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Introducing Age into National Accounts

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The purpose of this chapter is to describe the concepts underlying National Transfer Accounts, the methods used to construct them, and problems encountered in their construction. Many of the technical details are discussed in the NTA manual (Mason et al., 2009a) available on the NTA website: www.ntaccounts.org. Issues discussed here are also treated in more depth in Lee, Lee, and Mason (2008) and Mason, Lee, Tung, Lai, and Miller (2009b). The methods build on earlier work by Lee (1980, 1994), Lee and Miller (1997) and Mason (1981, 1987).

National Transfer Accounts (NTA) have been developed to describe, illuminate, and improve our understanding of the generational economy. The definition given in the introductory chapter is sufficiently important to be repeated here.

> **Generational economy** *n* (1) the social institutions and economic mechanisms used by each generation or age group to produce, consume, share, and save resources; (2) the economic flows across generations or age groups that characterize the generational economy; (3) explicit and implicit contracts that govern intergenerational flows.

National Transfer Accounts quantify the economic flows for members of each age group or generation. The flows are important, first, because they reflect a fundamental feature of all societies – the economic lifecycle. What it means to be young and to be old varies across societies and changes over time. In part, this is a consequence of changes in health and mortality. People are living longer and healthier lives today than ever before. In part, this is a consequence of changing educational needs and expectations. Children are spending longer in school and entering the labor force at a later age than ever before. And many other forces – income, culture, tastes, policy, etc. –influence what we consume and what we produce at each age. Understanding and responding to changes in

population age structure can be improved by measuring the basic features of the economic lifecycle.

A complete picture, however, requires measuring the economic mechanisms and institutions that are meeting lifecycle needs. Children in all countries rely heavily on transfers but there is important variation in the role of the state as compared with that of the family in providing for children. Moreover, in some societies familial responsibilities fall heavily on parents while in others grandparents and other relatives play an important economic role. In some countries young adults depend on credit markets to fund their schooling and meet material needs, while in other countries this is unheard of.

In all countries the elderly fund their lifecycle deficits relying on some mix of public transfer systems, familial support, and personal assets held in the form of housing, pension funds, family businesses, etc. But as is discussed throughout this book the mix varies greatly from country to country. It depends on the age of the elderly and it is changing over time.

Other chapters in this book explore these important features of the generational economy and discuss their significance. The purpose of this chapter is to describe the methods used to construct National Transfer Accounts.

<A>The National Transfer Flow Account

The National Transfer Flow Account is governed by the flow identity (see Lee, 1994a):

$$\underbrace{C(x)-Y^{l}(x)}_{\text{Lifecycle Deficit}} = \underbrace{\underbrace{\tau^{+}(x)-\tau^{-}(x)}_{\text{Net Transfers}} + \underbrace{Y^{A}(x)-S(x)}_{\text{Asset-based Reallocations}}}_{\text{Age Reallocations}} \tag{3.1}$$

The economic lifecycle is represented by consumption, $C(x)$, and by labor income $Y^l(x)$, at each age. The per capita economic lifecycle averaged over the 23 economies covered in this study is shown in Figure 3.1. To facilitate comparison across countries with greatly different levels of income, values have been normalized by dividing by the annual per capita labor income of persons 30-49.[1] The lifecycle deficit is the excess of consumption over labor income ($C(x) - Y^l(x)$) at each age *x*. We refer to the excess of labor income over consumption for prime-age adults as the lifecycle surplus.

<Figure 3.1. Economic Lifecycle about here.>

The lifecycle deficit necessarily equals reallocations at each age as shown in equation (1). Age reallocations come in two economic forms. Net transfers, $\tau(x)$, are defined as transfer inflows less transfer outflows, $\tau^+(x) - \tau^-(x)$. Asset-based reallocations are equal to asset income less saving ($Y^A(x) - S(x)$) for age group *x*. The equation or constraint holds for both aggregate and per capita values. Although the flow constraint as written emphasizes the connection between the economic lifecycle and age reallocations, it holds irrespective of the motives or purpose governing any of its elements. The constraint is an ex post accounting identity that follows from a simple principle that for any age group inflows (labor income, transfer inflows, and asset income) must be matched by outflows (consumption, transfer outflows, and saving).

Flows are further disaggregated by sector, distinguishing those mediated by the private sector from those mediated by the public sector. Public transfers consist of two flows: the inflows to each age group that arise from publicly-funded health, education,

[1] The age range was selected to minimize the influence of the ages at entry to and departure from the labor force.

pensions, and other public programs; and outflows from each age group, typically in the form of taxes, that fund these programs. Private transfers include both the flows between households and those that occur within households.

Asset-based reallocations are also distinguished by public and private sector. Private asset income includes the returns to capital, dividends, interest, rent, and the imputed return from owner-occupied housing. Public asset income includes the income earned from publicly owned assets and interest paid on public debt (a negative value). Public and private saving generate outflows while dis-saving (or increasing debt) generate inflows. The average values for the four main components – net public and private transfers and public and private asset-based flows – are charted by age for the xx countries for which the estimates are available (Figure 3.2).

<Figure 3.2. Per Capita Age Reallocations, normalized on labor income 30-49, simple average of values for xx countries.>

Per capita values are useful for comparing economic lifecycles and reallocation systems of different countries. Aggregate flows are important for understanding the macroeconomic consequences of population age structure and features of the generational economy. The NTA flow constraint holds for both per capita and aggregate flows. Aggregate flows for each age are calculated as the product of the per capita flows at each age and the population at each age. The aggregate NTA for the United States Japan, in highly summarized form, is shown in Table 3.1.

<Table 3.1. Aggregate National Transfer Account, United States, 2004, millions of dollars>

<B>The Relationship between NTA and SNA

National Transfer Accounts are broadly consistent with and complementary to National Income and Product Accounts as codified in the System of National Accounts (SNA) of the United Nations (United Nations 1993). This has important advantages because SNA provides the most widely available and frequently used source of aggregate economic data. The conceptual foundations are based on years of experience and the methods are thoroughly documented.

In NTA labor income plus asset income, i.e., primary income, summed over all ages, is equivalent to net national income in SNA. Income on foreign investment or from temporary employment abroad is included in the primary income of residents. Income on assets owned by non-residents and labor income of non-residents is excluded from net national income.[2] Net transfers in NTA accumulated across all ages is equivalent to net transfers to the rest of the world in SNA. NTA saving summed over all ages is equivalent to net national saving. NTA also relies on the SNA sectoral breakdown. Public in NTA is equivalent to General Government, private is equivalent to combined flows to corporate, household, and non-profit institutions serving households (NPISH) sectors, and rest of the world is equivalent in SNA and NTA.

Four important features of NTA distinguish it from SNA. First, in NTA all economic flows are classified by age groups (or rest of the world) and reported from the perspective of the individuals belonging to the age group. For example, tax payments are classified as public outflows for the age group. A separate account from the perspective of the government is not constructed.

[2] Asset income and saving in NTA are net of depreciation.

Second, NTA treats all private sectors in a consolidated fashion. The asset income for each age group includes all asset income, including the operating surplus of corporations, whether distributed through dividends or not. Moreover, private saving in NTA includes both household and corporate saving.

Third, NTA separates primary income into returns to labor and returns to assets. In SNA primary income of the household sector or mixed income combines labor and asset income. Mixed income is divided between asset and labor income to yield an estimate of labor and asset income in NTA. Fourth, NTA estimates of consumption, labor income, and asset income are measured using basic prices, i.e., income and consumption are valued prior to the assessment of taxes on production and products, also known as indirect taxes. Public transfer outflows, thus, include all taxes including taxes on production and products.

NTA is subject to the same limitations as SNA. One problem is the treatment of environmental resources (green accounting). Economic growth and saving are over-stated to the extent that the degradation of the environment is excluded from the accounts. A second important limitation is that non-market time is not valued. Currently, the value of services provided within the household mostly by women is not included in SNA – not included in measures of production, consumption, or transfers. As a consequence, production by women is under-valued, transfers to children and to the elderly are understated, as is consumption by children and the elderly to the extent that they are differentially the beneficiaries of unmeasured non-market production. The implications of incorporating non-market time into NTA are considered by Phananiramai (Chapter 31).

An important feature of NTA is that the individual and not the household is the basic unit of analysis. This is an advantage of NTA because it allows us to explore many important issues, but it comes at a cost. With rare exception no direct information is available about the allocation of resources within households. Instead we must rely on a variety of rules and assumptions to allocate the reported consumption of the household among its members, to assign asset income and saving to a member (the head), and to estimate intra-household transfers. The methods used are based on our reading of the literature and discussions with many colleagues. They have been consistently applied across all countries. However, appropriate use of NTA requires a clear understanding of the underlying assumptions and the limitations. These are discussed in more detail below.

<B>Overview of Estimation

NT Flow Accounts are estimated relying on a variety of data sources. National Income and Product Accounts, Government Financial Statistics (GFS) and government administrative records are used to estimate economy-wide aggregates, e.g., public and private consumption, labor income, public transfers, asset income, saving, and their components.

Broadly speaking, the estimation strategy is first to obtain initial estimates of an age profile, perhaps from a survey; second, to use the national population age distribution to calculate an implied aggregate value based on that age profile; and third, to multiplicatively adjust the level of the age profile so that the implied aggregate value exactly equals the national aggregate "control total" obtained from National Income and Product Accounts. We will now flesh out this basic approach, focusing on estimation of the age profiles and on choice of the appropriate control totals from NIPA.

Age profiles are estimated by making extensive use of administrative records and nationally representative income and expenditure surveys, labor force surveys, health expenditure surveys, and special purpose household surveys. Of course, countries vary greatly in the quality and the comprehensiveness of their economic data, but many countries have nationally representative income and expenditure surveys that provide data needed to estimate age profiles required for NTA.

<A>Economic Lifecycle

The economic lifecycle is composed of consumption, labor income, and the lifecycle deficit, consumption less labor income. The methods employed here are described in detail and compared with alternative approaches in Lee, Lee, and Mason (2007) and Mason et al. (2009). An-Chi Tung discusses consumption patterns in a comparative context in Chapter 6; Sang-Hyop Lee and Naohiro Ogawa provide a comparative analysis of labor income in Chapter 5.

<B>Consumption

Consumption in NTA consists of both public and private consumption. The aggregate counterpart in SNA is final consumption expenditure evaluated using basic prices, in other words, prior to the assessment of value added tax and other consumption taxes. Separate estimates of public and private consumption of education, health, and other goods and services are constructed for every NTA country.

Public expenditures on health and education are allocated by age relying primarily on administrative records. Education estimates use budget data to construct estimates of per student education spending by educational level. These data are then combined with

age- and level-specific enrollment data to estimate public education consumption by age. The methods used to allocate public spending on health are more varied and more subject to error. In some countries, for example, age profiles of in-patient and out-patient utilization are combined with estimates of per patient costs for in-patient and out-patient services. In some countries, very detailed estimates of public spending on health by age are available from government agencies or surveys of providers. The per capita age profile of public consumption of other goods and services, such as military, roads, or sewers, is assumed to be constant across age.[3]

Private consumption is allocated by age using a household expenditure survey with a complete household roster (reporting the number of members and their age) and spending on education, health, and other goods and services. Allocation rules are used to assign consumption to each household member. The age profile for each consumption type is obtained by averaging consumption by age across all members of all households. The age profile is then adjusted proportionately to match aggregate controls for each consumption category, given the national population age distribution.[4]

The rules used for allocation of private consumption among household members vary by consumption category—health, education, and other. An equivalence scale is used for allocating other private consumption. Children under the age of five are assigned a value of 0.4. The equivalence scale increases linearly from age 5 to reach 1.0 at age 20. Thereafter, the equivalence scale is held constant at 1.0. For a detailed discussion of this approach and alternatives, e.g., Engel's method or the Rothbarth method, see Lee, Lee, and Mason (2008) and Deaton (1997).

[3] In some countries, more detailed categories of public consumption are estimated.
[4] This procedure is based on the assumption that proportional errors in the original age profile are equal at all ages. The data necessary to relax this assumption are rarely available.

The allocation rules for education and for health care are based on regression estimates that rely on survey data to estimate the relative consumption of members at different ages. Education scales are estimated by regressing education spending on the number of non-enrolled and enrolled household members at each age. These scales are then used to assign the reported household spending on education to individual household members. The age profiles are then obtained by tabulating and averaging education spending by age and scaling to match the aggregate control total. The methods have been evaluated using data for which health and education spending is reported for individuals rather than households. In countries where long-term care spending is important, it is included with health spending, as in the US, or is reported separately, as in Japan.

Age profiles are selectively smoothed using lowess to reduce noise, but without masking key features of the series. Age profiles of education consumption are not smoothed as they rise and fall quite sharply. For similar reasons, the health profile of consumption is smoothed started at age 1 so as not to mask the relatively high consumption by newborns in most countries.

<B>Labor Income

Labor income is an estimate of the market value of the labor supplied by the average person in each age group. Labor income is composed of earnings, benefits including employer contributions to public entitlement programs, e.g., pensions and health care, and self-employment income. Taxes on products and production (indirect taxes) paid by labor are included in labor income. The value of time spent in home production of market goods and services is included in NTA as it is in SNA; however, the value of time spent in producing non-market goods and services is not included. For example, time

spent maintaining a personal residence or caring for own children is not measured in NTA (or in SNA).

Labor income is a composite measure that combines values for males and females and reflects variation in hourly wages, hours worked, unemployment, and labor force participation. Hence, labor income profiles reflect age-variation in productivity, age at entry and retirement from the labor force, female labor force participation, and country-specific features of labor markets, e.g., child labor and mandatory retirement laws, policies regarding family leave, and wage systems.

The age profile of labor income is estimated using nationally representative surveys. An important issue in some countries is treatment of unpaid family workers in households with a family business. The approach followed in NTA is to treat two thirds of reported mixed income as accruing to labor (Gollin, 2002), and to allocate this unpaid family labor income to reported unpaid family workers in proportion to the average labor income of employees of the same age.[5] S.H. Lee and Ogawa provide a detailed discussion of labor income profiles and their variation across countries in Chapter 5.

<B>Lifecycle Deficit

The lifecycle deficit (LCD) is defined as consumption less labor income. (The surplus of labor income over consumption among working-age adults is called the *lifecycle surplus* and is equivalent to a negative lifecycle deficit.) The lifecycle deficit measures the gap between what the young and the old are consuming and what they are producing through their labor. Although it is tempting to treat the lifecycle deficit as a measure of

[5] That is, we assume that the relative labor contributions of listed unpaid family workers by age are the same as the relative contributions of listed employed workers by age. These relative contributions by age are then adjusted proportionately to match two thirds of the reported total household mixed income. The remaining one third is assumed to be return on assets. See Lee, Lee and Mason (2008) for further details.

dependency, applying the term "dependency" in this way may fundamentally misrepresent the economic status of elderly, in particular, and the young to a lesser extent. Older adults with a lifecycle deficit may be supporting their consumption relying on assets accumulated during their working years. Young adults may fund their consumption by relying on student loans and credit card debt which they are obligated to repay in the future.

The lifecycle deficits measure the "demand" for age reallocations.[6] Labor income to the extent that it is consumed is distinctive among all economic resources because it is used directly and immediately to support consumption. Other economic mechanisms used to fund consumption, described in more detail below, involve interage flows.

The aggregate lifecycle deficit is an important feature of any economy. In a dynamically efficient economy consumption will equal or exceed labor income.[7] In golden rule growth, aggregate consumption and labor income are equal and the aggregate lifecycle deficit is zero. Among the NTA countries, China is the only country with an aggregate lifecycle surplus, i.e., aggregate consumption is less than aggregate labor income.

An-Chi Tung (Chapter 6) provides a comparative discussion of the economic lifecycle and lifecycle deficits.

[6] The accounts are measured *ex post*, so the life cycle deficit must equal the age reallocations as in equation (3.1). An individual who *ex ante* planned to have labor income and consumption described by these profiles would need to have (would demand) age reallocations in this amount.

[7] If an economy is not dynamically efficient, saving and investment are excessive. Consumption in all periods can be increased by reducing saving and investment.

<A>Economic Flows across Age

Differences between consumption and labor income must be matched by economic flows across age identified in the flow identity (equation 3.1). Two economic mechanisms are available: transfers and asset-based reallocations. Public flows, i.e., those mediated by government, are distinguished from private flows, i.e., those mediated by families, non-profit institutions, and firms. Important forms of asset-based reallocations are identified in Table 3.2.

<Table 3.2 about here>

<B>Public Flows

A quantitative overview of the public sector is provided by the *Structure of Public Flow Account* (Table 3.3) presented with values reported for Taiwan 1998 for illustrative purposes.

<Table 3.3. Structure of Public Flow Account, NTA Countries>

Net public transfers must be zero by definition. Any transfer inflow must be matched by a transfer outflow. Public transfer inflows to residents differ from public transfer outflows from residents by the value of net public transfers to the rest of the world (ROW). *Public Transfer Inflows to Residents* equal the value of in-kind and cash transfers received by the beneficiaries of public programs, while *Public Transfer Outflows from Residents* measure the value of economic resources of residents used to fund public transfers. One source is *Taxes and Grants,* including taxes, social contributions, current grants from foreign governments, and a portion of other revenues of the government.

The *Transfer Surplus(+)/Deficit(-)* is a balancing item for public transfers. A surplus is generated if taxes and grants are more than sufficient to fund public transfer inflows. A public transfer deficit is generated if taxes and grants are insufficient to fund public transfer inflows.

Public asset-based inflows arise from asset income or through public dis-saving. The net flow, *Public Asset-based Reallocations,* is equal to public asset income less public saving. The public transfer surplus/deficit and public asset-based reallocations must sum to zero. If asset income is sufficient to cover the transfer deficit, the residual is saved. If asset income is insufficient to cover the transfer deficit, public dis-saving is required. In many countries, public asset income is negative because interest on public debt exceeds other public asset income.

<C>Public Transfers

Public transfers in NTA also are identified by purpose, emphasizing age-related programs in a manner consistent with but simpler than UN Classification of Functions of Government (COFOG). Public transfers for education, health, and pensions are estimated for all countries. Other programs may have distinctive and important age profiles, e.g., unemployment benefits and long-term care programs. The particular programs for which estimates are constructed will vary with the particular public programs and policies of the country in question.

In most instances there is no ambiguity as to whether inflows should be classified as in-kind or as cash. In general, in-kind public transfers inflows are goods and services received directly from government agencies as opposed to goods and services that are purchased with the benefit of a publicly provided cash subsidy. Hence, public schooling

is an in-kind transfer whereas a scholarship is a cash transfer. An exception to this approach is health. National health insurance payments and similar reimbursement programs, e.g., Medicare and Medicaid in the US, are classified as in-kind transfer inflows (and as public consumption) in NTA. This approach is intended to facilitate comparisons across countries. Note that in-kind public transfers and public consumption as calculated in NTA are equivalent.

Classification of public spending on pensions is sometimes a source of confusion. Pensions paid to public workers as part of their compensation are not transfers. They are a component of the labor income of public workers and a cost of producing public goods or services. Retirement benefits for public school teachers, for example, are part of the cost of education and captured in the value of in-kind transfers of education to public school students. Pensions paid to public workers are treated in the same fashion as pensions paid to private workers by their employers.

The principle followed for estimating the age profile of inflows to residents is that the inflow is assigned to the age groups of the intended beneficiaries of the public program. The value of school lunch programs, for example, is assigned to students. Pre-natal health care is assigned to the mother. Some cases are difficult to assign. Maternity costs and the normal expenses associated with a birth are assigned to the mother. In the case of a US transfer program called TANF, only families with children qualify but the amount received is based on family size including any adults. Benefits are assigned equally to all household members. Many public transfers do not accrue to particular individuals at all. These inflows are assumed to be divided equally among all members of the population.

Methods for constructing age profiles of public consumption and, hence, in-kind public transfer inflows are discussed in the section on the economic lifecycle and are not repeated here. Cash transfers are estimated using administrative records or household surveys giving information about the amount of public cash transfers and characteristics of the recipients.

Transfer outflows must equal transfer inflows and, hence, their total value as well as the value for specific programs is given. The age profile of public transfer outflows depends on the tax source, the age distribution of the tax source, and age variation in tax rates, if any. Social contributions are not distinguished from taxes in NTA. Seven tax sources are distinguished in NTA: labor income, asset income, consumption, asset holding, asset transactions, rest of the world and other. The tax source, i.e., tax incidence, is determined in the same fashion as in Generational Accounting. The source of taxes is classified depending on the party, resource, or activity assessed. Taxes on wages and earnings are paid out of labor income, taxes on profits out of profits (asset income), taxes on consumption out of consumption, etc. Second order and general equilibrium effects are not considered, which limits the ability to draw inferences about welfare directly from NTA measures. To assess impacts on welfare, we would additionally need estimates of the indirect effects of transfers arising from behavioral responses, externalities, and distortions (see Fehr and Kotlikoff, 1999) and we would also need a measure of individual welfare. We have chosen to estimate only the financial flows.

In the simplest tax systems, all public revenues are pooled into a general fund used to support all public programs. In this case, the distribution of outflows by tax source and the relative age profiles of public transfer outflows will be the same for all

programs. In some countries, however, the funding sources vary across public programs. This may occur because programs have earmarked or committed sources of funding. Pension programs are often funded through payroll taxes, for example. Grants from foreign governments may target health or education programs. The source of outflows may vary by purpose because different levels of government, with different tax systems, may be responsible for different government programs. Education may be funded at the local level from property taxes while national defense is funded at the central level out of VAT, for example.

The age profile of some tax sources is already computed because the sources are NTA components. The age profiles of earnings, asset income, and consumption are examples. Additional analysis is required in other cases. Taxes on the consumption of alcohol or tobacco are examples.

Some tax rates, e.g., sales tax rates and VAT rates, do not vary with age. Taxes paid by each age group depend only on how much they consume of each type of good and service. Other tax rates vary by age for a variety of reasons: explicit provisions that favor age groups, e.g., exemptions for older individuals; ceilings on the value of the resource subject to taxation; taxes imposed only on resources above a floor; the use of graduated tax schedules; etc. Two general approaches can be used to estimate age-specific variation in tax rates. Administrative records may provide information about the age of those who paid taxes. Or household surveys may contain information about tax payments by households. If so, methods for allocating household variables to individual members may be used to estimate age-specific taxes and tax rates.

Miller and Bravo (Chapter 7) discuss public transfers in a comparative and more detailed fashion.

<C>Public Asset-based Reallocations

Public asset-based reallocations quantify the inflows to and outflows from age groups that are a consequence of public asset transactions. Asset-based reallocations consist of two distinct flows – public asset income and public saving. Public asset income (if positive) is an inflow for "taxpayers" while public saving (if positive) is an outflow for "taxpayers". The combined flow that arises from public assets, public asset-based reallocations, is equal to public asset income less public saving.

Public assets serve a variety of purposes. Some of these are explicitly intended to satisfy the reallocation of economic resources across age. Many, however, have other purposes, but nonetheless result in interage flows. A funded or partially funded public pension program is an important example of an asset-based program with age reallocations as its objective. Governments can fund pension programs by taxing workers and accumulating public assets. In subsequent periods income from the assets or dis-saving of the assets can be used to fund pensions of retirees. Fully-funded public pension programs are unusual, but many countries have partially-funded public pension programs.[8] Some public pension programs maintain individual accounts and, hence, the assets can be readily assigned to individuals and to ages. Chile and Singapore's Central Provident Fund (CPF) are examples. Most public asset-based reallocation systems do not share this feature. Rather, public assets are collectively owned. Whether the assets of

[8] Estimates of publicly-managed pension asset pools for 23 countries range from 0.2 percent to 69.6 percent of GDP as reported by Mitchell, O. S., Piggott, J., Kumru, C. 2008. "Managing Public Investment Funds: Best Practices and New Challenges", in *NBER Working Paper*,Vol. **14078**.

public pension programs are held in individual accounts or collectively held, they provide an economic mechanism for reallocating resources across age, as well as over time. If the social contributions or taxes of workers exceed current benefit payments (transfers), the surplus is accumulated as an asset. In subsequent periods, retirees can be supported, for example, using income earned on the asset and by drawing down the public fund.

Two other important forms of public financial assets are *Currency Stabilization Funds* and *Sovereign Wealth Funds*. Currency Stabilization Funds do not have an explicit intergenerational or age reallocation rationale. Rather these funds are maintained to smooth exchange rate fluctuations. Sovereign wealth funds, on the other hand, are often used by countries with substantial revenues generated by the depletion of natural resources with an explicit intergenerational equity objective. Norway and UAE, for example, both have large SWFs funded from oil revenues. A few countries are running fiscal surpluses and accumulating funds as a response to anticipated future fiscal needs of aging populations. Australia's Future Fund is an example.

Public debt is another important example of an asset involved in asset-based reallocations. Increasing pubic debt, i.e., dis-saving, generates an inflow to current taxpayers. Existing public debt generates an outflow, interest expense, from current taxpayers. Some countries have large publicly-owned natural resources that generate substantial public asset income. By convention, public capital, e.g., highways and public parks, does not yield asset income.

Following the UN System of National Accounts, *Public Asset Income* is equivalent to the Net Operating Surplus plus Property Income of the Government. The net operating surplus for the government is generally quite small because public capital

does not generate an operating surplus. In UNSNA property income consists of five components: interest (income and expense), distributed income of corporations, reinvested earnings on direct foreign investment, property income attributed to insurance policy holders, and rent, i.e., the return to land and sub-soil assets. Public saving in NTA is equivalent to net saving by general government in UNSNA.

In NTA public asset-based flows are assigned to age groups in proportion to each age group's general (non-earmarked) tax payments. The basis for this approach is relatively clear for public asset-based outflows: interest expense and the acquisition of public assets. Public interest expense is paid by taxpayers and allocated across age groups using the same procedures followed for allocating public transfer outflows. Likewise the acquisition of public assets is funded from taxes that are assigned to age groups using the same procedures as used to assign public transfer outflows.

The conceptual foundation for treating public asset income and public borrowing in this way relies on a counterfactual. In the absence of public asset income or public borrowing, general tax revenues would have been greater (given public spending). Thus, the asset-based inflow is allocated to age groups in proportion to the general taxes that they pay.

Social security funds are often classified as separate institutional units within general government. If funds are significant in size it may be advisable to calculate asset-based reallocations separately from other units of general government. In these cases the age profile of taxes used to fund the independent program provides the basis for determining age profile of asset income or program surpluses or deficits.

Mason, Ogawa, Chawla, and Matsukura (Chapter 9) provide comparative information about public asset-based reallocations.

<B>Private Flows

A quantitative overview of private age reallocations is provided by the Structure of Private Flow Account illustrated using value for Japan in 2004 in Table 3.3. Private transfers and private asset-based reallocations are distinguished as well as their key components. In Japan, private transfers are very substantial. Private transfer inflows or private transfer outflows exceed half of total labor income. Net transfers to the rest of the world are very small and positive. In other words, Japanese residents are transferring more to non-residents than they are receiving. Private transfers are dominated by intra-household transfers. This is consistently the case across NTA countries. Asset-based reallocations are positive in Japan. Asset income was 36% of labor income while net private saving was 19% of labor income. This produced a net asset-based inflow equal to 17% of total labor income.

<Table 3.3. Structure of Private Flow Account>

<C>Private Transfers

Private transfers consist of intra-household transfers and inter-household transfers. Inter-household transfer inflows consist of all private transfers received by residents irrespective of the source of those inflows (domestic or ROW). Likewise, inter-household transfer outflows consists of private transfers made by residents irrespective of the destination of those inflows (domestic or ROW). The difference between the two flows equals net private transfers to ROW. Inter-household transfers include direct

transfers between households and indirect transfers mediated by non-profit institutions serving households (NPISHs).

Only current transfers are reported in the NT Flow Account. Capital transfers such as bequests, dowry, and similar large transfers of assets are not included; they are the subject of ongoing NTA research. Private transfers also do not include the value of time transfers and, hence, understate the value of transfers to children and elderly parents provided by family caregivers.[9]

Inter-household transfers are assumed to flow only to and from household heads. The age profiles of inter-household transfers are estimated directly from household surveys of income and expenditure. Aggregate controls for transfer inflows and outflows to the household sector are available from national income and product accounts for some countries, but in other cases the aggregate levels are based on survey estimates. For these countries inflows and outflows are both adjusted, by an equal percentage but of opposite sign,so that net domestic transfers and net transfers to sum to zero.

In most countries, private transfers from ROW are relatively small, but remittances are important in some countries, e.g., the Philippines and Mexico. The treatment of remittances by foreign workers in UNSNA and NTA depends on the status of the workers and whether or not they are considered to be residents. Remittances by guest workers who are temporarily abroad are considered to be labor income for the resident household to which they belong and not as a transfer from ROW. Workers who are not temporarily abroad are not residents of the country of origin and, hence, their remittances are transfer inflows from ROW. It should be kept in mind that measuring

[9] See Phananiramai (chapter 31) for estimates of the value of time transfers in Thailand and an analysis of the implication for NTA of including time transfers.

these flows is particularly difficult and often the range of estimates is very wide. Two countries for which the treatment of remittances is important are Mexico (Guevara, chapter 13) and the Philippines (Racelis and Salas, chapter 18).

While inter-household transfers are estimated directly from survey data, intra-household transfers are estimated indirectly as the balancing item between private consumption and disposable income (labor income plus net private transfers plus public cash transfer inflows less taxes paid) for each household member. Household members with a deficit (disposable income less than current private consumption) receive transfers from household members with a surplus (disposable income greater than current private consumption). If disposable income is insufficient to fund household consumption, the household head makes additional intra-household transfers out of asset income and if necessary by dis-saving. If disposable income is more than sufficient to fund household consumption, the residual is transferred to the household head and saved.

The consumption of durables, including the services from owner-occupied housing, are treated in a distinct fashion because, by assumption, the household head owns all household assets and all income generated by those assets flows to the head. The consumption of durables by any non-head household member is *funded* by an intra-household transfer from the head to the member equal to the value of that member's durable consumption. For most countries only owner-occupied housing is treated in this fashion because of data limitations.

Any errors in the estimates of private consumption and disposable income will lead to corresponding errors in the estimates of net intra-household transfers. Moreover, assigning assets and asset income to the household head has important implications for

the calculation of net transfers. Non-head members with a deficit draw on the assets of the head, not their own assets, to support current needs. Non-head members with a surplus cannot save, but rather transfer their surplus to the head to be saved.

Net intra-household transfers can be computed given estimates of consumption and disposable income for each individual. Estimates of additional features of intra-household transfers require additional assumptions. First, intra-household transfer inflows and outflows are constructed by assuming that no individual within the household has both inflows and outflows, with one exception: a household member may have current transfer outflows and a transfer inflow associated with the consumption of durable services, e.g., housing. To the extent that household members actually have both current transfer inflows and outflows, the NTA estimates will understate inflows and outflows, but not net inflows.

Second, we construct estimates of intra-household transfers by purpose (education, health, etc.) To do so, we assume that the size of the purpose-specific intra-household transfer inflow is proportional to purpose-specific consumption by the individual receiving the transfer. Hence, in these calculations we do not allow for the possibility that intra-household transfers are targeted at particular purposes. No information is available, for example, to determine that a college student is paying for his or her education while relying on transfers for food and housing. Hence, we assume that an equal percentage of all purposes are funded through intra-household transfers.

Third, we construct estimates of the joint age distribution of intra-household flows by assuming that the proportion of flows received from any age group depends only on

the contribution of that age group to the total flow. In other words, there is no age targeting within the household. The estimates do not allow for the possibility, for example, that in a three generation household children receive more support from co-resident siblings while co-resident elderly are receiving more support from their adult children.

Lee and Donehower (Chapter 8) provide an extensive comparative discussion of private transfers.

<C>Private Asset-based Reallocations

The use of private assets is an important mechanism for shifting economic resources across age. Young adults may generate resources by accumulating debt. In some countries this is a common means by which students pay for part of their college education. Young adults also may use consumer debt to pay for material needs that they cannot fund out of current earnings. In both of these cases, asset-based reallocations are being used to shift resources to younger ages from older ages. In the conventional lifecycle saving model, asset-based reallocations are used to shift resources from younger ages to older ages. The patterns observed may be the product of a variety of motives. Individuals accumulate wealth to protect themselves from unforeseen events, to leave a bequest to their children, to smooth consumption over the lifecycle, and for other reasons. Asset income at each age reflects previous saving behavior, but it also reflects changes in asset prices and inheritances and other capital transfers received. Although the motives that lead to the accumulation of assets are an important research issue, the methods for measuring the flows in NTA are entirely independent of motive.

Asset-based reallocations are the composite of two flows: asset income and saving. In NTA two kinds of asset income are distinguished: capital income and property income. Private capital income is the return to capital held by corporations and households, consisting of the operating surplus of corporations and households and capital's share of mixed income. Property income is a flow generated by financial assets, e.g., debt instruments and corporate shares. Important forms of property income are interest, dividends, and rent (payments to owners of land, fossil fuels, and other subsoil minerals). For any form of property income inflows and outflows must always balance. Interest paid by debtors must equal interest received by creditors, dividends paid by corporations must equal dividends received by shareholders, and so forth.

Property income will not produce an age reallocation if the parties on either side of the transaction have the same age profile. If Corporation A pays interest on debt to Corporation B, the owners of Corporation A have negative interest income and owners of Corporation B have positive interest income. But if the age distribution of owners of Corporation A and B are the same, net interest income will be zero for the members of each age group. In NTA we use a single age profile to characterize the property income of corporations. Hence, property income flows between corporations are included in the outflow and inflow measures, but the net flows are zero and they do not generate age reallocations. Property income between the household and the corporate sector does results in age reallocations. Examples would be interest paid on credit card debt, a home mortgage, or a student loan.

The age profiles of asset income are based on household survey data. Asset income and saving are, by assumption, assigned to the household head. The age profile

of capital income is approximated by the age profile of property income. For this to hold exactly, the age profiles of asset income from interest, dividends, and rent must be identical and the age profile of earnings retained by corporations must be identical to the age profile of earning distributed by corporations. Likewise, the age profile of property income inflows is estimated using the age profiles of household survey data on property income. The age profile of the operating surplus of households (asset income from owner-occupied housing) is estimated using the rental value of owner-occupied housing reported in household surveys. The age profile of non-corporate capital income is approximated by estimates of mixed income from household surveys. The age profile of interest outflows from consumer debt is estimated using household interest expense. All other property income outflows are approximated by the age profile of property income.

The second major component of asset-based reallocations is saving. Individuals can acquire debt or dispose of existing assets to generate inflows. Or individuals can dispose of debt or acquire assets generating outflows. Private saving is the balancing item in NTA as it is in UNSNA. It is calculated for each age group as the difference between the lifecycle deficit and age reallocations other than saving. Summed across all ages, saving is equivalent to net private saving.

Asset-based reallocations are discussed in more detail, comparing NTA countries for which estimates are available, in Mason et al. (chapter 9).

<A> SUMMARY MEASURES

NTA is very detailed with each variable estimated for single-years of age typically from age 0 to 90+. For purposes of analysis and description we use a variety of summary measures, some of which are described here.

Economic support ratio. A measure of population age structure that explicitly incorporates age variation in productivity and consumption needs. The support ratio is calculated using age profiles of per capita consumption ($c(a,t_0)$) and labor income ($y_l(a,t_0)$) from a base year t_0 to weight historical and projected population data ($N(a,t)$):

$$ESR_t = \frac{\sum_a y_l(a,t_0)N(a,t)}{\sum_a c(a,t_0)N(a,t)} \tag{1.2}$$

Mean ages. Mean ages provide a useful summary of the age at which the inflow or outflow is experienced. The mean age of consumption (A_C), for example, is calculated as:

$$A_C(t) = \frac{\sum_a ac(a,t)N(a,t)}{\sum_a c(a,t)N(a,t)} \tag{1.3}$$

Transfers and some other economic flows, e.g., property income, always have an inflow and an outflow with corresponding mean ages of inflows and outflows. The difference between the mean age of an inflow and an outflow summarizes the extent to which transfer system shifts resources across age. Under special circumstances, golden rule growth, the present value of flows will equal the product of the annual flow and the difference between the mean age of the inflow and the outflow (see Chapter 2).

Synthetic cohort estimates. Synthetic cohort estimates are used to construct a measure that is unaffected by the population age distribution, similar to a Total Fertility Rate (TFR), Net Reproduction Ratio (NRR), or period Life Expectancy (e_0) in demography. The measure is constructed using a per capita age profile of a flow and (in some cases) age specific survival weights ($s(a)$). For example, a measure of consumption by children is $\sum_{a=0}^{24} s(a)c(a)$. The measure can be interpreted as the total expected consumption during childhood given current age-specific survival rates and consumption flows.

Cross-country comparisons and normalization. Comparing countries at different levels of development is difficult. In many instances we facilitate comparison by expressing age profiles relative to the average of per capita labor income over the 30-49 age range. A simple average of single-year-of-age values of labor income is used for this purpose. Labor income is pre-tax income. The 30-49 age range is selected so that it will be unaffected by departure from school or retirement.

<A>CONCLUSIONS

Constructing National Transfer Accounts is a complex and demanding task. The data requirements are considerable, drawing on national income and product accounts, comprehensive and nationally representative surveys of income, expenditure, wages, labor supply, etc., detailed administrative records maintained by a variety of public institutions, and demographic data. These data vary in their quality and completeness.

The quality of data is particularly problematic in lower income countries where literacy rates are low, statistical agencies are under-funded, and many workers are working in informal, partially monetized sectors of the economy. Despite these challenges, many low- and middle-income countries conduct censuses surveys and maintain account systems that provide important information about the generational economy. NTA provides a systematic way of organizing these data in a way that can shed light on an important set of issues.

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Table 3.1. National Transfer Flow Account, US, 2003, Aggregate Values, Nominal, (US$ millions)

	Total	0-19	20-29	30-49	50-64	65+
Lifecycle Deficit	**2,119,800**	**1,824,745**	**220,216**	**-1,109,414**	**-116,299**	**1,300,552**
Consumption	8,988,800	1,870,912	1,096,737	2,707,976	1,777,601	1,535,575
Public	2,288,300	819,235	248,384	457,720	290,751	472,210
Private	6,700,500	1,051,676	848,353	2,250,256	1,486,850	1,063,365
Less: Labor income	6,869,000	46,167	876,521	3,817,390	1,893,900	235,022
Age Reallocations	**2,119,800**	**1,824,745**	**220,216**	**-1,109,414**	**-116,299**	**1,300,552**
Transfers	-69,600	1,808,579	92,505	-1,611,016	-743,689	384,021
Public	-17,500	792,236	-2,580	-856,060	-446,589	495,493
Private	-52,100	1,016,343	95,084	-754,956	-297,099	-111,472
Asset-based Reallocations	2,189,400	16,165	127,712	501,602	627,390	916,531
Public	189,500	5,623	18,646	88,930	53,631	22,670
Income on Assets	-203,000	-6,023	-19,975	-95,265	-57,452	-24,285
Less: Public Saving	-392,500	-11,646	-38,621	-184,195	-111,083	-46,955
Private	1,999,900	10,543	109,065	412,672	573,759	893,861
Income on Assets	2,515,029	3,094	50,711	522,371	886,578	1,052,275
Less: Private Saving	515,129	-7,448	-58,354	109,699	312,819	158,414

Table 3.2. A Classification of National Transfer Accounts Reallocations			
	Asset-based flows		**Transfers**
	Capital	**Property**	
Public	Negligible	Public debt Sovereign wealth funds Currency stabilization funds Publicly-owned natural resources	Public education Public health care Unfunded pension plans
Private	Corporations Partnerships and sole proprietorships Owner-occupied housing	Consumer debt Land Sub-soil minerals Mutual funds Private pension funds Personal savings	Familial support of children and parents Bequests Charitable contributions
Source: Adapted from Lee 1994a.			

Table 3.3. Structure of Public Flow Account, Taiwan 1998 NT$ millions

	Value	% of Labor Income	Value	% of Labor Income
Public Transfers				
Net Public Transfers			0	0.0
Public Transfer Inflows to Residents			1,997,684	41.7
In-kind Transfer Inflows	1,665,536	34.8		
Cash Transfer Inflows	332,148	6.9		
Public Transfer Outflows from Residents			-1,995,878	-41.6
Taxes and Grants	-1,881,751	-39.3		
Transfer Surplus(+)/Deficit(-)	-114,128	-2.4		
Net Public Transfers to ROW			-1,806	0.0
Public Asset-based Flows				
Public Asset-based Reallocations			114,128	2.4
Asset Income, net	267,008	5.6		
Less: Public Saving	152,881	3.2		

Source: Estimates from An-Chi Tung 2008.

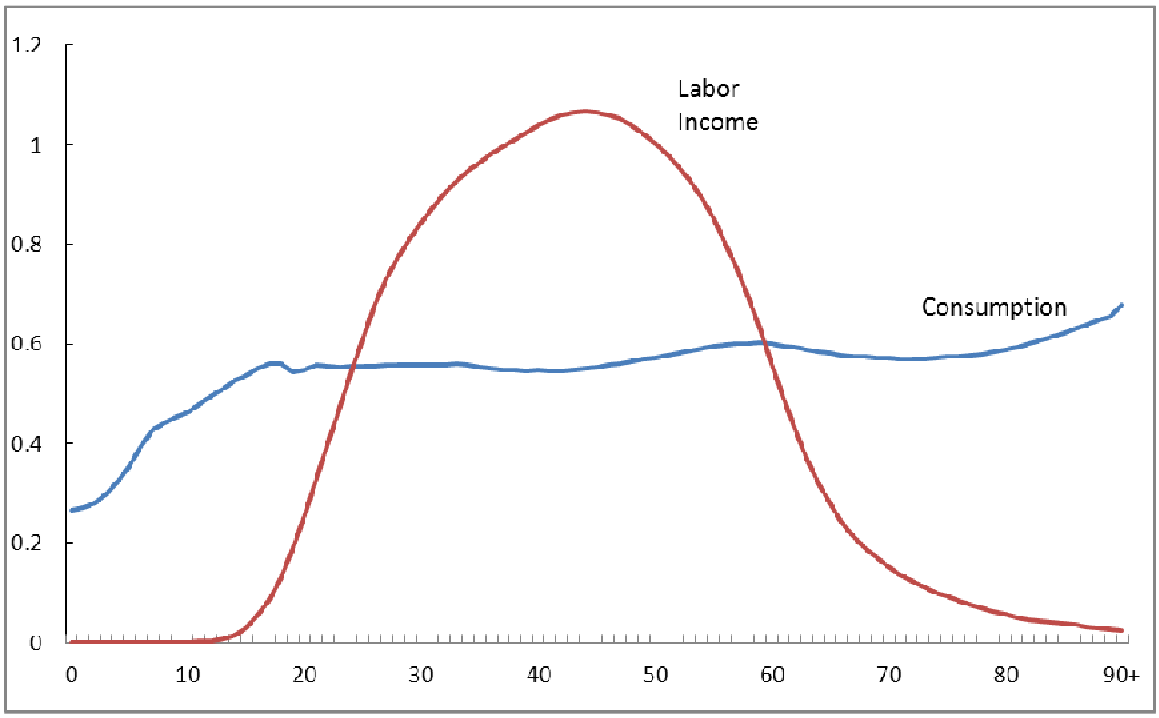
Leave for now, but I would like to replace this with values fro Brazil when they become available.

Table 3.4. Structure of Private Flow Account, Japan 2004, values in billions of yen.

	Value	% of labor income	Value	% of labor income
Private Transfers				
Net Private Transfers			0	0.0
Private Transfer Inflows			138,004	51.2
Intra-household Transfer Inflows	137,476	51.0		
Inter-household Transfer Inflows	528	0.2		
Private Transfer Outflows			-138,044	51.2
Intra-household Transfer Outflows	-137,476	51.0		
Inter-household Transfer Outflows	-568	0.2		
Net Private Transfers to ROW			41	0.0
Private Asset-based Flows				
Private Asset-based Reallocations			46,555	17.2
Private Asset Income			98,228	36.4
Less: Private Saving			51,673	19.2

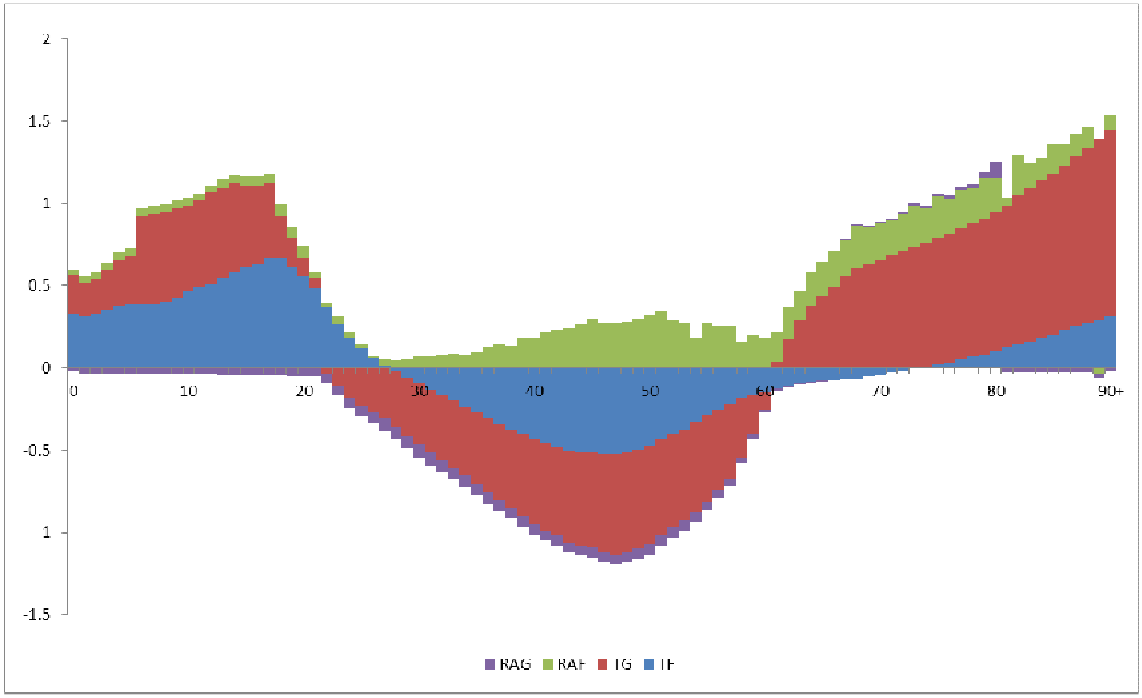
Source: Naohiro Ogawa, Andrew Mason, Amonthep Chawla, and Rikiya Matsukura 2008) "Japan's Unprecedented Aging and Changing Intergenerational Transfers". NTA Working Paper. Additional data at http://www.ntaccounts.org.

Figure 3.1. Economic lifecycle, per capita values, average of 23 countries. All values are normalized on per capita labor income of persons 30-49. Values are a simple average of country values.



<To be updated when estimates are finalized>

Figure 3.2. Age Reallocations, per capita values, average of xx countries. All values are normalized on per capita labor income of persons 30-49. Values are a simple average of country values.



<Update when final estimates are available. Add English labels rather than var names (RAG)>