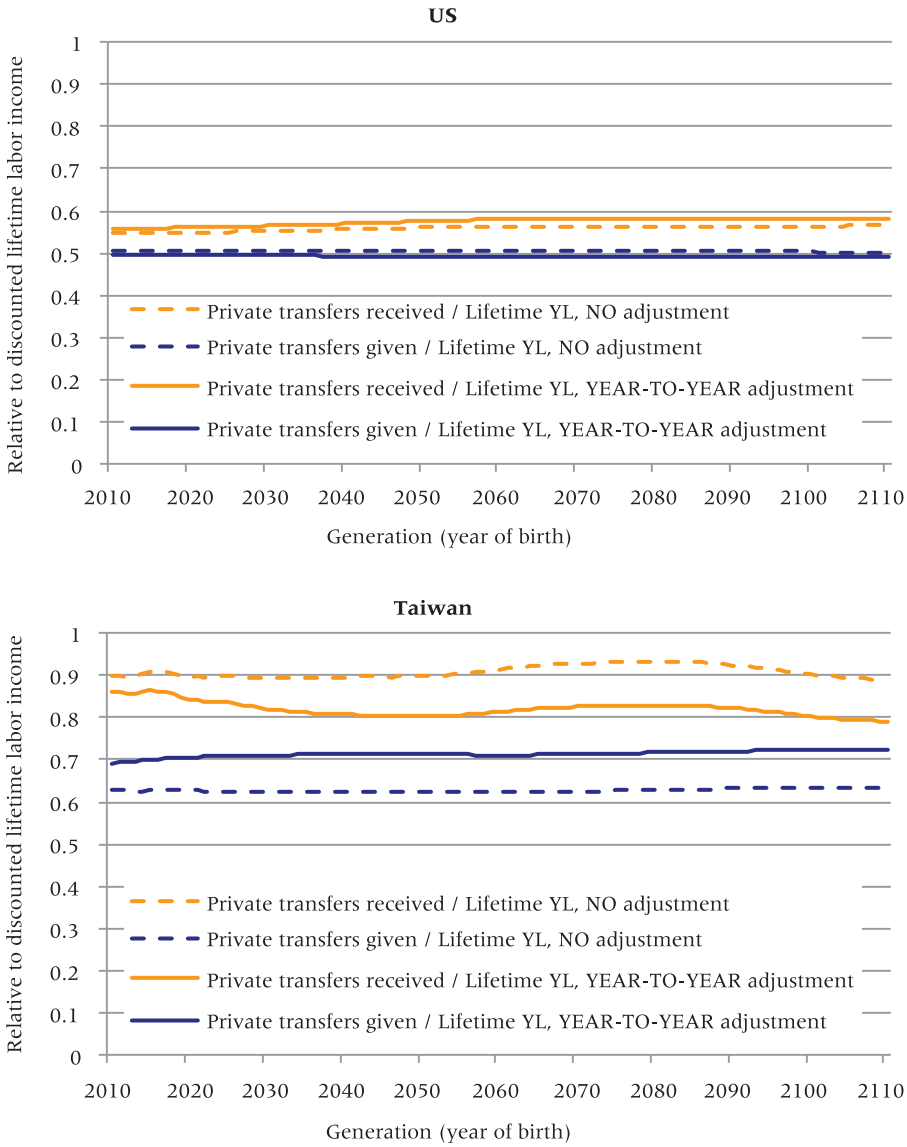
In Taiwan, where population aging will be more rapid and more severe due to very low fertility, the situation is different. For newborns the present value of taxes will rise far more than that of benefit payments. For the generation born in 2010, the balance is only slightly negative (the present value of taxes is about 2 percent higher than that of benefits); thereafter the gap increases up to 15 percent for later generations before declining slightly.

Figure 5 shows the analogous private transfer results for newborns. As already explained, only the adjusted paths for private transfers are meaningful. In both countries, lifetime private transfers received are greater than lifetime private transfers given, both before and after adjustment. In the US, population aging relaxes the private budget constraint because the elderly make net downward transfers to their children and grandchildren. Adjustment slightly raises the excess of the present value of transfers received over those given. In Taiwan, the present value of private transfers received is much greater relative to lifetime labor income than in the US, by about 35 percentage points for the generation born in 2010, and this is 27 percentage points greater than the present value of transfers given. But after adjustment, this positive gap declines, initially to about 17 percentage points and by mid-century to only 9 points.

If we shift our attention to births about a generation later, born in 2040, the story changes somewhat owing to more rapid population aging in Taiwan than the US. In the US, the present value of net public transfers drops from +2.4 percent to –1.2 percent, while the present value of net private transfers rises from 6.2 percent to 7.7 percent. In Taiwan there are larger adverse changes, from –1.7 percent to –14.9 percent for net public transfers and from 17.0 percent to 9.3 percent for net private transfers.

In real populations, the rate of return earned on contributions to public transfers is close to the population growth rate plus the growth rate of productivity (that is, the growth rate of GDP), a relationship that is exact in steady state. But interest rates are generally higher than this. Therefore the net present value (NPV) of net upward transfers from younger to older, such as transfers to the elderly, is generally negative, while the net present value of downward transfers from older to younger, such as transfers to children, is generally positive. Public transfers are mainly the first kind, with negative NPVs, while private transfers are mainly of the second kind, with positive NPVs.

FIGURE 5 Present value at birth of private transfers and tax payments prior to and after adjustments to maintain fiscal balance year to year, US and Taiwan, as a percent of the PV of lifetime labor income (YL)

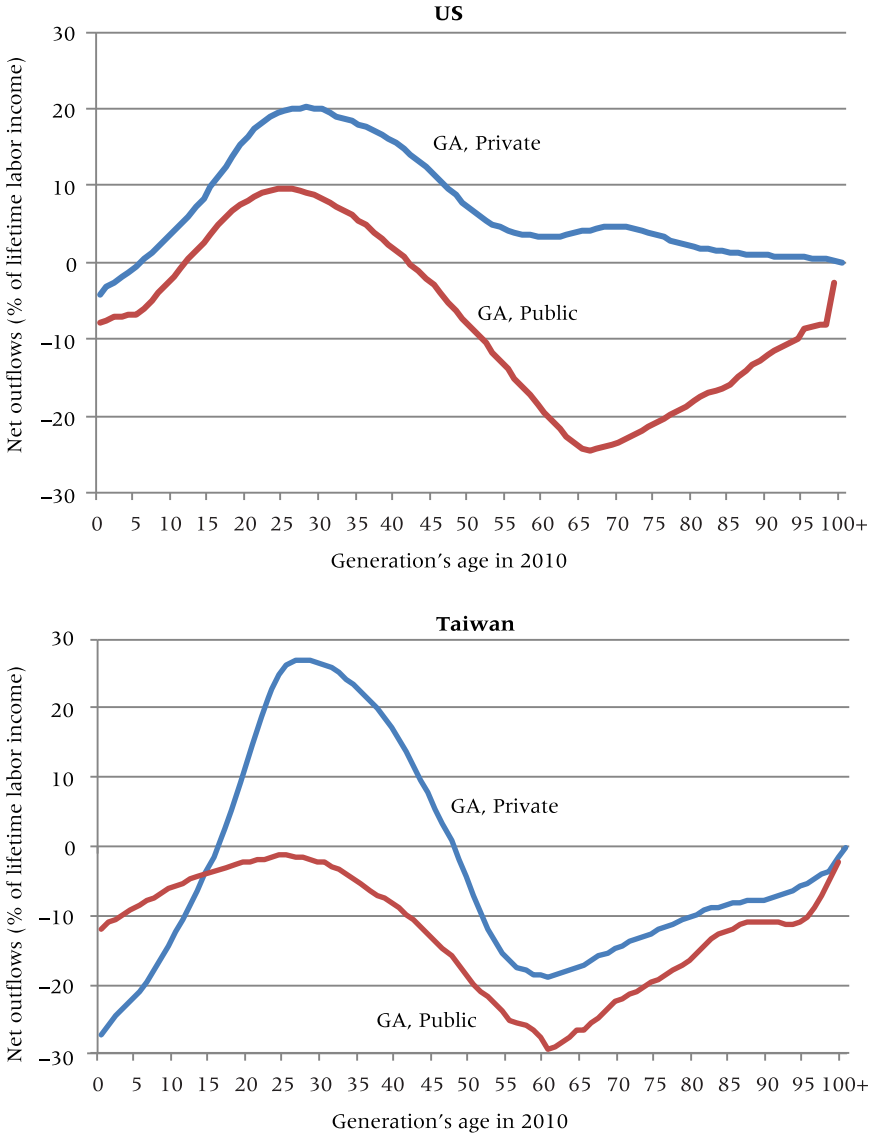


SOURCE: Constructed from calculations described in the text and United Nations 2012a.

Generational accounts for public and private sectors

We first discuss the generational accounts without adjustment to maintain balance in the future, as shown in Figure 6. The horizontal axis gives the age

FIGURE 6 Public and private generational accounts (GA) without balancing adjustments or bequests: NPV of expected future transfers (given – received) by age of generation in 2010, US and Taiwan, as a percent of PV lifetime labor income of births in 2010



NOTE: Negative values indicate positive net transfers received, and conversely.
SOURCE: Constructed from calculations described in the text and United Nations 2012a.

of different generations in the base year, 2010. The lines give the net present value over the remaining years of each generation as of 2010 of transfers given (or taxes paid) minus benefits or private transfers received, but excluding bequests made and received. A negative value indicates that in its

remaining lifetime the generation will receive more than it gives in present value, whereas a positive value means the generation will pay more than it receives. For the US a newborn in 2010 has negative NPVs for both public and private transfers, valued at –4.1 (private) and –7.8 (public) percent of the discounted value of lifetime labor income. For Taiwan the corresponding numbers are –27.1 and –11.8 percent, showing much larger private and public surpluses for the generation of 2010 under the assumption of no future adjustments in the transfer systems.

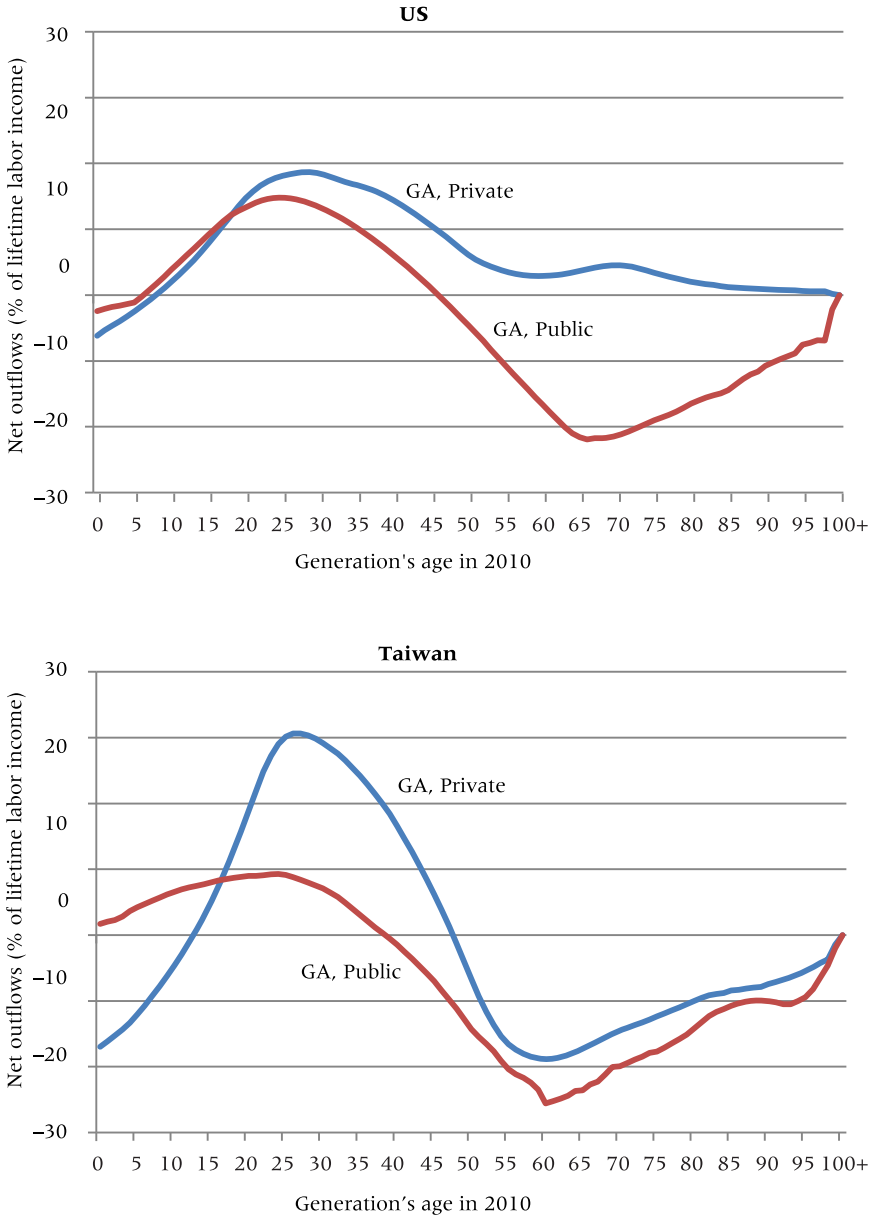
Two important conclusions follow. First, standard Generational Accounting for the public sector is only a small portion of this particular NPV outcome; second, newborns in 2010 are doing better than zero in both countries. In Taiwan the public NPV is larger than the private one, and both are larger (in absolute value) than their US counterparts.

For the public sector the patterns by age are qualitatively similar in Taiwan and the US. They start negative, reflecting the costly public education that is received at a young age and is therefore discounted only slightly. As children age there is less public education remaining to enter the NPV calculation, but the amount of tax payments to support future transfers for public education and the aging population is undiminished and indeed its discount factor declines over time, so the NPV rises to reflect these tax payments. Then as individuals move through the working years there are fewer taxpaying years remaining, while the retirement benefits are undiminished and are more lightly discounted, so the NPV falls into the negative range in which benefits predominate. Then, once pension benefits begin, aging reduces the future years over which they will be received, and the NPV rises toward zero.

For the private sector the same forces are at work. In Taiwan the age pattern is qualitatively similar to that for the public sector, because familial old-age support mimics pension benefits, and support of a co-resident elderly parent in the prime working years mimics payroll tax payments for pensions and health care. For the US, however, the elderly are never net recipients of private transfers, so the NPV declines gradually toward zero as the number of future years of making net transfers to others declines toward zero.

Figure 7 shows generational accounts for the case in which the projected public and private transfers have been balanced in each year, half by cutting inflows and half by raising outflows.[5] Assuming that both public and private transfer systems are restructured to achieve balance might seem to assume away the very point of interest in this article. Actually, this is not so. Bommier et al. (2010, Figure 4) show that all generations in the US would do better with no reform, on the assumption that transfer systems could continue to function. Without restructuring, newborns would be able to enjoy the same low taxes and high benefits that create the imbalance. Restructuring would raise their taxes and cut their benefits, so of course

FIGURE 7 Public and private generational accounts (GA) with balancing adjustments but no bequests: NPV of expected future transfers (given – received) by age of generation in 2010, US and Taiwan, as a percent of PV lifetime labor income of births in 2010



NOTE: Negative values indicate positive net transfers received, and conversely.
SOURCE: Constructed from calculations described in the text and United Nations 2012a.

their net present values for the public sector are less favorable. Comparison of Figures 6 and 7 confirms this point for Taiwan. With no adjustment, every generation has a negative public NPV in Figure 6, whereas in Figure 7 every generation under 40 has a positive value and therefore receives less than it pays. Taiwanese newborns in 2010 lose 2 percent of their present value of lifetime labor income with adjustment instead of gaining 12 percent through public transfers. For the US the differences are smaller, but a 25-year-old in 2010 will lose 15 percent through public transfers with adjustment, but will lose only 10 percent without adjustment. Unfortunately, the assumption that the transfer systems could continue to function without restructuring is not defensible, so results premised on restructuring are more realistic and informative.

For private transfers, newborns in the US do slightly better with balancing, for reasons already discussed, while in Taiwan they do not do nearly as well after rebalancing because of the rising costs of supporting the elderly. A newborn in Taiwan gains 17 percent through private transfers compared with 27 percent without adjustment.

Full Generational Accounts including bequests

The Full Generational Account (FGA) is the sum of the public and private components. As discussed earlier, FGA can be calculated based on gross transfers received, net transfers received, or a hybrid of net public and gross private. The FGA also includes the value of bequests received, discounted to birth. Since the average age of receiving a bequest will be in the 50s, and $\exp(-55*.03) = .19$, the bequest is heavily discounted in the calculation.

Using procedures and software developed by Miguel Sanchez-Romero (see Appendix B), we estimated that the present value at birth of future bequests received is 7.5 percent of the present value of lifetime labor income (PVYL) for both countries. As discussed in the appendix, the estimated value of bequests varies widely when different assumptions are made. Fortunately the bequest calculation reinforces the other results rather than counteracting them.

Table 1 shows the resulting FGAs. For the US, if we add the public and private NPVs to calculate FGA-N, the net transfer to the newborns of 2010 is 9 percent of the present value of their expected lifetime labor income. For Taiwan the net transfer is even larger at 15 percent. As suggested earlier, these sizable positive values indicate that the newborns of 2010 are benefiting from transitional advantages of one sort or another, since in steady state the value would be zero. In fact, in both countries the net public transfer is very close to zero: 2.4 percent in the US and –1.7 percent in Taiwan. It is the net private transfers that elevate the total net transfer.

Of course the FGA-G, the sum of the gross transfers received, is far larger: 123 percent for the US, 158 percent for Taiwan. In the US, the private

TABLE 1 Full Generational Accounts for the US and Taiwan as a percent of present value of lifetime labor income for newborns in 2010

	US	Taiwan
Gross public received	60.1	64.2
Gross public paid	57.7	65.9
Net public received	2.4	−1.7
Gross private received	55.7	86.2
Gross private paid	49.5	69.2
Net private received	6.2	17.0
Bequests received	7.5	7.5
FGA-N (net received)	8.6	15.2
FGA-G (gross received)	123.3	157.9
FGA-H (net public + gross private received)	65.6	92.0

NOTE: Net bequests are assumed to be zero for the net private FGA measures, but bequests received are added to the gross private in FGA.
SOURCE: Constructed from calculations described in the text and United Nations 2012a.

transfers received are slightly less than the public (56 percent vs 60 percent), while in Taiwan the reverse is true (86 percent vs 64 percent). In both cases the FGA-G indicates that the generation born in 2010 will receive more in total transfers over its lifetime than it earns through its labor over its lifetime, in present values.

Finally, if we exclude the private transfers that this generation is expected to make to others, on the grounds that these are voluntary, we obtain the FGA-H, which lies between the other two measures. For the US this is 66 percent, for Taiwan 92 percent.

Both the FGA-G and FGA-H are very large numbers, consistent with the view that individuals are passing very large amounts of wealth, in one form or another, down the generations. Some of these transfers take the simple form of parental provision for their children's basic consumption.

We can make similar calculations for the newborns of other years, based on the projections shown in Figures 4 and 5. For births in 2040, roughly one generation later, the total net transfer (FGA-N) drops from 8.6 percent to 6.4 percent in the US and from 15.2 percent to –5.5 percent in Taiwan. In Taiwan net private transfers drop substantially, but net public transfers drop even more.

Conclusions

To get an accurate picture of intergenerational transfers and intergenerational equity, we need to look at both public and private transfers. The relative importance of public and private transfers to children and the elderly can vary greatly from country to country, as the US and Taiwan examples

illustrate. Focusing on just one or the other can mislead about the overall situation. Lifetime private transfers received are equal to public ones in the US, and are half again as large in Taiwan.

Public transfer programs are unsustainable in both the US and Taiwan in light of the pension and health care costs of population aging, and quite large adjustments to programs are necessary to achieve balance. For the US, private transfers are close to long-term balance and will actually benefit slightly from population aging, because the elderly make net private transfers to the young. Population aging permits either each newborn to receive larger transfers or the elderly to make smaller transfers, or both. In Taiwan, by contrast, the elderly receive substantial net transfers from their children, and population aging will affect the private transfer system in ways similar to the public one.

Our basic results suggest that despite population aging, growing welfare-state transfers to the elderly, early retirement, increased reliance on annuitized PAYG public pensions, and other developments in the US, younger generations still receive a very large lifetime transfer from preceding generations. In both countries, the gross transfers received exceed the present value of lifetime labor income: 123 percent in US, 158 percent in Taiwan. Of these gross transfers, 10 percent are for education in the US, coming mostly through the public sector, and 12 percent in Taiwan, coming mostly through the family.

But the 2010 generation will also be required by law (for the public sector) and by sociocultural norms (for the family) to make large transfers to others. Consequently, the net value of transfers received is less than one tenth the value of the gross, or 8.6 percent for the US and 15.2 percent for Taiwan. In steady state, these net transfers would be identically zero, so their positive value here indicates that the generation of 2010 will benefit from transitional changes in the demography, economy, and policy in both countries. A hybrid measure based on net public and gross private transfers lies halfway between the net and the gross. By all three measures, then, newborns in 2010 will receive over their lifetimes a large endowment from their elders, including a heavy investment in their human capital.

The generation born 30 years later, in 2040, will again receive very large gross transfers. In the US it will also receive a total net transfer very similar to the generation of 2010. In Taiwan, however, where population aging will be more severe, the net transfer will turn negative (–5.5 percent) due mainly to pressures on public transfers.

We would like to know how Full Generational Accounts have varied over time. Are we giving more or less to newborns today than in past decades? It would also be informative to compare the transfers to newborns in other countries around the world. These topics will be addressed in future work.

Appendix A

Constructing consistent and balanced NTA profiles

To calculate the FGA for a generation, we require the NTA flows over the remainder of its life, say for 90 or 100 years. The simplest approach would be to project forward the baseline NTA age profiles for public taxes and transfers, saving and dissaving, and similarly for private transfers including bequests. The difficulty is that various balancing constraints will not be satisfied; for example, future asset holdings by age may not be consistent with future bequest flows. It is a complex task to construct future NTA trajectories along which the balancing constraints are all satisfied. McCarthy et al. (2016) achieve balance by treating the bequest flows as residuals.

A different approach to balancing is taken by Mason and Lee (2007), who develop a model and algorithms to do this by solving by backward recursion for the unique trajectory that satisfies all the constraints for an exogenously specified but possibly variable share $\tau(t)$ of net consumption in old age that is financed through transfers (public or private) versus asset income at time t. In this model the shapes of the cross-sectional age profiles for consumption and labor income are maintained, consistent with the idea that the cross-sectional intergenerational equity achieved through public and private sharing is central rather than individual life cycle optimization. In this setup, the share $\tau(t)$ can be viewed as a policy instrument, with variations driven by changes in public transfer programs, or it can be viewed as a relatively invariant cultural feature of a society. In practice in NTA baseline data, τ varies from close to zero (Mexico, Philippines, India) to close to 1.0 (Austria, Sweden, Slovenia, Hungary, Brazil), with the US around .33, Germany around .70, and Japan .60.

As populations age, the demand for assets to finance the consumption of the more numerous elderly rises, which raises the asset holdings per capita. If τ is closer to 0, then this effect (which is one component of the so-called second demographic dividend) may be large, and if τ is closer to 1.0 the effect will be small. If the economy is closed, then rising assets will correspond to rising capital stock, which will raise wages while reducing the rate of return to capital and interest rates. If the economy is open, then wages, interest rates, and rates of return to capital will all be determined on the international market, and the increased asset holding per capita will raise asset income per capita.

This model and analysis can be used to construct unique trajectories satisfying all the cross-sectional and inter-temporal balancing constraints for consumption, savings, assets, bequests, and labor income for any country in the NTA database. Once this is done, it is straightforward to calculate the net present values needed to estimate Full Generational Accounts.

In this approach it is somewhat arbitrary to whom ownership of assets is assigned. If ownership of assets is arbitrary, then so is calculation of bequest flows. Within the model, the trajectories of asset accumulation and consumption by age are determined, along with the degree to which assets are consumed or saved. The overall flow of assets to the younger generation is likewise determined, but the precise timing of these flows, and whether inter vivos or end of life, will depend on the way that ownership of assets is assigned.

Our approach here is more limited. We adjust the public and private transfer programs to achieve balance in each future year, with half the adjustment falling on transfers received and half on transfers given. For example, future shortfalls in the Social Security system would be balanced in the face of population aging half by raising payroll tax rates and half by reducing the level of benefits. Familial transfer systems would be treated similarly. However, the full balance equilibrium including saving rates and asset accumulation is not derived, although the preceding paragraphs explain how it might be done in future work.

Appendix B

Estimating bequest flows

The estimation of bequest flows was carried out using methods and software developed by Miguel Sanchez-Romero. The basic approach is to use the reported asset income for each age and to divide this by an average rate of return on assets, to estimate the per capita asset holding at each age. On the assumption that age-sex-specific mortality is independent of asset holdings (surely not true, but the best that can be done for now), the average bequest left by people dying at age x can be calculated given death rates taken from the Human Mortality Database or other source. Although it is possible that some portion of the bequest goes to institutions, we assume that a specified percentage goes to children (equally divided among them) with the remainder going to a surviving spouse if applicable. The age distribution of children of a man or woman at age x is calculated from the age-specific fertility rates of earlier years, as given in unpublished United Nations data. In this way the average bequest inflow and outflow at each age is calculated, subject to specification of the children's share of bequests, which is typically taken to be 50 percent.

Rates of return on capital are set on international markets for open economies, and it appears that a rate of return (r) of .08 or .09 is a reasonable number. However, a substantial share of capital is in the form of housing, and these rates of return may be different. It is also possible to calculate the rate of return to capital from a production function, as the marginal product of capital minus the rate of depreciation, which is usually taken to be about

5 percent per year. The share of asset income in national income varies and is much higher in Taiwan than in the US.

After trying many approaches, we chose to use the simplest, that is, to assume that the rate of return to the average asset (housing, stock market holdings, farms, etc.) is .08, so that asset holdings at each age are 12.5 times the average asset income received at that age. On this assumption, bequest inflows over a lifetime discounted to birth are equal to 7.5 percent of the net present value of lifetime labor income in both the US and Taiwan. This equality is coincidental, and we have found very different values across the range of NTA countries.

To test robustness we used other assumptions to adjust the levels of reported asset income by age, in line with various macroeconomic data and production functions. For example, in one estimate we used the capital share of income in national accounts, leading to a bequest share of 10 percent for the US and 14 percent for Taiwan (out of the present value of lifetime labor income). Assuming that international factor markets lead to a labor/capital ratio of .13 in both countries implies a US share of 15 percent and Taiwan share of 8 percent. For a labor to capital ratio of .1, these shares are 20 percent and 11 percent. Obviously there is considerable uncertainty here, which is unlikely to be resolved. Every kind of data, including probate records and survey data directly on bequests, has its biases. The hope is that variations within this range of estimated shares will not have a major effect on the main conclusions.

Notes

Lee's research was funded by the National Institutes of Health through grants NIA R37 AG025247 and R24AG045055. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. We are particularly grateful to An-Chi Tung and Mun Sim Lai, who developed the National Transfer Accounts and the Generational Accounts for Taiwan; to Ivan Mejia, who estimated the standard Generational Accounts for the US; to Gretchen Donehower, who provided the latest National Transfer Accounts estimates for the US; and to Miguel Sanchez-Romero, who developed the techniques and software for estimating bequests and advised us on our use of his methods.

1 This condition is automatically satisfied for private transfers, but the situation is more complicated for public sector transfer programs such as the US Social Security system. These programs may generate cash flow surpluses, such as was the case by design for US Social Security in recent decades until recently, or flow deficits that are made up by subsidies from general government revenues. For accounting purposes, we treat the balance constraint as definitional, by viewing these surpluses and deficits of particular public transfer systems as part of the broader revenue/expenditure operations of the government in operating the transfer system, and not as a violation of the principle of a pure PAYG transfer system.

2 Viewed on a closed-system basis (that is, taking account only of the payments due from or to current members of the system), every transfer system creates implicit debt if the transfers are upward as with public pensions, or implicit credit if transfers are

downward as with public education. This is an intrinsic feature of any transfer system and is not a problem. It becomes a problem, as with the US Social Security system, when implicit debt exists on an "open system" basis, that is, when the present value of expected future payments into the system is very different from the present value of expected future benefit payments provided by the system, even when the payments and benefits of future system members are taken into account. Transfer systems with only closed-system liabilities can generally run indefinitely without changes, but systems with significant open-system liabilities will need subsidies or adjustments.

3 As discussed, private transfer systems are always in balance. When we say that private transfer systems are unsustainable, we mean that it is not possible for the current age profiles of giving and receiving private transfers to remain unchanged in the future as the population ages.

4 In the calculations we follow cohorts (i.e. diagonals) in projections of labor income. The projections of labor income are obtained by multiplying age profiles of labor income (from the base year, shifted up by g and discounted at rate r) and the population projections (by age) which include net immigrants. Thus, the results also depend on the number of immigrants, not only on the proportion of the original birth cohort that survives to each age.

5 Balancing the public and private transfer systems as populations age would lead to further changes that we have not taken into account here; for example, bequests would then be altered.

References

Auerbach, Alan J., Jagadeesh Gokhale, and Laurence J. Kotlikoff. 1991. "Generational accounts: A meaningful alternative to deficit accounting," in David Bradford (ed.), *Tax Policy and the Economy*. Cambridge, MA: MIT Press, for the National Bureau of Economic Research, pp. 55–110.

Becker, Gary and Robert Barro. 1988. "A reformulation of the economic theory of fertility," *Quarterly Journal of Economics* 103(1): 1–25.

Bommier, Antoine, Ronald Lee, Tim Miller, and Stéphane Zuber. 2010. "Who wins and who loses? Public transfer accounts for US generations born 1850–2090," *Population and Development Review* 36(1): 1–26. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2840408/

Lee, Ronald and Andrew Mason (eds.). 2011. *Population Aging and the Generational Economy: A Global Perspective*. Edward Elgar.

Lee, Ronald, Gretchen Donehower, and Tim Miller. 2011. "The changing shape of the economic lifecycle in the United States, 1960 to 2003," in Ronald Lee and Andrew Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective*. Edward Elgar, pp. 313–326.

Mason, Andrew and Ronald Lee. 2007. "Transfers, capital, and consumption over the demographic transition," in Robert Clark, Naohiro Ogawa, and Andrew Mason (eds.), *Population Aging, Intergenerational Transfers and the Macroeconomy*. Cheltenham, UK: Edward Elgar, pp. 128–162.

McCarthy, David, James Sefton, Ronald Lee, and Jože Sambt. 2016. "Generational wealth accounts," https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3052381.

Nerlove, Marc, Assaf Razin, and Efraim Sadka. 1987. *Household and Economy: Welfare Economics of Endogenous Fertility*. Orlando, FL: Academic Press.

Razin, Assaf and Efraim Sadka. 1995. *Population Economics*. Cambridge, MA: MIT Press.

Tung, An-Chi and Nicole Mun Sim Lai. 2011. "Living arrangements and support for the elderly in Taiwan," in Ronald Lee and Andrew Mason (eds.), *Population Aging and the Generational Economy: A Global Perspective. Edward Elgar*, pp. 488–499.

United Nations. 2012a. *Estimates and Projections*.

———. 2012b. *National Transfer Accounts Manual: Measuring and Analyzing the Generational Economy*. ROA167.