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Full Generational Accounts: What do we give to the next generation?

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ABSTRACT: Full Generational Accounts: What do we give to the next generation?

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What do we give to the next generation? Do we make large transfers of wealth and human capital to our children, or do we saddle them with debt and obligate them to support us in our old age? Here we take exploratory first steps toward answering this question at the national level. Standard Generational Accounts (GA) calculates the net present value of public sector taxes and benefits. Full Generational Accounts (FGA) adds to this the Present Value of expected private transfers received over a lifetime, including parental costs of childrearing, bequests, and inter vivos transfers. FGA counts the private transfers received, but does not net out those made to others, because the latter are discretionary, unlike taxes. Using data from National Transfer Accounts (NTA) we make a first attempt to calculate FGA for the US, where public transfers to children and the elderly are important, and for Taiwan, where the family plays a larger role in both. We decompose the FGA into public and private components, and into human capital investments (health, education), bequests, and other consumption. The accounts refer to averages for ages and generations, with no disaggregation by socioeconomic status. They also do not reflect the intergenerational transfer of knowledge, technology, institutions, or the natural world. Nonetheless we believe that this approach may yield new and useful insights.

Introduction

Each generation supports the next and endows it with assets and human capital. Or so we like to think. But in rich industrial nations, increased public sector transfers to the elderly and rising public debt have redistributed income upwards 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 consumption and human capital investment per child, both public and private, other things equal.

Analysis of National Transfer Account data suggests that in the past, income was on average redistributed from older to younger people in all societies, but today redistribution is approaching age neutrality in many countries and has actually reversed direction in others, going from younger to older due to 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. Rhetoric aside, there is a real and serious question about intergenerational equity and endowments for the young.

Standard Generational Accounting, or GA (Auerbach, Ghokale 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 transfers to the elderly.

Here we broaden the measure 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 will be more specific and 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 included in standard National Accounts, and to include private transfers as well as public ones.

The motivation and emphasis is somewhat different than Generational Accounting (GA). Here 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 and 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 as well as 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 it will also be interesting 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 PAYGO pensions. The decomposed FGA provide estimates of all these quantities of interest, although not all will be reported in this paper.

This paper is a first attempt to estimate FGA. We construct the FGA for two countries, the US and Taiwan. In the US, as in most other rich industrial nations, 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), 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). For these reasons, the comparison of the two countries should be useful and interesting. In future work, we intend to construct similar FGA for many more of the currently 42 NTA countries. It may also be possible to extend the concept to include intergenerational transfers of time, as National Time Transfer Accounts are already under development for many countries.

The FGA Concept

Before we embark on estimation, it will be helpful to deepen our understanding of what we are seeking 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 τ(x) be the overall pattern of net transfers, that is, the average at each age of transfers received minus transfers given. In fact, τ(x) can represent either the sum of all transfers or any one of many sub-transfer systems such as Social Security taxes and benefits, or being raised by your parents and raising children yourself 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.

It is in the nature of transfers both overall and in each subsystem that they must sum to zero across the whole population, since a dollar given by one person is a dollar received by someone else.[i] 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 times 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 her lifetime? This is the 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 transfer inflows and outflows must balance in the population. Viewed longitudinally it tells us that discounted at the 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 and per capita income growth at a rate λ. In this case, the steady state cross-sectional net transfer profile would rise over time at this 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+ λ, which could be near the realistic "risk free" real rate of 2 or 3%, 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. However, as defined earlier the FGA is based on net public transfers but on gross private transfers received. In this case it need not be zero, even in this artificial steady state case.

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

1) When we assume that the transfer pattern τ(x) is unchanging, we are denying our newborn the ability to choose. Perhaps this makes sense in the case of government transfers which carry the force of law, and which must be taken as given by an individual, including legislated future changes such as the rising full retirement age for the US Social Security system. But childrearing is a different matter. A newborn will receive intensive support from her parents and grandparents while they live, and receive bequests from them when they die. These net transfers could easily be worth $500,000 or much more over the child's lifetime. By assuming unchanging patterns, we are assuming that these generous transfers are cancelled out (in the FGA) by the child's transfers to her own children when she herself becomes an adult parent and then grandparent. But is this not a choice she will make in the future, a way in which she may or may not choose to spend the life, education and gifts her forbears have given her? For this reason we find it more interesting to count only the gross transfers she receives, and not the gross transfers she makes to others which are a matter of choice for her.

2) We have assumed a stable population, while the actual populations around us are full of change. In the US, cohort fertility has varied 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 has risen from 47 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. Together these changes produce a rapidly aging population in the US and elsewhere around the world, with more adults to transfer to each child, but also more elderly to receive either public or private support from working adults.

3) Public transfer patterns have changed dramatically over the past 50 or 60 years in the US (and similarly in other industrial nations), with the rise in secondary school enrollments, rising level of

Social Security retirement benefits, the start of Medicare and Medicaid, and the rapid run-up of health care costs which push the costs of public health care steadily upwards. 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 change in the terms of transfer programs.

4) 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 nations (as we know from NTA—Lee and Mason 2011). This family support system for the elderly is changing in Taiwan, particularly as Taiwan moves 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.

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

6) Younger generations can be saddled not only with the excess implicit debt of unbalanced public transfer systems[ii], 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.

Because of all these changes, and because we exclude downward private transfers, the FGA can vary widely across generations within a country and across countries.

Some of the conceptual and practical difficulties of estimating and projecting the NTA flows and bequests are discussed in Appendix A and B. Estimation of the NTA age profiles is discussed in Lee and Mason (2011) and described in detail in United Nations (2013).

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% 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% (real) which is intended to correspond to the risk-free rate of return in the US, and which is widely used in life cycle calculations. With assumed productivity growth at 1.5% and a discount rate of 3%, we effectively discount the cross-sectional age profiles at 1.5% = (3%-1.5%) with respect to age.

For the public transfer accounts, we include all government expenditures such as for education, health care, pensions, long term care, the military, and so on. 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 non-coresident individuals. Bequests are calculated and presented separately as described in Appendix B.

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 as currently structured 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.[iii]

When we want to assess the sustainability of public or private transfer systems it makes sense to use the current age profiles, modified in the future to reflect any legislated planned reforms. We will 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 want to assess what will actually be given to the next generations, it makes sense to 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 raising taxes or transfers made, and half by reducing benefits or transfers received.

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 this approach of balancing transfer systems.

Age profiles of public and private inflows and outflows

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 1 shows**Error! Reference source not found.** the age profiles of private and public transfers made and received for the US and Taiwan, relative to the average 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 indeed the elderly in Taiwan have much lower consumption than in the US compared to younger adults. On the side of transfers given, we see that tax payments are generally higher in the US while private transfers are generally higher in Taiwan, with roughly 100% of labor income transferred to others by adults in their 40s in both countries.

They themselves can nonetheless consume by virtue of receiving public and private transfers amounting to about 40% of their labor income, and also by consuming some of their asset income.

Sustainability

By multiplying the age profiles shown in Figure 1 times the projected population age distributions (United Nations, 2012) we calculate the future trajectories of aggregate inflows and outflows to reveal any imbalances. The results are shown in Figure 2. For the US public sector, as the population ages, the ratio of aggregate public benefits paid to taxes received will increase as the Baby Boom generation ages. The long term outlook is very uncertain 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 direr with benefit costs coming to exceed revenues by 30% after midcentury.

Population aging can also exert pressures on the system of private transfers, although this is little noted. In Taiwan pressures on private transfers look very similar to the public, although taking longer to develop. This would also be true for some other countries in Asia, particularly East Asia. However, in the US population aging will be beneficial for private transfers because the elderly are net givers as they are in most rich industrial nations as well as 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

In the GA approach all projected inflows (transfers received) and outflows (transfers made, or taxes) are discounted back to the base year, here 2010. For comparability, the results will be shown relative to the discounted value of lifetime labor income[iv] (PVYL). (Note that this standardization for these stocks is different than the earlier standardization for the age profiles of flows in Figure 1, 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% per year, which is the assumed rate of productivity growth. We discount at 3% per year.

Without any policy adjustments to achieve fiscal sustainability the discounted public inflows would substantially exceed discounted public outflows for all generations born between 2010 and 2110. In the GA framework one of the standard indicators for long-term imbalance in the current public system is the immediate percentage permanent increase (or decrease) of all taxes or transfers that would be required to achieve intertemporal balance in the public sector in the long run. We want to analyze the impact of future adjustments in inflows and outflows on individual cohorts. Consequently we adjust inflows and outflows to make them balance on a year-to-year basis, 50-50 through raising taxes and reducing benefits. Below, we will present the public and private generational accounts both with and without these balancing adjustments so their effects can be assessed.

Figure 3 shows the results of the adjustments for the public transfers, and Figure 4 shows them for private transfers. We see that for the US, population aging will require a mild long term increase in public taxes, and that the discounted value of public benefits will remain very close to the discounted value of taxes over the course of these adjustments. For Taiwan, however, where population aging will be more rapid and more severe due to the very low fertility, the present value of taxes will rise far more

than that of benefit payments, to achieve balance. Figure 4 shows the analogous results for the private sector.

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 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.

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 5.

The horizontal axis of Figure 5 gives the age of different generations in the base year, 2010. The lines give the net present value of transfers given (or taxes paid) minus benefits or private transfers received. A negative value indicates that 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 we see that a newborn in 2010 has negative NPVs for both public and private transfers, valued at -2.4 (public) and -6.2 (private) percent of the discounted value of lifetime labor income (PVYL). Two important conclusions follow: first, Generational Accounting for the public sector is only a small portion of this particular NPV outcome; and second, newborns in 2010 are doing better than zero, the expectation for the steady state case discussed earlier. We will return to this point later. In Taiwan the public NPV is larger than the private one, and both are larger (in absolute value) than their US counterparts.

The patterns by age are interesting. For the public sector these are qualitatively similar in Taiwan and the US. They start negative, reflecting the costly public education that is received at a young age and discounted only slightly. As children age there is less public education in front of them to enter the NPV calculation, but the amount of tax payments to support future transfers to pay for public education and the aging population is undiminished and indeed its discount factor declines as it comes closer in time, so the NPV rises to reflect tax payments. Then as individuals move through the working years there are fewer taxpaying years in front of them 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 old parent in the prime working years mimics payroll tax payments for pensions and health care. For the US, however, the elderly never are net recipients of private transfers, so the NPV just declines gradually toward zero as the number of future years of making net transfers to others declines toward zero.

Figure 6 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. One might think that to assume that both public and private transfer systems are restructured to achieve balance is to

assume away the very point of interest in this paper. 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 their net present values for the public sector are less favorable. 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 more interesting. For private transfers, newborns do slightly better with balancing, for reasons already discussed.

Comparison of Figures 5 and 6 confirms this point dramatically for the case of Taiwan. With no adjustment, every generation has a negative public NPV in Figure 5, whereas in Figure 6, every generation under 40 has a positive value and therefore receives less than it pays. Taiwanese newborns in 2010 lose 2% of their PVLY with adjustment instead of gaining 12% through public transfers. A newborn gains 17% through private transfers instead of gaining 28% without adjustment.

For the US the differences are smaller, but a 25 year old in 2010 will lose 15% through public transfers with adjustment, but will lose only 10% without transfers. For private transfers, the differences are subtle and small.

Full Generational Accounts Including Bequests

The Full Generational Account (FGA) is the sum of the public and the private components, with two modifications. First, as discussed at the beginning, we may want to omit the cost of private transfers made since these are made by choice. Second, the FGA should include 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 Romero-Sanchez (see Appendix B) we estimated the PV at birth of future bequests received to be 7.5% of PVYL for both countries. As discussed in the appendix, this value 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 and the value of bequests, we find a net transfer to the newborns of 2010 of 16% of the present value of their expected lifetime earnings. If we exclude the private transfers that they are expected to make to others, on the grounds that these are voluntary, the transfer rises to about two thirds of their lifetime earnings. Similar calculations for Taiwan show an even larger net transfer, either 23% or 92%, depending on whether we exclude their expected private transfers to others.

In both cases these are very large numbers, consistent with the view that we 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 basic consumption by their children. Some is for education, amounting to 12 percent of PVYl in the US and 21 percent in Taiwan. This is nearly a fifth of the total FGA in the US and a bit more than a fifth in Taiwan. Bequests amount to 11% of the FGA in the US and 8% in Taiwan. Private transfers, including bequests, make up 96% of the FGA in the US, while public transfers make up 4%. In Taiwan the private transfers make up 102% of the FGA. It must be recalled, however, that these private transfers in the FGA are gross, not net of private transfers made, whereas

the public transfers are net. If we instead look at total gross transfers received over the lifetime of a newborn, these are split 50-50 between public and private in the US, and in Taiwan they are 41% public and 59% private. This difference reflects the larger role of the family in Taiwan, and the lower fertility which raises transfers received on a per child basis.

Conclusions

It is valuable to construct generational accounts for the public sector because this sector can pass on debt to future generations creating intergenerational inequities, and because public transfers are subject to explicit policy decisions. For private transfers debt cannot be passed down to younger generations in countries where children are not legally responsible for the debts of their parents, and consequently private transfers are always automatically in balance: for each dollar received by one person there is another person who gave that dollar.

Nonetheless, if we want an accurate picture of intergenerational transfers and equity then we need to look at both public and private transfers. There are substantial variations across countries in the extent to which transfers to children and to the elderly are public versus private, as the US and Taiwan illustrate. Focusing on just one or the other can mislead us about the overall situation.

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, the younger generations still receive a very large lifetime transfer from preceding generations, equal to about two thirds of their lifetime labor incomes. The situation in Taiwan is similar, with newborns expected to receive a transfer equal to more than 90% of their life time labor income. These large positive transfers reflect the very high value of receiving public education and other public and private transfers early in life.

Public transfer programs are unsustainable in both the US and Taiwan, due to the pension and health 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. This is because the elderly actually make small net private transfers to the young, so population aging permits either each newborn to receive larger transfers or the elderly to make smaller transfers, or both. In Taiwan the situation is different, since the elderly receive net transfers from their children, and population aging will affect the private transfer system in ways similar to the public one.

Bequests play only a moderate role in the FGA because they are on average received in the mid-50s, and when discounted to birth at 3% their value drops to less than 20% of the value at the time when they are received, whereas human capital investments are discounted for only a few years. Human capital investments amount to close to a fifth of the total FGA in both countries.

Lifetime private transfers received are equal to public ones in the US, and are half again as large in Taiwan. Expressed relative to the FGA, which does not net out private transfers made, private transfers account for virtually the entire amount.

It is important to note that this picture would change depending on the assumptions made about how public programs are balanced in the future, and it would also change if we looked at later born generations who may bear heavy adjustment costs if balancing is delayed and greater implicit and explicit public debt is accumulated (Bommier et al, 2010). Future work will explore these possibilities.

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Appendices

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 one hundred 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. It is a complex task to construct future NTA trajectories along which the balancing constraints are all satisfied.

Mason and Lee (2007) 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 τ(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 τ(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, Mexico) 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. For example, the phrase SKI trip assumes that in some sense the elders' assets already belong to their children. If ownership of assets is somewhat arbitrary then calculation of bequest flows is also somewhat arbitrary. Within the model, the trajectory of asset accumulation and consumption by age are determined, along with the degree to which assets are consumed versus 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 will be more limited. We will adjust the public and private transfer programs to achieve balance in each future year, with half the adjustment burden 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.

B. Estimating bequest flows

The estimation of bequest flows was carried out using methods and software developed by Miguel Romero-Sanchez. 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 (bad, but best we can do for now) assumption that age-sex specific mortality is independent of asset holdings, the average bequest left by people dying at age x can be calculated given death rates taken from Human Mortality Database or other source. Although it is possible that some portion of the bequest goes to institutions, we assume a specified percentage goes to children (equally divided among them) with the remainder going to a surviving spouse if one exists. 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%.

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% 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, stocks 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% of the net present value of life time earnings 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 10% for the US and 14% for Taiwan (out of the NPV 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% and Taiwan share of 8%. For a labor to capital ratio of .1, these shares are 20% and 11%. 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.

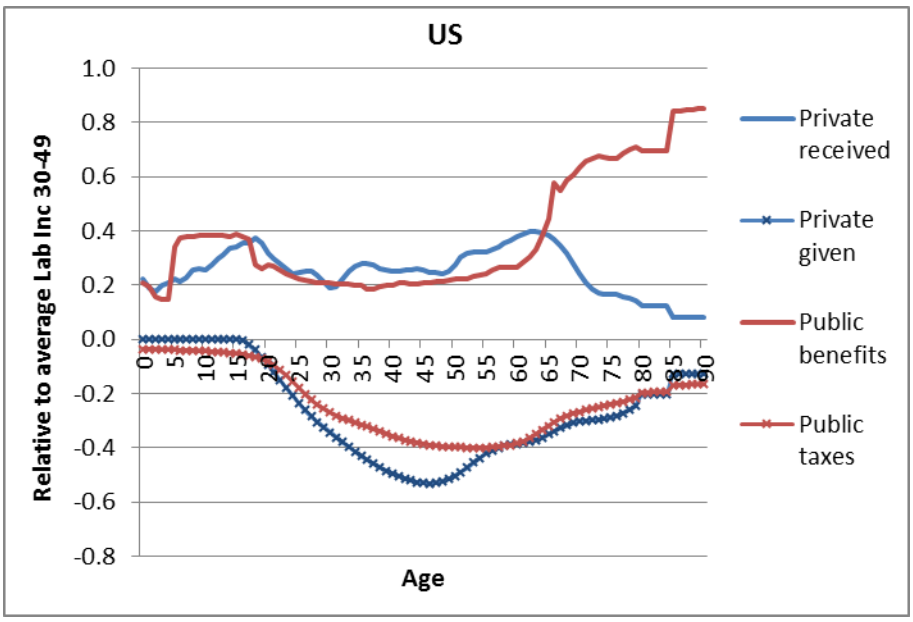
Table 1. The Full Generational Account (FGA) and its Decomposition, Expressed as a Percent of PV of Lifetime Labor Income

	Net public outflows	**Net private outflows**	**Bequests**	**TOTAL**	***Full Generational Account, Which excludes private outflows***
US	**-2.4**	**-6.2**	**-7.5**	**-16.1**	***-65.6***
Taiwan	**1.7**	**-17.0**	**-7.5**	**-22.7**	**-91.9**

Table 2. Net Transfers received as a % of PV of lifetime income
(With adjustments to public and private systems)

	US	Taiwan
NPV Pub	-2.4	1.7
NPV Priv	-6.2	-17
Bequests	-7.5	-7.5
NPV Tot	-16.1	-22.8
PV Priv O	49.5	69.2
No Prv O	**-65.6**	**-92**
Pub Rcvd	60.1	64.2
Priv Rcvd	55.7	86.2
Beq Rcvd	7.5	7.5
Tot Rcvd	**123.3**	**157.9**
Pub Ed	10.5	7.5
Priv Ed	1.8	13.1
Tot Ed	**12.3**	**20.6**

Figure 1. 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, ages 30-49



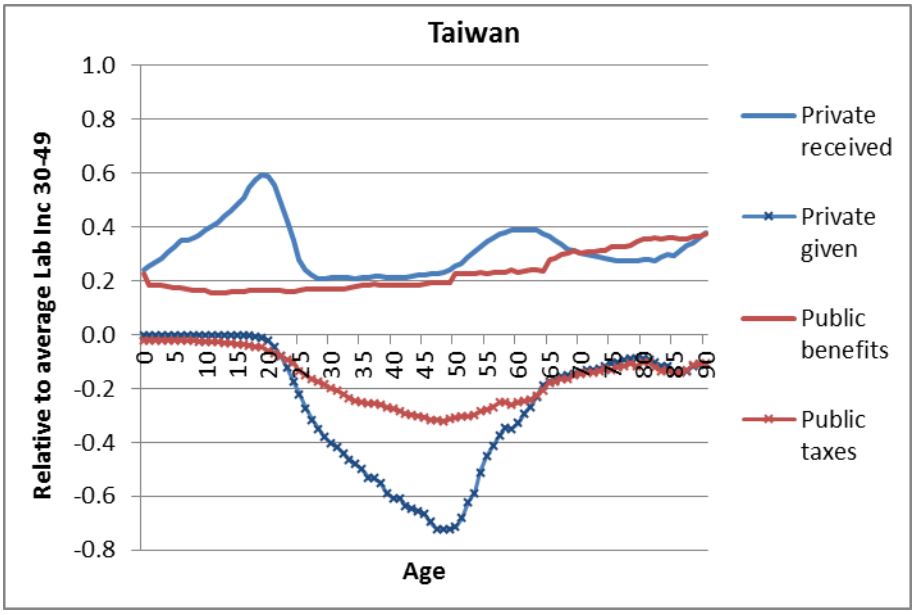
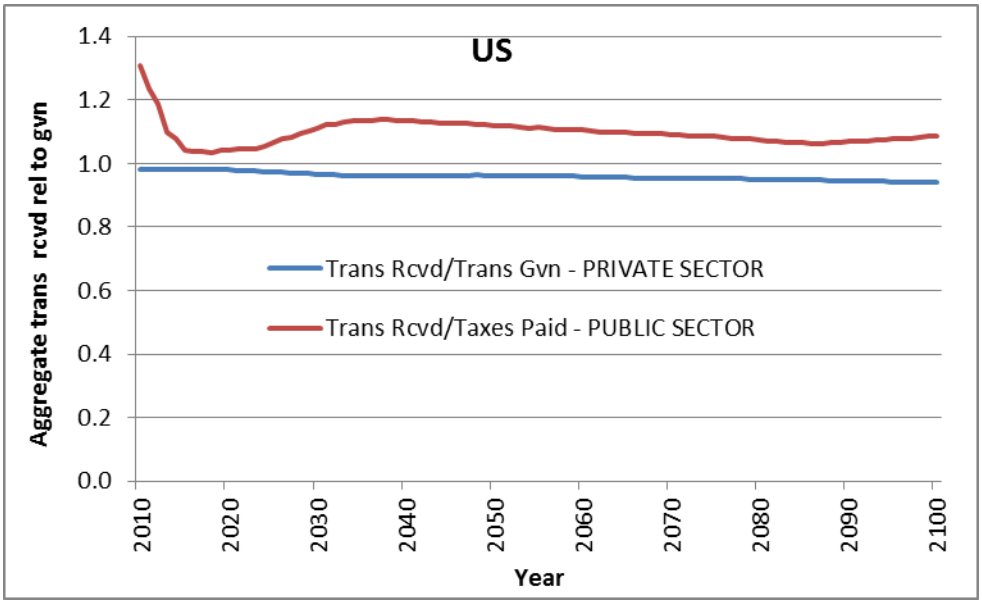


Figure 2. Are transfer systems sustainable? Ratio of Projected Aggregate Transfers Received and Given if no Adjustment, Public and Private Sectors



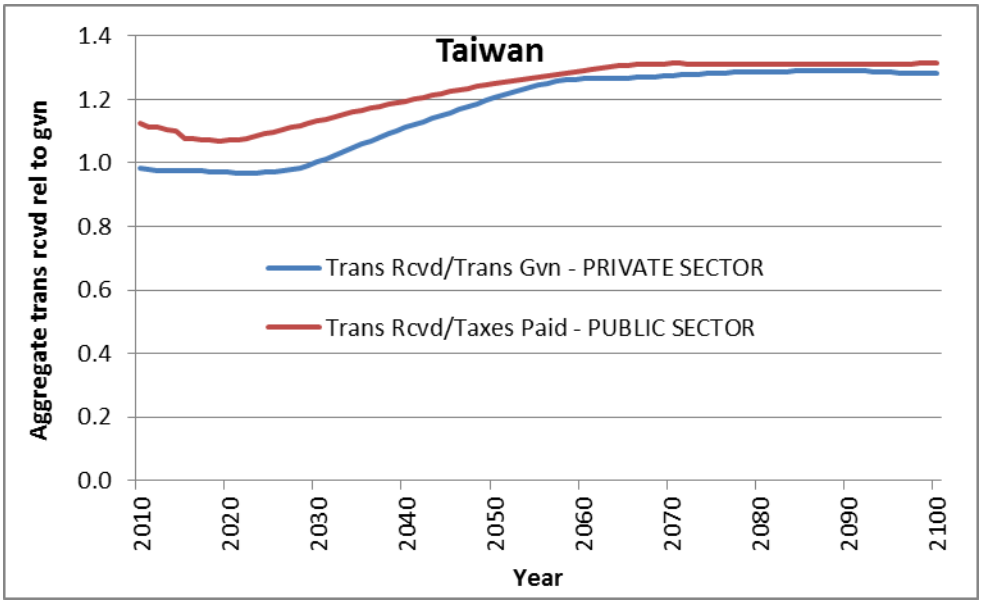
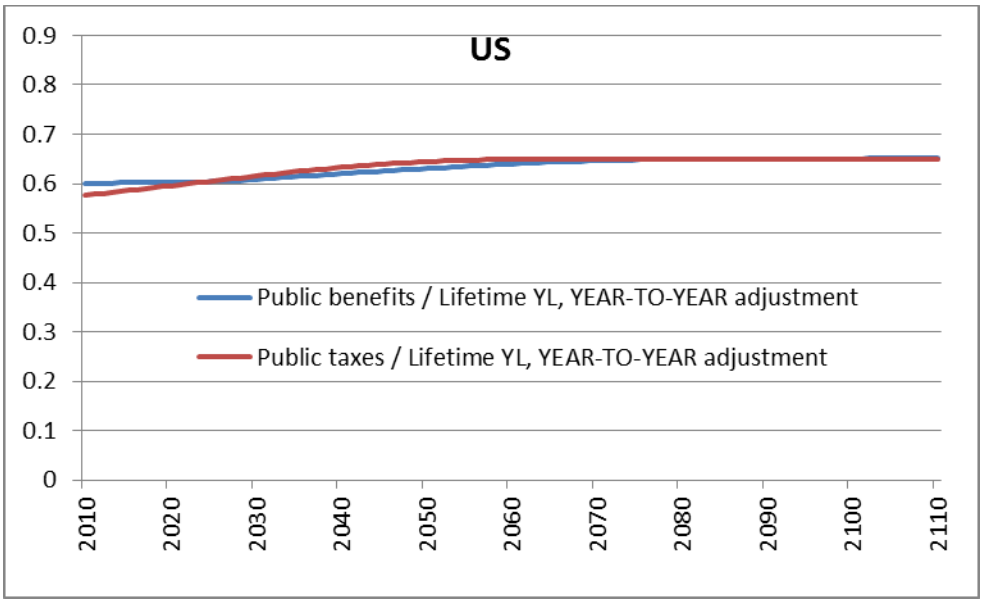


Figure 3. Public transfers and tax payments after adjustments to maintain fiscal balance year to year



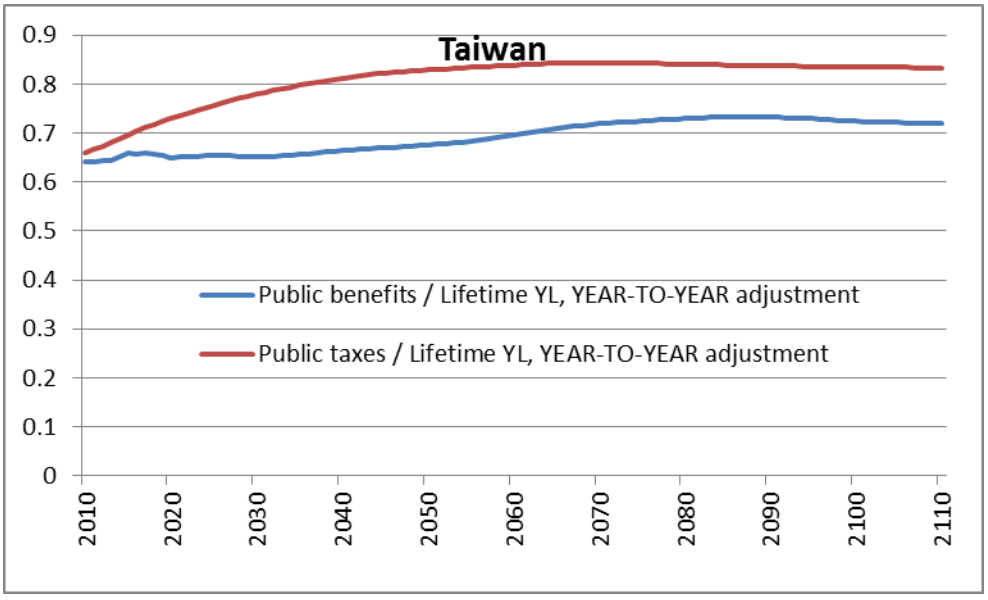
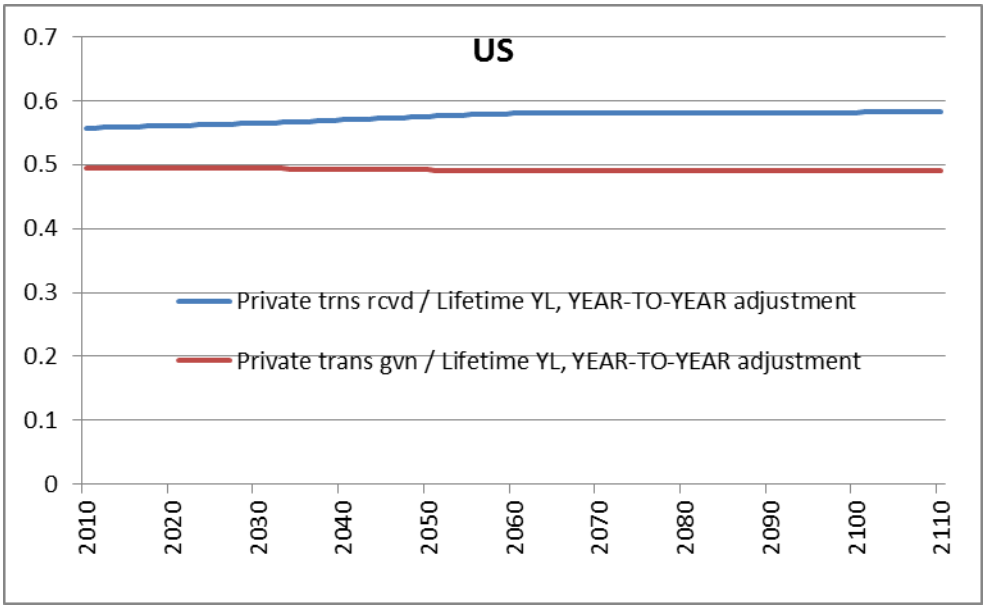


Figure 4. Private transfers received and given after adjustments to maintain transfer balance year to year



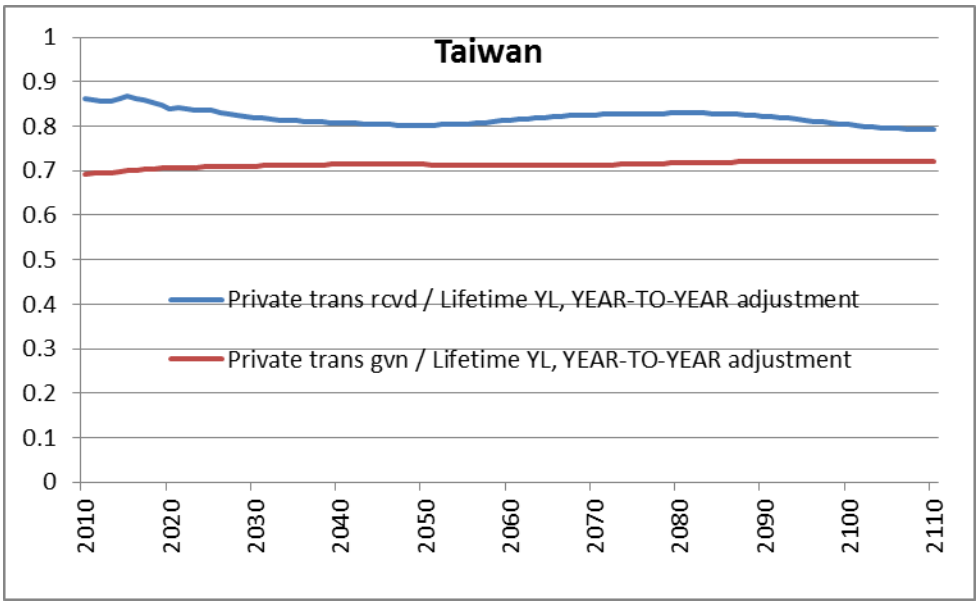
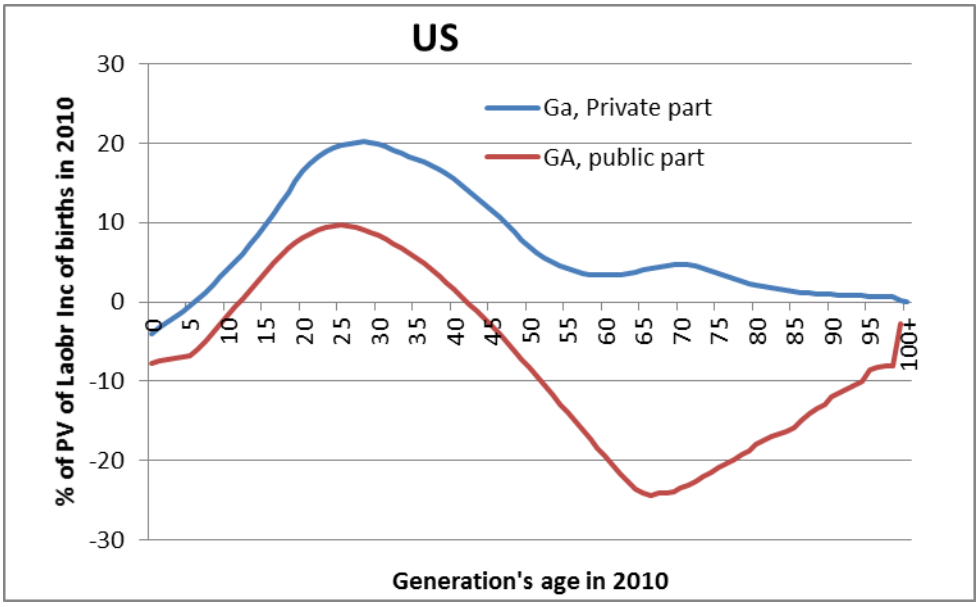


Figure 5. Public and Private Generational Accounts without Balancing Adjustments: NPV of Expected Future Transfers (given – received) by Age of generation in 2010
(expressed as % PV Lifetime Labor Income for Births in 2010)



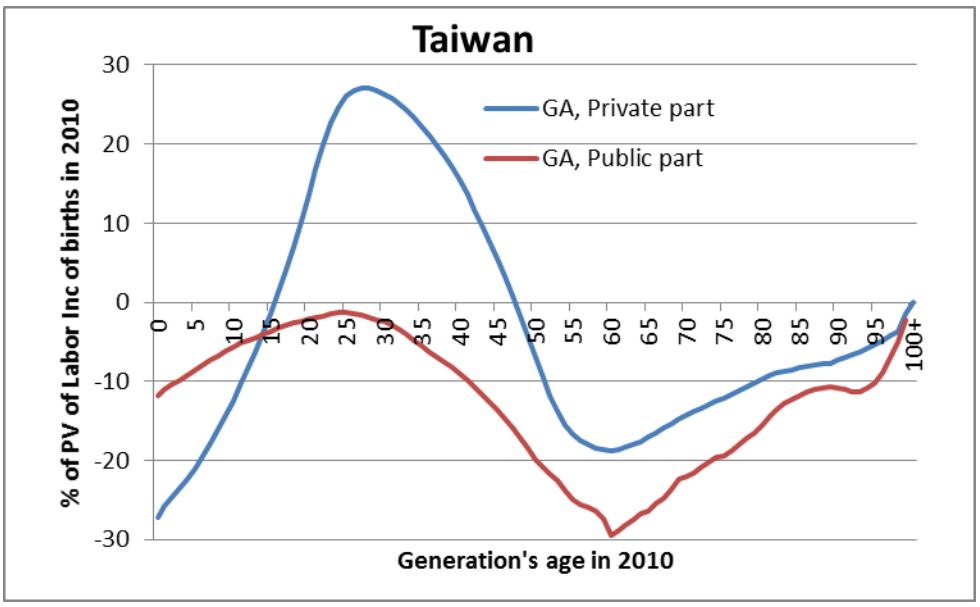
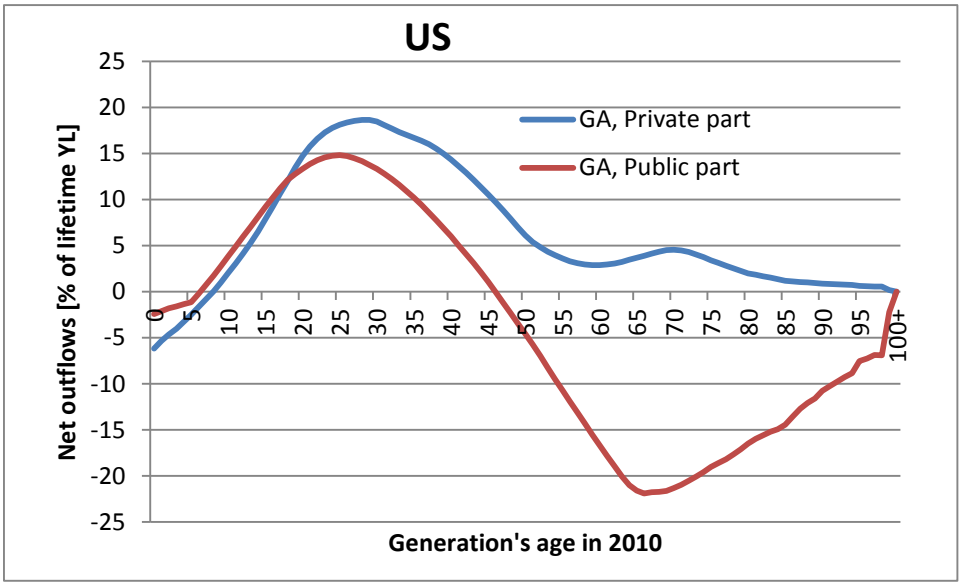
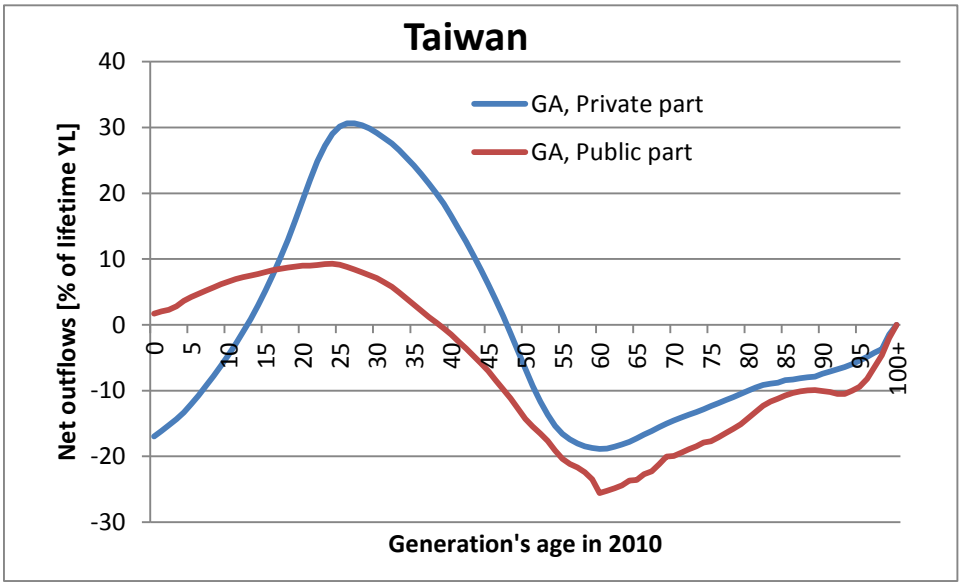


Figure 6. Public and Private Generational Accounts ***with*** Balancing Adjustments: NPV of Expected Future Transfers (given – received) by Age of generation in 2010 (expressed as % PV Lifetime Labor Income for Births in 2010)





[i] Public sector transfer programs such as the US Social Security system may accumulate either assets (the Social Security Trust Fund, for example) or debt (if bonds are issued to cover the costs of public transfers). However, these assets or debts are properly viewed as part of the asset/credit operations by the government in operating the transfer system, and not as a violation of the principle a PAYG transfer system.

[ii] Every transfer system creates implicit debt if the transfers are upwards as with public pensions, or implicit credit if transfers are downwards as with public education. This is an intrinsic feature of any transfer system and is not a problem. It becomes a problem when there is "excess" implicit debt or credit, that is, when the present value of expected future payments into the system falls short of the present value of expected future benefit payments by the system, as is currently the case for the US Social Security system for example.

[iii] As discussed, private transfer systems are always in balance. When we say they 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.

[iv] 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). Thus, the results also depend on the number of migrants, not only on the proportion of the original birth cohort that survives to each age.