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ABSTRACT

Generational accounting is a method of long-term fiscal analysis and planning. The goals are to assess the sustainability of fiscal policy and to measure the fiscal burdens facing current and future generations. The growing interest in generational accounting is stimulated by the rapid population aging taking place in virtually all the developed world and in much of the developing world. This demographic transition portends enormous fiscal bills in the first half of the next century as those generations born since World War II retire and begin collecting social security pension and old-age health-care benefits. The tremendous size of this fiscal liability, its dire implications for our children, and its orthogonality to the traditional deficit is leading economists, government officials, and the press to search for a meaningful measure of our fiscal future.

Key Words: aging, fiscal deficits, fiscal policy, generational accounting

JEL classification: H1,H3,H6

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Introduction

Generational Accounting is a method of long-term fiscal analysis and planning.[1] Its goals are to assess the sustainability of fiscal policy and to measure the fiscal burdens facing current and future generations. Although generational accounting is only seven years old, there are now 23 countries around the world doing generational accounting: Argentina, Austria, Australia, Belgium, Brazil, Canada, Chile, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Thailand, the United Kingdom, and the United States.

Much of this generational accounting is being done by or in conjunction with governmental bodies including the Argentine Ministry of Planning, the Bank of England, the Bank of Japan, the Board of Governors of the Federal Reserve System, the Congressional Budget Office, the Office of Management and Budget of the U.S. Government, the New Zealand Treasury, and the Norwegian Ministry of Finance. The International Monetary Fund has constructed generational accounts for France and Sweden. The World Bank has constructed generational accounts for Thailand and is about to begin constructing generational accounts for Slovenia. In addition, the Congressional Budget Office, the European Commission, and the Organization for Economic Cooperation and Development have each produced detailed studies of generational accounting.[2]

Generational accounting has also received its fair share of academic scrutiny.[3] Its methodology has been debated in leading economics journals, including the Journal of Economic Perspectives, The National Tax Journal, and the Economic Journal. This debate

[1] See Auerbach, Gokhale and Kotlikoff, (1991) and Kotlikoff (1992).

[2] See Sturrock (1995), Leibfritz et al (1995) and Raffelhueschen (1997).

[3] See Haveman (1994), Auerbach et al (1994), Cutler (1993), Diamond (1996) and Kotlikoff (1997).

has stimulated ongoing research, some of which is discussed here, on general equilibrium effects, immigration, and the proper way to discount government receipts and payments in light of their uncertainty. Finally, generational accounting has received a fair amount of public attention. Its findings have been discussed in leading newspapers, magazines, and television news shows in many of the countries for which the accounts have been prepared.

The growing interest in generational accounting is stimulated by the rapid population aging taking place in virtually all the developed world and in much of the developing world. This demographic transition portends enormous fiscal bills in the first half of the next century as those generations born since World War II retire and begin collecting social security pension and old-age health-care benefits. The tremendous size of this fiscal liability, its dire implications for our children, and its orthogonality to the traditional deficit is leading economists, government officials, and the press to search for a meaningful measure of our fiscal future.

How It Works and What It Does

Generational accounting is based on the government's intertermporal budget constraint which requires that either current or future generations pay the government's bills - the present value of the government's projected future purchases of goods and services plus its official net financial liabilities. Subtracting from these bills the present value of projected future net tax payments of current generations gives the present value net tax burden facing future generations implied by current policy. Net tax payments are taxes paid less social security, welfare, and other transfer payments received.[4]

[4] The fact that the government's bills left unpaid by current generations must be paid by future generations does not mean that future generations must pay off (retire) official government debt at some finite future date. They do, however, have to service the debt.

By comparing the growth-adjusted lifetime net tax burden facing future generations with that facing current newborns (who are assumed to pay, over their lifetimes, only the net taxes implied by current policy), one can assess the sustainability of current fiscal policies. For example, if the growth-adjusted lifetime net tax burden facing future generations is higher than that facing newborns, maintaining current policy through time, which means taxing successive new generations at the same rate as current generations, is not sustainable because it won't suffice to pay the government's bills.

Besides comparing the lifetime tax burdens facing future generations with that of newborns, generational accounting calculates the present value changes in net taxes of generations, both living and future, resulting from changes in fiscal policies. Take an expansion of pay-as-you-go-financed social security retirement benefits. Generational accounting shows that this policy helps the current elderly and harms current younger and future generations. Specifically, it records the reduction in the present value net tax payments of older generations arising under the policy as well as the increase in the present value net tax payments of young and future generations (whose increased payroll taxes have a larger present value than do their increased social security retirement benefits).[5]

Finally, generational accounting can identify the set of sustainable policies available to the government. For example, generational accounting can calculate the immediate and permanent annual percentage increase in income tax revenues (relative to the baseline projected time path of these revenues) needed to achieve intertemporal budget balance. This calculation takes the government's projected expenditures and other tax receipts as given and asks: "By what percentage would one need immediately and permanently to raise income taxes so as to be able (in conjunction with other tax receipts) to pay for the

[5] This statement assumes that the return to capital exceeds the growth rate of the economy.

government's projected future expenditures and its current net financial liabilities, and never have to raise taxes again."

In forming its calculations, generational accounting considers not only the course of future policy, but also the future demographic structure of the economy. Projected population totals of currently living generations are a key element in determining the contribution of current generations in paying the government's bills. Projected population totals of future generations are a key element in determining how large will be the burden per future person of covering the bills left unpaid by those now alive.

This Paper's Agenda

1. This paper previews the results of *Generational Accounting Around the World* -- a forthcoming National Bureau of Economic Research volume to be published by the University of Chicago Press. The volume, edited by this paper's authors, brings together the latest generational accounting results for 17 of the 23 countries listed above: Argentina, Australia, Belgium, Brazil, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Sweden, Thailand, and the United States.[6] This paper brings together the introduction, methodology, and cross-country comparison chapters of the forthcoming volume. The next section describes the method of generational accounting. We then turn to a presentation and comparison of the results themselves. These results were generated by the 31 country-study authors. These authors are Marcello Altimaranda (Argentina), John Ablett, Australia, Jean-Philippe Stijns, Belgium, Regina Malvar, Brazil, Philip Oreopolous, Canada, Bernd Raffelheuschen and Svend Jensen, Denmark, Ousmane Dore and Joaquim Levy (France), Jan Walliser and Bernd Raffelheuschen (Germany), Nicola Sartor (Italy), Lans Bovenberg and Harry ter Rele (The Netherlands), Bruce Baker, New Zealand, Ousmane Dore and Joaquim Levy (France), Erling Steigum and Carl Gjersem (Norway), Robert Haggeman and Christoph John (Sweden), Nanak Kakwani and Medhi Krongkaew (Thailand), Yukinobu Kitamura, Noriyuki Takayama, and Hiroshi Yoshida (Japan),

[6] Unfortunately, accounts for the other countries were not completed in time for inclusion in this book.

George DeMacedo, Carlos Andrade, and Jan Walliser (Portugal), andd Jagadeesh Gokhale, Benjamin Page, and John Sturrock (U.S.).

Methodology

This section describes the standard method of generational accounting which is used, with minor modifications, in all country studies. This methodology was first developed in Auerbach, Gokhale and Kotlikoff (1991) on which this section closely draws.

The government's intertemporal budget constraint, written in equation (1), requires that the future net tax payments of current and future generations be sufficient, in present value, to cover the present value of future government consumption as well as service the government's initial net indebtedness.[7]

$$(1) \qquad \sum_{k=t-D}^{t} N_{t,k} + (1+r)^{-(k-t)} \sum_{k=t+1}^{\infty} N_{t,k} = \sum_{s=t}^{\infty} G_s (1+r)^{-(s-t)} - W_t^g$$

The first summation on the left-hand side of (1) adds together the *generational accounts* -- the present value of the remaining lifetime net payments -- of existing generations. The term $N_{t,k}$ stands for the account of the generation born in year k. The index k in this summation runs from t-D (those age D, the maximum length of life, in year 0) to t (those born in year 0).

The second summation on the left side of (1) adds together the present values of the generational accounts of future generations, with k again representing the year of birth. As each of these generational accounts is expressed in dollars of the respective generation's

[7] The constraint does not assume that government debt is ever fully paid off, merely that the debt grows less quickly than the rate of discount -- that it does not explode. Thus, it is consistent with the long-run existence of government deficits, as long as these deficits are smaller than the amount needed simply to service the level of outstanding debt.

birth year, they must be discounted back to year t in the summation, using the government's real, before-tax return *r*.

The first term on the right hand side of (1) expresses the present value of government consumption. In this summation the values of government consumption in year s, given by G_s, are also discounted to year t. The remaining term on the right-hand side, W_t^g, denotes the government's net wealth in year t -- its assets minus its explicit debt.

Equation (1) indicates the zero-sum nature of intergenerational fiscal policy. Holding the present value of government consumption fixed, a reduction in the present value of net taxes extracted from current generations (a decline in the first summation on the left side of (1)) necessitates an increase in the present value of net tax payments of future generations.

The generational account $N_{t,k}$ is defined by:

$$(2) \qquad N_{t,k} = \sum_{s=\kappa}^{k+D} T_{s,k} P_{s,k} (1+r)^{-(s-\kappa)}$$

where κ=max(t,k). In expression (2) $T_{s,k}$ stands for the projected average net tax payment to the government made in year s by a member of the generation born in year k. The term $P_{s,k}$ stands for the number of surviving members of the cohort in year s who were born in year k.[8] For generations who are born prior to year t, the summation begins in year t and is discounted to year t. For generations who are born in year k>t, the summation begins in year k and is discounted to that year.

[8] The population weights $P_{s,k}$ incorporate both mortality and immigration, implicitly treating immigration as if it were a "rebirth" and assigning the taxes paid by immigrants to the representative members of their respective cohorts. This approach does not, therefore, separate the burdens of natives and immigrants. Such an extension is desirable, particularly if one wishes to study the effects on generational accounts of changes in immigration patterns.

A set of generational accounts is simply a set of values of $N_{t,k}$, one for each existing and future generation, with the property that the combined present value adds up to the right hand side of equation (1). Though we distinguish male and female cohorts in the results presented below, we suppress sex subscripts in (1) and (2) to limit notation.

Note that generational accounts reflect only taxes paid less transfers received. With the exception of government expenditures on health care (and, in some cases, education), which are treated as transfer payments, the accounts do not impute to particular generations the value of the government's purchases of goods and services because it is difficult to attribute the benefits of such purchases. Therefore, the accounts do not show the full net benefit or burden that any generation receives from government policy as a whole, although they can show a generation's net benefit or burden from a particular policy change that affects only taxes and transfers. Thus generational accounting tells us which generations will pay for government spending not included in the accounts, rather than telling us which generations will benefit from that spending. This implies nothing about the value of government spending; i.e., there is no assumption, explicit or implicit, concerning the value to households of government purchases.

Assessing the Fiscal Burden Facing Future Generations

Given the right-hand-side of equation (1) and the first term on the left-hand-side of equation (1), we determine, as a residual, the value of the second term on the left-hand side of equation (1), which is the collective payment, measured as a time-t present value, required of future generations. Based on this amount, we determine the average present value lifetime net tax payment of each member of each future generation under the assumption that the average lifetime tax payment of successive generations rises at the economy's rate of productivity growth. This makes the lifetime payment a constant share of lifetime income. Controlling for this growth adjustment, the lifetime net tax payments of future generations are directly comparable with those of current newborns, since the generational accounts of both newborns and future generations take into account net tax payments over these generations' entire lifetimes and are discounted back to their respective years of birth.

Our assumption that the generational accounts of all future generations are equal, except for a growth adjustment, is just one of many assumptions one could make about the distribution across future generations of their collective net payment to the government. We could, for example, assume a phase-in of the additional fiscal burden (positive or negative) to be imposed on future generations, allocating a greater share of the burden to later future generations and a smaller share to earlier ones. Clearly, such a phase-in would mean that generations born after the phase-in period has elapsed would face larger values of lifetime burdens (the $N_{t,k}$s) than we are calculating here.

Another way of measuring the imbalance of fiscal policy, illustrated below, is to ask what permanent change in some tax or transfer instrument, such as an increase in income taxes or a reduction in old-age social security benefits, would be necessary to equalize the lifetime growth-adjusted fiscal burden facing current newborns and future generations. Because such policies satisfy the government's intertemporal budget constraint, they also sustainable.

Assumptions Underlying Generational Account Calculations

To produce generational accounts, we require projections of population, taxes, transfers, and government expenditures, an initial value of government wealth, and a discount rate. We consider the impact of total, not just national, government.

Typically, we assume that government purchases grow at the same rate as GDP, although in some cases we break these purchases down into age-specific components and assume that each component remains constant per member of the relevant population, adjusted for the overall growth of GDP per capita. This causes different components of government purchases to grow more or less rapidly than GDP according to whether the relevant population grows or shrinks as a share of the overall population.

Government infrastructure purchases are treated like other forms of purchases in the calculations. Although such purchases provide an ongoing stream rather than a one-time amount of services, they must still be paid for. Generational accounting clarifies which generation or generations will have to bear the burden of these and other purchases. For government wealth, we measure the government's net financial assets – its financial assets less its gross debt. We do not include the real assets of state enterprises in this measure, but instead subtract projected net profits from state enterprises from projected government spending. This procedure effectively capitalizes the value of these enterprises.

Government wealth does not include the value of the government’s existing infrastructure, such as parks. Including such assets would have no impact on the estimated fiscal burden facing future generations because including these assets would require adding to the projected flow of government purchases an offsetting flow of imputed rent on the government’s existing infrastructure.

Taxes and transfer payments are each broken down into several categories. Our general rule regarding tax incidence is to assume that taxes are borne by those paying the taxes, when the taxes are paid: income taxes on income, consumption taxes on consumers, and property taxes on property owners. There are two exceptions here, both of which involve capital income taxes. First, we distinguish between marginal and infra-marginal capital income taxes. As described below, infra-marginal capital income taxes are distributed to existing wealth holders, whereas marginal capital income taxes are based on future projected wealth holdings. Second, in the case of small open economies, marginal corporate income taxes are assumed to be borne by (and are therefore allocated to) labor.

The typical method used to project the average values of particular taxes and transfer payments by age and sex starts with government forecasts of the aggregate amounts of each type of tax (e.g., payroll) and transfer payment (e.g., welfare benefits) in future years. These aggregate amounts are then distributed by age and sex based on cross-section relative age-tax and age-transfer profiles derived from cross-section micro data sets. For years beyond those for which government forecasts are available, age- and sex-specific average tax and transfer amounts are assumed to equal those for the latest year for which forecasts are available, with an adjustment for growth.

Calculating Infra-Marginal Capital Income Taxes

Capital income taxes require special treatment because, unlike other taxes, they may be capitalized into the values of existing assets. Also, the time pattern of income and tax payments may differ. As a result of these features of capital income taxes, such taxes must be attributed with care to ensure that they are assigned to the proper generation. If all forms of capital income were taxed at the same rate, there would be no such problem: all assets would yield the same rate of return before tax (adjusted for risk) and each individual would face a rate of return reduced by the full extent of the tax. However, if tax rates on the income from some assets, typically older ones, are higher than those facing income from new assets (e.g., because of investment incentives target toward new investment) a simple arbitrage argument indicates that the extra tax burden on the old assets should be capitalized into these assets' values.

To illustrate the nature of the necessary correction, consider the case of cash-flow taxation in which assets are written off immediately. A well-known result is that the effective marginal capital income tax rate under cash-flow taxation is zero. However, taxes would be collected each year on existing capital assets, and such assets should therefore be valued at a discount. Assigning these taxes to the assets' initial owners, rather than to members of future generations who may purchase the assets, is consistent with the fact that such future generations of individuals may freely invest in new assets and pay a zero rate of tax on the resulting income. Our correction to actual tax payments should, in this case, result in a zero tax burden on the income from new assets.

For the general case, we use the following methodology. Our calculation begins with expression (3) for the user cost of capital, to which firms set their marginal products:

(3) $$C = \frac{(r+\delta)(1-k-\tau z)}{(1-\tau)}$$

where r is the investor's required after-tax return, δ is the investment's economic rate of depreciation, τ is the investor's marginal tax rate, k is the investment tax credit or grant received upon investment, and z is the present value of depreciation allowances. We wish to calculate two measures. The first, which we denote by Q, is the tax-based discount on old capital, which equals the difference between tax savings from depreciation allowances and investment credits per unit of new capital and those available per unit of existing capital:

(4) $$Q = k + \tau(z - z^o)$$

where z^o is the present value of depreciation allowances per unit of old capital.

Measured capital income tax payments are not based on the effective rate of tax on new capital *m*, where

(5) $$m = \frac{C - (r + \delta)}{C - \delta}$$

Instead, they are based on an average tax rate, α, where

(6) $$\alpha = \frac{\tau(C - b) - k}{C - \delta}$$

and *b* is the average current depreciation deduction per unit of total capital . Comparing (5) and (6) indicates that we must correct measured taxes per unit of capital by subtracting from $\alpha(C\text{-}\delta)$ the term Δ, where

(7) $$\Delta = (\alpha - m)(C - \delta)$$

The values of z^o and *b* depend on past patterns of investment and the depreciation schedules permitted existing assets. For the case in which investment grows smoothly at rate *n*, and all capital (new and old) is written off at rate ψ based on historic asset cost, the value of undepreciated basis per unit of existing capital may be shown to equal:

(8) $$\frac{n + \delta}{n + \pi + \psi}$$

where π is the rate of inflation. Thus, the value of b, the average current depreciation deduction per unit of capital, is ψ multiplied by this basis:

(9)
$$b = \psi \frac{n + \delta}{n + \pi + \psi}$$

and the value of z^o, the present value of depreciation deductions per unit of existing capital, equals:

(10)
$$z^o = z \frac{n + \delta}{n + \pi + \psi}$$

where z is the present value of depreciation deductions per unit of basis (and per unit of new capital),

(11)
$$z = \frac{\psi}{r + \pi + \psi}$$

Substituting (5), (6), (9) and (11) into (7), we obtain:

(12)
$$\Delta = (r + \delta)\tau z\left[1 - \frac{(r + \pi + \psi)(n + \delta)}{(n + \pi + \psi)(r + \delta)}\right]$$

Substituting (10) into (4), we obtain:

(13)
$$Q = k + \tau z\left(1 - \frac{n + \delta}{n + \pi + \psi}\right)$$

Based on parameter values for the United States in the 1990s, Auerbach, Gokhale and Kotlikoff (1991) estimated values of Δ=.00111 and Q=.111.

There are other possible assumptions one could make about the incidence of capital income taxes. For a small open economy, for example, it may make sense to assume that taxes on mobile corporate capital are borne by local, fixed factors like labor.[9]

Discount Rates and Uncertainty

For base-case calculations, generational accounts typically use a real rate of discount in the neighborhood of 5 percent, a rate that exceeds the real government short-term borrowing rate in most developed countries. This rate seems justified given the riskiness of the flows being discounted. However, as we now discuss, the "right" discount rate to use is in sufficient question to merit presenting results based on a range of alternative discount rates – a practice routinely followed by generational accountants.

The appropriate discount rate for calculating the present value of future government revenues and expenditures depends on their uncertainty. If all such flows were certain and riskless, it would clearly be appropriate to discount them using the prevailing term-structure of risk-free interest rates. However, even in this simple and unrealistic case, such discounting could be problematic since it would require knowing the values of this term structure. To discern these values, one might examine the real yields paid on short-term, medium-term, and long-term inflation-indexed government bonds. But this presupposes the existence of such bonds. Many countries do not issue indexed bonds, and those that do don't necessarily issue indexed bonds of all maturities. The United States is a case in point. It has just begun to issue indexed bonds, but so far has limited it issue of such

[9] This approach is taken in Auerbach, Baker, Kotlikoff and Walliser (1997) for New Zealand.

bonds to those with 10-year maturities. Even if a country issues indexed bonds of multiple maturities, equating their real yields with the risk-free rate requires assuming no default risk which, for many countries, is a very strong assumption.

In the realistic case in which countries' tax revenues and expenditures are uncertain, discerning the correct discount rate is even more difficult. In this case, discounting based on the term structure of risk-free rates (even if it is observable) is no longer theoretically justified. Instead, the appropriate discount rates would be those that adjust for the riskiness of the stream in question. Since the riskiness of taxes, spending, and transfer payments presumably differ, the theoretically appropriate risk-adjusted rates at which to discount taxes, spending, and transfer payments would also differ.

Is risk adjusting really important? A priori, one might think that forming the expected present value of future taxes and transfers of current and future generations, with discounting done at risk-free rates, would yield a meaningful measure of the fiscal burdens facing different generations on average.[10] But this is not the case as the following line of argument, relying on the invariance of economic outcomes to fiscal labels, makes clear.

There are an infinite number of ways to label a country's underlying fiscal policy. If economic agents are rational, the choice of labels will have no real impact, including no impact on the intergenerational distribution of well-being – which generational accounting seeks to help illuminate. This proposition that economic outcomes are invariant to the government's vocabulary is true regardless of whether the economy features uncertainty, including uncertain government policy. However, in the context of uncertain government policy, relabeling fiscal policy can easily alter expected future taxes and expected future

[10] Diamond's (1996) endorsement of "projections" seems to come close to endorsing such analysis, although Diamond main argument is the same as we make here, namely that properly valuing uncertain tax and transfer flows requires adjusting for risk when one discounts.

transfer payments. Such relabeling will also alter the riskiness of reported taxes and transfer payments and, therefore, the proper rates at which to discount expected future tax and transfer streams. If one discounts these altered expected values with the proper risk-adjusted discount rates, one finds what one should find -- no change in the expected utilities of any generation. However, if one simply uses the time-path of risk-free rates of return to discount the expected value of future taxes and transfers, one gets nonsensical results – the "expected" fiscal burdens facing alternative generations depend on how the fiscal policy is labeled; i.e., they depend on the government's choice of vocabulary.

An example may help clarify this point. Take the case of a fully funded defined benefit social security system. Suppose the government has held risk-free bonds and now chooses instead to invest in risky stock To acquire the stock, the government sells the public its bonds. Consequently, the public ends up holding stock through the government and bonds in its private portfolio. If the stocks perform well, the government rebates to the public (in the form of a transfer payment) the amount beyond what is needed to cover its social security pension obligations. If the stocks perform poorly, the government taxes the public to cover its social security obligations.

Hence, under the "new" policy, the public receives a sure income on the bonds that it has purchased from the government, but a risky stream associated with the transfer or taxes it now faces. On balance, the public ends up with exactly the same income; i.e., it gets the same social security pension income and the combination of its safe bond income and its now risky net taxes is equivalent to its holding directly the stock sold to the government. This "portfolio" change on the part of the government alters the expected net tax payments of the public, but has no real effects -- it is nothing more than a relabeling of government receipts and payments. The fact that the government and the private sector exchange different securities with the public is simply part of the relabeling process, not evidence that policy has fundamentally changed

Another issue that arises with respect to risk-adjusted discounting is that the proper risk adjustments may be generation specific. To see this, consider a two period model in which there are two generations and no government purchases -- just an initial stock of debt that needs to be serviced and repaid in the second period. Generation 1, currently alive, will pay some tax rate, τ, times its uncertain income, and generation 2, not yet alive, will pay the residual. Since, by construction, the payments of the two generations equal principal plus interest on the debt in every state of nature, the government's intertemporal budget constraint is always satisfied.

In this example, aggregate tax payments are certain, although each generation's own tax payments are not. For generation 1, the uncertainty of its tax payments are actually a plus, since its risky income is being insured. Thus, we would be justified in applying a discount rate of $\rho > r$, where r is the risk-free rate, in valuing the expected tax payments from generation 1's perspective. From generation 2's point of view, the situation is more complicated. It depends on how much generation 2's marginal utility of consumption is correlated with that of generation 1. If there were perfect correlation (say, because of a single source of income, or complete intergenerational risk-sharing.), then generation 2's burden would be *greater* than that implied by discounting at the risk-free rate -- it's burden would be relatively higher in bad (low-income) states of nature – so its expected tax payments should be discounted at a rate $\rho < r$.

Hence, by discounting the burdens of each generation at an appropriate discount rate (higher than the risk-free rate for generation 1, lower than the risk-free rate for generation 2), we would still find that the sum of the burdens satisfied the government's intertemporal budget constraint, but get a better measure of the impact on individual utility.

To see the implications of this result, let us go back to the general, multiperiod and multigeneration model, and assume again for the moment that there is a single set of state-contingent future prices that all generations use to evaluate future flows. Then, our current approach, to define the burden on future generations as a residual, gives a correct measure of the aggregate burden on future generations. That is, we define this collective burden as:

$$N_{fut} = \sum_{k=-D}^{0} N_{0,k} - \sum_{t=0}^{\infty} (1+\rho)^{-t} G_t - B_0 \tag{18}$$

where $N_{0,k}$ is the generational account for the generation born in year k, formed by discounting that generation's flows using the discount rate ρ. As long as ρ is chosen appropriately (as already discussed, this would include, perhaps, using different values of ? for government purchases than taxes and transfers), N_{fut} is the value of the burden placed on future generations. Note that this procedure *will not* give us a measure of the expected values of net tax payments by future generations, but rather the value of these payments based on the valuation that would be placed on such payments by existing generations.

But now, we must come back to consider how to value the residual flows that must be paid by future generations under incomplete risk-sharing across generations. Consider again the simple model with two agents. In this instance, we can't use a discount rate based on generation 1's valuation of generation 2's burden. If we evaluate generation 2's burden from its own point of view, the burden may be lower. For example, suppose that the income of the two generations is negatively correlated; the negative correlation might arise if, for example, the source of shocks was to the relative productivity of capital and labor and generation 1 (2) supplied capital (labor). Then generation 2's burden, from its own perspective, will be less onerous than a certain burden with the same expected value.

This is because generation 2's taxes will be higher in states where its income is higher (even though generation 1's income is lower). Hence, we should discount generation 2's expected burden at a rate higher than the risk-free rate. Thus, both generations will perceive lower burdens than would be implied by discounting their respective expected tax payments at the risk-free rate. Since the total burden in the second period is $(1+r)B_0$, this means that the sum of the burdens from the individual perspectives will be lower than the present value of the debt repayment -- because government policy improves intergenerational risk-sharing.

In short, with incomplete risk-sharing, we can’t use the valuations of existing generations to discount the flows of future generations. Indeed, we don't even have the valuations of existing generations to rely on for future years that occur after all current generations are deceased.[11]

Our standard approach, then, may overstate the burdens on future generations to the extent that government policy improves intergenerational risk-sharing. However, it may be justified with the argument that such benefits of government policy should be considered separately from the first-order redistributions among generations.

In summary, measuring fiscal policy’s welfare effects on different generations, as generational accounting seeks to do, requires an evaluation of the risk characteristics of fiscal flows and an appropriate risk-adjustment of these flows or, as an approximate substitute, the use of risk-adjusted discount rates. Attempts to side-step this issue simply by discounting expected flows with a risk-free rate of interest are plagued by the same fundamental problem as deficit accounting -- the resulting measures would not be invariant

[11] Adding the possibility of incomplete *intra*generational risk-sharing would simply extend the complexity one additional step. Even within a generation, the total burden might be lighter than would be implied by discounting that generation's overall payments with a market discount rate.

with respect to changes in the superficial labels attached to government transactions. As generational accounting methods to date have not fully identified the appropriate adjustment for risk, it remains standard practice to estimate generational accounts for a range of discount rates.

Results

For most of the 17 countries considered in this paper, generational accounting's message is highly unpleasant. The reason is that most of these countries are running fiscal policies, which if left unchanged, will sentence their children to sky-high rates of net taxation. This section documents this contention. It compares the countries' generational accounts, the role of demographics in producing their generational imbalances, and the policies they could adopt to achieve generational balance – a situation in which future generations face the same lifetime net tax rates as current newborns.

In the first incarnations of generational accounting, educational expenditure was treated as a government purchase rather than as a transfer payment to those on whose behalf the expenditure is made. This treatment followed the classification of educational expenditures of the U.S. National Income and Product Accounts. To maintain comparability with previous work, we present generational accounts treating educational expenditure both as a government purchase (Case A) and as transfer payments (Case B).

The Demographic Transition

Table 1 considers the demographic trends underway in each of our 17 countries. The first four columns show projected population growth rates for this decade and the next three. The next two columns compare the elderly share of the population in 1990 and 2030, and the last two columns compare 1990 and 2020 elderly-dependency ratios -- the ratio of those aged 65 and over to those aged 15-64.

In this decade, each country's annual population growth rate is positive. But each is projected to decline dramatically over time. Indeed, in the 2020s, 6 of the 17 countries will experience negative population growth. In Brazil, Argentina, and Thailand population growth is projected to decline from 1 to 1.5 percent per year in the 1990s to 0.6 to 0.7 percent per year after 2020. In the United States, Canada, Australia and New Zealand, population growth will decline from this decade's rates of 0.9 to 1.2 percent per year to 0.3 to 0.4 percent per year after 2020. Starting at the turn of the century, the German, Italian, and Belgium populations will actually begin to shrink. Thailand, whose elderly currently make up only 4 percent of the population, will have a population that is 11 percent old in 2030.

Of the 17 countries, Germany, Italy, Japan, and the Netherlands will be the oldest in 2030, with over one quarter of their populations in the ranks of the elderly. In these countries as well as Belgium, there will be over 4 oldsters for every 10 workers (working-age persons). In Germany and Italy, there will be almost 5 oldsters per 10 workers. In another 9 countries – the United States, Canada, Australia, Denmark, New Zealand, France, Norway, Portugal, and Sweden – there will be between 3 and 4 oldsters per 10 workers. And in Thailand, Argentina, and Brazil, there will be roughly 2 oldster for every 10 workers.

Generational Accounts of Living Generations

When people are young, they receive transfers (*e.g.* child benefits, or education allowances) and pay consumption taxes. During their working life, they continue to pay consumption taxes, but also pay taxes on their labor and capital income in the form of personal income taxes and payroll taxes. The present-value of a generation's remaining lifetime net tax payments -- its generational account -- is generally highest for generations at the beginning of their workspans, as it does not include child and education benefits received in youth. When workers reach older ages, the sum of future net tax payments tends to decline as future transfer receipts (*e.g*. pensions) gain in importance compared with future tax payments. Between the ages of 50 and 60, future transfer receipts generally start to exceed future tax payments so that generational accounts become negative (net transfers). The absolute amount of net transfers declines during retirement as the remaining lifetime shortens.

Table 2 shows the generational accounts of each of our 17 countries. Each set of accounts exhibits a hump-shaped pattern with respect to age. This is true whether one considers Case A (educational expenditures treated as a government purchase) or Case B (education expenditures treated as a transfer payment). All amounts in this and subsequent tables are expressed in 1995 dollars.

Although the accounts all rise and then fall with age, the absolute levels of the accounts vary considerably across countries. Much of this variation – for example, the difference between U.S. and Thai accounts -- reflects the level of development. But there is great variation even among developed countries. Take Case A, and compare the accounts of 40 year-old Germans and those of 40-year-old Swedes. The Swedish age-40 account equals $228,500, which is 43 percent larger than the corresponding $160,100 German age-40 account. The difference in the two accounts reflects the much higher net transfers paid to older Germans compared to older Swedes. Or compare the 70 year-old Norwegian account with the corresponding Japanese account. The Norwegian account is $85,000 smaller than the Japanese account.

These big cross-country differences in the accounts should not obscure their similarities. Take Italy and Canada. Both countries have quite similar accounts through roughly age 25. But beyond this age, the Italians have much smaller accounts than do the

Canadians. Or compare the German and French accounts, on the one hand, or the Argentine and Brazilian accounts, on the other. They are quite similar across all ages.

There are four features of the accounts that particularly merit comment. First, the Japanese, Germans, Swedes, Danes, Dutch, French, and Belgians are confronting their young and middle aged citizens with strikingly high levels of remaining lifetime net taxes. At age 25, the respective Case-A accounts of these countries are $295,200, $295,200, $251,000, $237,300, $321,900, and $272,500. These values are not only large in absolute terms, but also relative to each of the countries' annual average labor earning. They are also much higher than the corresponding $175,400 age-25 U.S. account.

Second, with the exception of the Thailand, which does not yet have a pay-as-you-go social security system, the accounts of all the countries are negative after age 65. In a number of the countries they are negative at earlier ages. For example, Brazil's accounts turn negative at age 50. Third, certain countries are much more generous to their current elderly than are others. Comparing Australia and Norway makes this point. Both countries have quite similar Case-A accounts prior to age 40. But for older cohorts, Norway has substantially lower levels of net taxation. Indeed, at age 75 the Norwegian account is $154,000 less than the Australian account. Fourth, as expected, the Case-B accounts are much lower for all countries at younger ages since educational expenditures are allocated to children and young adults on whose behalf the expenditure is made. For example, in Canada the Case-B account for 5 year-olds is $66,400 – less than half the corresponding Case-A account.

Table 4 repeats Table 2 except it scales each country's accounts by the ratio of U.S. per capita GDP to the country's per capita GDP. Table 3 reports the absolute levels of 1995 per capita GDP for each country as well as the ratio of these living standards to 1995 U.S. per capita GDP. Living standards are measured on a purchasing price parity basis.

In absolute terms, the countries' living standards range from $5,400 in Brazil to $26,980 in the United States. Brazil's living standard is only a fifth of that of the United States. Japan's living standard, in contrast, is 82 percent of the U.S. standard.

Scaling the accounts is informative. It shows remarkable differences across countries in the extent of net taxation even after one has taken into account differences in levels of income. Take 40 year-olds. The largest Case-A account for this cohort is found in Japan. It equals $322,100. The smallest – equal to $42,300 -- is found in Thailand. The U.S. age-40 Case-A account is $135,700. In addition to Japan, Germany, Canada, Australia, Denmark, The Netherlands, France, Sweden, and Belgium have higher scaled age-40 generational accounts. Next consider 65 year-olds. The smallest age-65 scaled account is -$277,800 and belongs to Germany, whereas the largest -- $13,300 -- is that of Thailand. The age-65 U.S account is -$96,000. In addition to Germany, the age-65 accounts of Italy, Canada, Denmark, The Netherlands, France, Norway, Portugal, Sweden, Argentina, Belgium, and Brazil are less than that of the U.S. Finally, consider newborns. The U.S. Case-A account is $86,300. This is less than one third the corresponding scaled Swedish newborn account of $268,300. It's also smaller, and in most case a lot smaller, than the scaled newborn accounts of Japan, Germany, Italy, Canada, Australia, Denmark, The Netherlands, New Zealand, France, Norway, Portugal, and Belgium.

Imbalances in Generational Policy

The comparison of the generation account facing newborns with that facing future generations indicates the degree of imbalance in generational policy. These accounts can be found in the first and the third-from-last rows of Table 2. The last two rows show the imbalance in both absolute and percentage terms. Take the U.S. The Case-A generational account of newborn Americans is $86,300, whereas that facing future

Americans is $130,400. The difference between these numbers -- $44,100 – is the absolute imbalance. This absolute imbalance is 51.1 percent of the account of current newborns; i.e., unless currently living Americans are forced to pay more in net taxes or unless government in the U.S. can curtail its purchases, future Americans will face net tax rates that are more than 50 percent higher than those facing current newborn Americans! The Case-B absolute imbalance is quite close to the Case-A imbalance, but since the Case-B generational account of newborns is only about one third the size of the corresponding Case-A account, the Case-B percentage imbalance is must larger than the Case-A percentage imbalance – indeed, three times larger!

Whether one considers the Case-A or Case-B imbalance, one thing is clear: there is a very large imbalance in U.S. generational policy. But the U.S. is certainly not alone in placing the next generation in harm's way. According to Table 2, Japan, Germany, Italy, the Netherlands, Norway, and Belgium have larger percentage imbalances under Case A, and Japan, Italy, Denmark, the Netherlands, and Norway have larger percentage imbalances under Case B!

The country with the largest absolute imbalances is Japan. Its Case-A and Case-B imbalances are $169,300 and $337,800, respectively. These amounts are startling. If future Japanese are asked to pay these sums in addition to what current newborn Japanese are now being asked to pay, they will, in effect, be handed a net tax at birth in excess of $300,000. To view this number in a different light, compound it to age 20 at the 5 percent real discount. The resulting amount exceeds $800,000 and represents the effective lifetime net tax bill that would be handed to future Japanese upon entering the workforce.

In percentage terms, the Japanese imbalance is 169 percent in Case A and 338 percent in Case B. In other words, absent some other and quite dramatic fiscal adjustment, future Japanese face lifetime net tax rates that are 2.7 to 4.4 times the lifetime net tax rates facing current newborn Japanese. These findings were developed in a year-long Bank of Japan study by Dr. Yukinobu Kitamura of the Bank of Japan and Professor Hiroshi Yoshida of Tohoku University working in collaboration with Professor Noriyuki Takayama – one of Japan's leading academic economists. They are remarkable in light of the relatively high level of generational accounts facing young and middle aged Japanese and the relatively small (in absolute value) negative accounts of Japanese elderly. The explanation for Japan 's particularly severe generational imbalance lies in its particularly rapid rate of aging.

Although Japan has the worst generational imbalance, the German, Italian, Dutch, Norwegian, and Brazilian imbalances are also grave. In these countries, the tax burden on future generations will have to rise by more than 75 per cent under Case A and by more than 100 percent under Case B unless those now alive pay more or their governments spend less. Another five countries have severe imbalances – the United States, Norway, Portugal, Argentina, and Belgium. In these countries, the growth-adjusted fiscal burdens facing future generations are 50 to 75 percent larger than those facing current newborns.

Three countries – Australia, Denmark, and France -- have substantial imbalances that leave their descendants facing 30 to 50 percent higher lifetime net tax rates. Canada's appears to be essentially in generational balance. The remaining three countries – New Zealand, Thailand, and Sweden have negative imbalances; i.e., their polices, if maintained, would leave future generations facing lower lifetime net tax rates than current newborns. The main reason is that in these countries the aging of populations is less rapid and also their governments are currently following a strict course of fiscal consolidation. In these countries, intergenerational equity could be restored by reducing (somewhat) the tax burden on currently living generations.

Australia is another country whose recent policy measures have had a significant impact on its generational accounts. There, a compulsory savings scheme has been established which leads individuals to accumulate savings for retirement, while public pensions are steadily reduced; these measures increased the net taxes of current generations (as pension benefits of new-borns were reduced) while net taxes of future generations declined. However, during the transition from the pay-as-you-go pension system to a private funded system, current young Australians have to finance both the pensions of the currently retired generations and the accumulation of reserves for their own retirement; i.e., they have to "pay twice".

Generational Accounting vs. Deficit Accounting

It's interesting to compare generational accounting's assessment of fiscal sustainability with that suggested by official deficits and debts. Table 5 records, as a share of GDP, government deficits, primary deficits (taxes minus non-interest expenditures), levels of gross debt (gross government liabilities), and levels of net debt (gross government liabilities minus the government's financial assets) for our 17 countries. Consider Japan and Norway. Although Japan has the largest and Norway one of the largest generational imbalances, the two countries have the lowest ratios of net debt to GDP. Indeed, Norway's net debt is negative; the Norwegian government has positive net wealth. If one considers gross rather than net debt, Japan's and Norway's debt levels are still relatively modest. And if one considers deficits, one finds that the Japanese deficit is lower than that of Canada and that Norway is running a surplus. The correlation of generational imbalance with the primary deficit is no better. Norway's primary deficit is negative, and Japan's is lower than Sweden's, even though the Swedes have a negative generational imbalance.

The complete lack of any consistent relationship between nations' generational imbalances and their deficit or debt positions is not surprising given that, from a theoretical perspective, there is no intrinsic connection between the two measures. Nonetheless, this finding should be of interest to those who believe deficit or debt levels represent useful criteria for assessing a country's fiscal responsibility. Two institutions that immediately come to mind in this regard are the International Monetary Fund and the European Union. The IMF routinely uses budget deficit targets in determining structural-adjustment policies for its client countries. And the European Union has adopted a deficit target as the principal requirement for membership in its proposed single-currency monetary union.

In considering the desirability and sustainability of European monetary union, it's worth bearing the following in mind: imposing higher net taxes on current generations by printing money (and exacting a seignorage tax) is one of the easiest "solutions" to the major generational imbalances facing the various countries who are now likely to join the union. Because their imbalances are quite different, each country will wish to turn on the printing presses to a different degree. This may place significant stress on the union and lead to its eventual collapse.

Sensitivity of the Results

Estimates of generational accounts are based on the assumption that except for demographic influences, no other fundamental changes in the economy are assumed to occur. But with a given working-age population, labor supply could increase if (female) labor participation increases, and this would raise labor tax revenues and reduce transfers. Furthermore, if private saving increases (which may result from a shift towards private funded pension systems), receipts from capital income taxes would rise. Results for the Netherlands, for example, suggest that the combined effects of increasing the labor participation rate of women and increasing aggregate savings could significantly raise the future tax base and reduce the generational imbalance. Also, if population aging were slower than assumed here (e.g., if fertility rates were higher or if there was more immigration of young workers), the imbalance against future generations would be reduced. This would result from a larger number of taxpayers available to help finance government expenditures.

The results are also sensitive to assumptions about productivity growth and the discount rate. For a given discount rate, a higher productivity growth increases the absolute amounts of net tax payments of both existing and future generations. For a given productivity growth rate, a higher discount rate reduces these present value amounts. Table 6 shows Case-A generational imbalances for three discount rate assumptions (3 percent, 5 percent and 7 percent) and three productivity growth assumptions (1 per cent, 1.5 per cent and 2 per cent). Table 7 does the same for Case B.

It's clear from the two tables that the absolute sizes of the accounts of current newborns as well as future generations are fairly sensitive particularly to the choice of discount rates. On the other hand, the values of both variables move in the same direction in response to changes in the rates of productivity growth and interest. Consequently, the absolute generational imbalance in many countries is rather invariant to the choice of these rates. In Japan, for example, the absolute Case-A imbalance across the 9 combinations of growth and discount rates ranges from $223,800 to $294,500. Or take Thailand whose absolute Case-A imbalance ranges from –$6,400 to -$8,400.

Even in countries where the absolute imbalance is fairly sensitive to the choice of growth and discount rates, the basic message of the generational accounting may be the same. France is a good example. Its absolute imbalance ranges from $34,400 to $167,800. But the $34,400 imbalance arising from the assumption of a 7 percent discount rate and a 1.5 percent growth rate represents a percentage imbalance of 42 percent, and he $167,800 imbalance represents a percentage imbalance of 71 percent; hence, both sets of parameters indicate that future Frenchmen and Frenchwomen face much higher rates of lifetime net taxation than do current newborns assuming current newborns face, over their lifetimes, the panoply of French taxes and transfers now in existence.

Another message emerging from Tables 6 and 7 is that the sensitivity of the generational accounts to growth and interest rate assumptions depends on the country in question. Norway makes this clear. The Norwegian absolute imbalance switches from a small negative to a large positive value depending on parameter values. For Norway the choice of the discount rate is particularly critical. With the base-case 1.5 percent growth rate and 5 percent discount rate, Norway has a sizeable generational imbalance. But with a 7 percent discount rate and a 1.5 labor productivity growth rate, Norway is roughly in generational balance.

Sources of Generational Imbalances

Table 8 asks how much of the imbalance in generational policy in the various countries can be traced to the country's demographic transition and how much can be traced to its official net debt. The demographics experiment considers how large the generational imbalance would be were each country to experience no change whatsoever over time in the size or age-sex composition of its population. The zero-debt experiment sets official net debt to zero and recalculates the generational imbalance.

Demographics make a very substantial difference to the imbalance in almost all of the countries. The reason is that the countries are aging and the elderly are net beneficiaries of the governments' tax-transfer systems. For instance, Argentina's imbalance is essentially wiped out if there is no change in demographics. The same is true for Germany, the U.S., Denmark, Italy, the Netherlands, France, and Norway. In the case of Japan, zero demographic change would eliminate about three quarters of the Case-A imbalance and about four fifths of the Case-B imbalance.

Eliminating the government official net debt has a range of impacts on generational imbalances. Eliminating official debt would have a minor impact on the Japanese imbalance. The same goes for the imbalances in Norway and Brazil. For the U.S., the absence of net debt would eliminate only about one third of the outstanding imbalance. About half of the imbalance would be eliminated in Germany, Argentina, France, Australia, and Italy. The majority, then, of the 17 countries would still face very significant generational imbalances even were there no official net debt. This provides yet more evidence that official deficit and debt figures fall far short of being sufficient statistics for generational policy.

Restoring Generational Balance

Apart from the moral dimension of restoring generational balance, doing so represents an economic imperative. Countries that take no action to achieve generational balance will find their generational imbalances worsening over time. Why? Because failure to act in the short run means permitting each new generation that is born in the short run to experience the status-quo policy and thus pay the same lifetime net taxes as those now alive. In terms of generational accounting, this confronts generations born in the more distant future with an even larger lifetime net tax rate. But there is a limit – 100 percent – to the rate of lifetime net taxation; i.e., governments can't extract more from people in net taxes than they earn. Moreover, the marginal tax rates that would be associated with trying to collect anything close to a 100 percent average net tax would eliminate people's interest in working and, in the process, the government's net tax base.

Eliminating generational imbalances can be done in only two ways. The government can either force those now alive to pay higher net taxes by raising their taxes or by cutting their transfer payments or it can reduce the time-path of its spending. Table 9 explores each of these alternatives. It considers a) immediately and permanently reducing the time-path of government spending by a fixed percentage, b) immediately and permanently cutting all government transfers by a fixed percentage, c) immediately and permanently raising all taxes by a fixed percentage, and d) immediately and permanently raising all income taxes by a fixed percentage. These percentages are determined such that the residual growth-adjusted net tax bill facing future generations is the same as that facing newborns. Thus, each of these policy alternatives achieves generational balance on its own. Obviously, combinations of the policy instruments could achieve the same end, and, if the instruments were combined, less would be required of any single policy instrument.

In considering the magnitude of these alternative immediate fiscal adjustments, it's important to bear in mind that larger adjustments are needed if the policies under consideration are not enacted immediately. It's also important to note that the different types of adjustments would affect different currently living generations differently. For example, an income-tax hike would hurt current workers more than would a cut in transfer payments.

Restoring the balance between new-borns and future generations would require immediate and permanent cuts in government purchases of more than one half in Italy, of about one quarter in Japan, Argentina, and Brazil, and of about one fifth in the United States, Germany, the Netherlands, and France. These are very sizeable adjustments. Their enactment would materially alter the official deficits now being reported by these countries. In the U.S., the government-sector (federal, state, and local) deficit would fall by roughly $200 billion. The U.S. federal deficit is now small, but positive, so these cuts would produce close to a $200 billion surplus in the U.S. federal government's budget. Thus, achieving generational balance in the U.S. requires immediately running what would be, from an historical perspective, huge official surpluses rather than wait until 2002, as the U.S. federal government apparently intends, to achieve "budget balance."

Not all countries would need to cut spending to achieve generational balance. Thailand, Sweden, and New Zealand need to raise government spending -- by about 40 percent, 8 percent, and 1 percent respectively -- since their base-line generational imbalances are negative. Another point is that the spending adjustment needed to achieve balance is quite similar across alternatives A and B; i.e., how one allocates educational expenditures does not matter much to the adjustments needed to achieve generational balance.

An alternative to cutting government spending is cutting all transfer payments be they government-provided health-care, unemployment benefits, social security pensions, or welfare benefits.[12] Achieving generational balance in this way means transfer cuts of roughly two fifths in Italy, one quarter in Japan, and one fifth in the U.S., the Netherlands, and Brazil. For other countries, the requisite cut is smaller. Germany's Case-A required transfer cut is 17.6 percent. The corresponding U.S. cut is 19.8 percent. Germany's cut is smaller because transfer payments relative to GDP are somewhat larger in Germany than they are in the U.S. Thailand's current transfers are so small relative to GDP that they would need to be more than doubled to achieve generational balance.

Restoring generational balance in Italy through higher taxes translates into more than a 60 percent across-the-board tax hike. The corresponding general tax hike needed

[12] In the case of social security pensions, the cuts might come in the form of raising early and normal retirement ages.

for generational balance in the United States, Japan, Germany, Netherlands, Brazil and Argentina ranges from 9 to 16 percent. In France and Norway, a roughly 7 percent hike is needed. Portugal, Australia, Denmark, Canada, and Belgium require about a 2 to 5 percent hike. In Thailand, New Zealand, and Sweden across-the-board tax cuts of about 25 percent, .4 percent, and 3 percent, respectively, would produce generational balance.

The corresponding income-tax hikes needed to achieve generational balance have a much greater range across countries because the ratio of income taxes to GDP varies more across countries than does the ratio of total taxes to GDP. In Italy, which has a relatively small income-tax to GDP ratio, almost a tripling of the income tax rate would be needed to achieve generational balance. This assumes no erosion in the income-tax base. If one were to take such erosion into account, it might well be the case that achieving generational balance in Italy solely through a hike in the income tax is infeasible.

Argentina, Brazil, and France would also need to raise their income taxes dramatically to bring their accounts into balance. The requisite income-tax hikes for these countries range from 64 to 97 percent. Japan is not far behind. It would need over a 50 percent income-tax hike. The corresponding U.S. and German income-tax hikes range from 24 to 30 percent. These U.S. and Germany generationally balancing income-tax hikes are modest compared to what would be needed in Italy, but they would be viewed as enormously painful by current generations of Americans and Germans. Indeed, the focus of U.S. politicians is now on cutting, not raising, federal income taxes. For other countries -- Belgium, Portugal, Norway, Australia, Denmark, and Canada – a more modest income-tax hike would do the trick. At the other end of the imbalance spectrum is Thailand, which would have to cut its income taxes by 82 percent to achieve balance. Sweden could get to balance with a 9 percent income-tax cut, and New Zealand with a 1 percent cut.

Summary and Conclusion

Policymakers take official budget deficits and debts as their primary fiscal indicators. For example, European countries are currently aiming at budget deficits below 3 per cent of GDP -- the target for European monetary union membership -- while others (e.g. the United States) are aiming at balancing their budgets over the medium-term. Such deficit reductions may succeed in stabilizing debt-to-GDP ratios in the near future, they do not represent fiscally sustainable policies which will achieve generational balance – a situation in which today's and tomorrow's children pay, in net taxes, the same share of their lifetime labor incomes. In fact, by focusing on budget balance, rather than generational balance, many countries appear to be doing too little to achieve generational balance. This makes their long-term fiscal situations worse. The reason is that the longer a country waits to adjust, the more painful the ultimate adjustment will be. And adjusting too little in the short run is a form of waiting too long to adjust.

The international generational accounts presented here are quite shocking. The world's leading industrial powers – the U.S., Japan, and Germany – all have severe imbalances in their generational policies. Unless currently living members of these countries pay more in net taxes or unless these countries dramatically cut their purchases of goods and services, future Americans, Japanese, and Germans will face dramatically higher rates of lifetime net taxation. Leaving current Americans untouched and maintaining the current projected time-path of government purchases will leave future Americans collectively facing roughly 50 percent higher net tax rates over their lifetimes than those confronting a newborn American based on current U.S. tax-transfer policy. For future Germans, the imbalance, if not rectified, means they would face lifetime net tax rates that are roughly twice as high as those now in place. And for future Japanese, policy inaction means lifetime net tax rates that are more than 2.5 times as high as current values.

These three countries are not alone with respect to running imbalanced generational policies. Of the seventeen countries examined here, five (Japan, Italy, Germany, The Netherlands, and Brazil) have extreme imbalances. Another five (the United States, Norway, Portugal, Argentina, and Belgium) have severe imbalances. Three countries – Australia, Denmark, and France -- have substantial imbalances. Canada's appears to be essentially in generational balance. The remaining three countries – New Zealand, Thailand, and Sweden have negative imbalances; i.e., their polices, if maintained, would leave future generations facing lower lifetime net tax rates than current newborns.

There are a range of policy options that can be used to restore fiscal sustainability and generational equity. But for most of the 17 countries, their medicine, no matter how they take it, will be very unpleasant. Since conditions differ substantially across the various countries, the best combination of fiscal responses will be country-specific. Although each country may respond differently, those with sizeable generational imbalances all need to act immediately. Generational accounting's fundamental message is that who pays the government's bills is a zero-sum game. The less those now alive pay, the larger the amounts their descendants will pay. Delay not only makes the situation worse, it also leaves everyone in society uncertain about how long-term fiscal problems will ultimately be resolved.

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Table 1
Demographic Trends

Country	Population Growth Rates (percent per year)				Elderly Share of the Population[a]		Elderly Dependency Ratio[b]	
	1990-2000	2000-2010	2010-2020	2020-2030	1990	2030	1990	2030
United States	1.0	0.8	0.6	0.4	12.9	21.9	19.1	36.8
Japan	0.3	0.1	-0.2	-0.3	11.9	26.1	17.1	44.5
Germany	0.2	-0.3	-0.3	-0.4	14.0	28.1	21.7	49.2
Italy	0.0	-0.2	-0.3	-0.4	14.8	27.9	21.6	48.3
Canada	1.2	0.8	0.6	0.3	11.3	23.1	16.7	39.1
Thailand	1.4	1.1	0.8	0.7	3.8	11.0	6.0	16.3
Australia	1.2	0.8	0.5	0.3	10.7	20.3	16.0	33.0
Denmark	0.2	0.0	0.0	-0.1	15.4	22.6	22.7	37.7
Netherlands	0.5	0.1	0.0	-0.1	13.2	26.0	19.1	45.1
New Zealand	0.9	0.6	0.5	0.4	11.1	18.9	16.7	30.5
France	0.5	0.3	0.2	0.1	13.8	23.3	20.9	39.1
Norway	0.5	0.2	0.2	0.2	16.3	23.0	25.2	38.7
Portugal	0.0	0.0	0.0	0.0	13.0	20.9	19.5	33.5
Sweden	0.4	0.2	0.2	0.1	17.8	23.1	27.6	39.4
Argentina	1.0	0.8	0.8	0.6	9.1	13.9	15.0	21.3
Belgium	0.2	-0.1	-0.1	-0.1	15.0	24.3	22.4	41.1
Brazil	1.5	1.2	1.0	0.7	4.7	11.9	7.7	17.8

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[a] Population aged 65 and over as a percent of total population.

[b] Population aged 65 and over as a percent of population aged 15-64.

Source: "World Bank Projections," The World Bank, 1994

Table 2 1995 Generational Accounts

(thousands of 1995 U.S. dollars)

Generation's age in 1995	United States		Japan		Germany		Italy		Canada		Thailand	
	A	B	A	B	A	B	A	B	A	B	A	B
0	86.3	28.5	143.4	73.0	165.0	97.1	114.2	68.4	113.8	56.3	8.3	5.9
5	102.0	35.3	169.3	90.9	194.3	123.6	132.9	80.3	130.1	66.4	9.6	6.8
10	121.7	71.4	200.1	135.4	233.8	179.0	154.1	112.4	152.0	99.0	10.9	8.9
15	144.6	115.0	235.9	187.4	287.9	252.2	178.4	158.9	176.9	138.5	12.3	11.3
20	168.7	159.3	278.1	257.4	333.6	313.6	193.5	186.6	199.0	177.0	13.6	13.2
25	175.4	172.7	295.2	295.2	309.7	303.4	184.4	183.7	183.7	193.1	14.2	14.1
30	170.0	168.7	297.8	297.8	271.8	271.8	155.2	155.2	189.1	183.3	14.1	14.1
35	157.5	156.9	287.4	287.4	224.4	224.4	113.5	113.5	165.2	161.1	13.3	13.3
40	135.7	135.6	263.8	263.8	160.1	160.1	63.4	63.4	137.3	134.5	11.8	11.8
45	101.3	101.3	227.7	227.7	94.0	94.0	10.7	10.7	98.9	97.1	10.0	10.0
50	56.4	56.4	173.1	173.1	-4.2	-4.2	-46.8	-46.8	51.8	50.8	8.1	8.1
55	4.0	4.0	99.0	99.0	-98.9	-98.9	-103.1	-103.1	5.8	5.5	6.2	6.2
60	-51.7	-51.7	11.9	11.9	-183.6	-183.6	-142.0	-142.0	-45.3	-44.8	4.8	4.8
65	-96.0	-96.0	-47.7	-47.7	-206.7	-206.7	-138.3	-138.3	-84.7	-83.6	3.7	3.7
70	-104.6	-104.6	-44.8	-44.8	-180.7	-180.7	-117.5	-117.5	-89.1	-87.9	2.8	2.8
75	-101.9	-101.9	-36.0	-36.0	-150.2	-150.2	-94.7	-94.7	-85.6	-84.4	2.1	2.1
80	-89.5	-89.5	-26.7	-26.7	-109.6	-109.6	-72.2	-72.2	-80.9	-79.8	1.5	1.5
85	-74.4	-74.4	-18.2	-18.2	-68.0	-68.0	-52.7	-52.7	-69.4	-68.5	1.0	1.0
90	-56.7	-56.7	-9.7	-9.7	-3.2	-3.2	-7.4	-7.4	-11.0	-10.9	0.5	0.5
Future generations	130.4	73.9	386.2	319.4	316.8	248.8	264.8	209.9	114.0	58.0	1.0	-1.5
Generational imbalance												
Absolute	44.1	45.3	242.8	246.4	151.8	151.7	150.6	145.1	0.2	2.7	-7.3	-7.4
In per cent	51.1	159.0	169.3	337.8	92.0	156.1	131.8	223.8	0.0	3.1	-88.0	-125.4

A. Education expenditure treated as government consumption.

B. Education expenditure treated as government transfers and distributed by age groups.

Table 2 (continued) 1995 Generational Accounts

(thousands of 1995 dollars)

Generation's age in 1995	Australia		Denmark		The Netherlands		New Zealand		France	
	A	B	A	B	A	B	A	B	A	B
0	79.6	49.4	84	-18	110.0	49.4	57.3	18.0	151.5	82.2
5	95.3	60.1	134	14	139.8	68.9	68.2	26.4	191.7	125.4
10	112.8	85.4	178	79	171.0	113.8	74.4	39.0	229.4	175.4
15	134.3	115.8	211	143	205.0	164.0	82.8	57.9	264.8	222.2
20	148.4	138.3	243	209	231.7	209.9	91.9	78.7	304.4	284.8
25	147.7	141.9	251	232	237.3	237.3	104.2	95.3	321.9	318.7
30	138.5	134.2	238	225	220.0	222.0	102.9	95.9	293.7	293.7
35	128.2	124.4	214	202	196.7	196.7	94.1	88.7	242.7	242.7
40	111.9	108.5	166	157	161.2	161.2	79.0	75.1	166.8	166.8
45	87.4	84.5	99	91	116.3	116.3	57.9	55.6	77.5	77.5
50	57.4	55.1	14	9	62.2	62.2	31.3	30.3	-12.5	-12.5
55	25.9	24.2	-61	-64	5.5	5.5	2.5	2.4	-134.7	-134.7
60	1.5	1.5	-143	-143	-46.5	-46.5	-26.3	-26.3	-197.0	-197.0
65	-12.7	-12.7	-172	-172	-91.4	-91.4	-50.2	-50.2	-199.9	-199.9
70	-17.6	-17.6	-186	-186	-103.4	-103.4	-55.8	-55.8	-151.5	-151.5
75	-16.1	-16.1	-194	-194	-113.0	-113.0	-53.7	-53.7	-162.1	-162.1
80	-13.8	-13.8	-202	-202	-118.8	-118.0	-47.1	-47.1	-93.9	-93.9
85	-11.3	-11.3	-202	-202	-116.6	-116.6	-44.5	-44.5	-102.9	-102.9
90	-9.4	-9.4	-49	-49	-110.9	-110.9	-36.3	-36.3	-94.4	-94.4
Future generations	105.2	73.4	124	26	193.8	137.0	55.3	16.0	222.8	161.4
Generational imbalance										
Absolute	25.6	24.0	40	44	83.7	87.6	-2.0	-2.0	71.3	79.2
In per cent	32.2	48.6	46.9	--	76.0	177.7	-3.4	-10.8	47.1	96.3

A. Education expenditure treated as government consumption.

B. Education expenditure treated as government transfers and distributed by age groups.

Table 2 (continued) 1995 Generational Accounts

(thousands of 1995 U.S dollars)

Generation's age in 1995	Norway		Portugal		Sweden		Argentina		Belgium		Brazil	
	A	B	A	B	A	B	A	B	A	B	A	B
0	106.3	1.4	**61.8**	**43.5**	**184.3**	**121.8**	**22.7**	13.9	93.5	43.3	14.3	10.2
5	112.3	-7.5	**67.1**	**45.5**	**203.4**	**140.8**	**25.3**	15.7	132.4	76.2	17.1	12.3
10	123.7	14.7	**73.0**	**50.9**	**226.4**	**162.9**	**28.7**	20.3	170.1	116.0	20.9	17.1
15	135.3	58.4	**79.6**	**65.3**	**253.5**	**211.3**	**32.6**	26.3	210.5	172.3	25.0	22.6
20	140.8	106.3	**86.0**	**82.7**	**281.2**	**265.1**	**34.0**	30.8	242.3	232.9	28.9	27.0
25	143.2	127.1	**85.1**	**84.5**	**295.2**	**284.2**	**33.5**	31.6	272.5	270.8	31.2	30.1
30	138.1	129.6	**75.0**	**75.0**	**283.7**	**278.9**	**29.8**	28.2	278.6	278.6	31.5	31.3
35	120.9	116.2	**60.0**	**60.0**	**261.9**	**258.3**	**22.8**	21.6	259.3	259.3	28.0	28.0
40	93.1	90.3	**39.7**	**39.7**	**228.5**	**226.5**	**13.6**	12.6	215.5	215.5	19.7	19.7
45	40.5	38.9	**15.9**	**15.9**	**177.2**	**175.8**	**2.1**	1.5	149.3	149.3	6.9	6.9
50	-22.0	-22.3	**-10.6**	**-10.6**	**105.3**	**104.6**	**-11.0**	-11.3	65.1	65.1	-6.3	-6.3
55	-73.0	-73.0	**-33.9**	**-33.9**	**16.5**	**16.1**	**-25.2**	-25.2	-34.6	-34.6	-18.1	-18.1
60	-135.0	-135.3	**-47.1**	**-47.1**	**-66.3**	**-66.4**	**-39.9**	-39.9	-130.6	-130.6	-28.0	-28.0
65	-170.6	-170.6	**-49.4**	**-49.4**	**-110.8**	**-110.9**	**-42.9**	-42.9	-165.7	-165.7	-33.3	-33.3
70	-179.8	-179.6	**-42.7**	**-42.7**	**-97.8**	**-97.8**	**-43.0**	-43.0	-172.4	-172.4	-32.9	-32.9
75	-170.0	-170.0	**-33.3**	**-33.3**	**-79.7**	**-79.7**	**-41.2**	-41.2	-163.7	-163.7	-22.1	-22.1
80	-155.1	-155.1	**-24.8**	**-24.8**	**-58.1**	**-58.1**	**-34.3**	-34.3	-153.1	-153.1	-14.1	-14.1
85	-139.4	-139.4	**-15.4**	**-15.4**	**-33.2**	**-33.2**	**-32.5**	-32.5	-138.6	-138.6	-9.6	-9.6
90	-122.6	-122.6	**-4.1**	**-4.1**	**-6.5**	**-6.5**	**-7.1**	-7.1	-119.0	-119.0	-2.7	-2.7
Future generations	173.5	57.3	**98.7**	**73.2**	**143.5**	**83.8**	**36.1**	24.3	147.8	89.5	27.0	22.1
Generational imbalance												
Absolute	**67.2**	**55.9**	**36.9**	**29.7**	**-40.9**	**-38.0**	**13.4**	**10.4**	**54.2**	**46.3**	**12.7**	**11.9**
In percent	**63.2**	**4091.8**	**59.7**	**68.3**	**-22.2**	**-31.2**	**58.6**	**74.8**	**58.0**	**107.0**	**88.8**	**116.7**

A. Education expenditure treated as government consumption.

B. Education expenditure treated as government transfers and distributed by age groups.

A.

Table 3
Absolute and Relative Levels of Per Capita GDP

Country	Per Capita GDP	Per Capita GDP as a Percent of U.S. GDP
United States	26,980	100.0
Japan	22,110	81.9
Germany	20,070	74.4
Italy	19,870	73.6
Canada	21,130	78.3
Thailand	7,540	27.9
Australia	18,940	70.2
Denmark	21,230	78.7
Netherlands	19,950	73.9
New Zealand	16,360	60.6
France	21,030	77.9
Norway	21,940	81.3
Portugal	12,670	47.0
Sweden	18,540	68.7
Argentina	8,310	30.8
Belgium	21,660	80.3
Brazil	5,400	20.0

Source: World Development Report 1997, The World Bank.

Table 4 1995 Scaled Generational Accounts

(thousands of 1995 U.S. dollars)

Generation's age in 1995	United States		Japan		Germany		Italy		Canada		Thailand	
	A	B	A	B	A	B	A	B	A	B	A	B
0	86.3	28.5	175.1	89.1	221.8	130.5	155.2	92.9	145.3	71.9	29.7	21.1
5	102.0	35.3	206.7	111.0	261.2	166.1	180.6	109.1	166.2	84.8	34.4	24.4
10	121.7	71.4	244.3	165.3	314.2	240.6	209.4	152.7	194.1	126.4	39.1	31.9
15	144.6	115.0	288.0	228.8	387.0	339.0	242.4	215.9	225.9	176.9	44.1	40.5
20	168.7	159.3	339.6	314.3	448.4	421.5	262.9	253.5	254.2	226.1	48.7	47.3
25	175.4	172.7	360.4	360.4	416.3	407.8	250.5	249.6	234.6	246.6	50.9	50.5
30	170.0	168.7	363.6	363.6	365.3	365.3	210.9	210.9	241.5	234.1	50.5	50.5
35	157.5	156.9	350.9	350.9	301.6	301.6	154.2	154.2	211.0	205.7	47.7	47.7
40	135.7	135.6	322.1	322.1	215.2	215.2	86.1	86.1	175.4	171.8	42.3	42.3
45	101.3	101.3	278.0	278.0	126.3	126.3	14.5	14.5	126.3	124.0	35.8	35.8
50	56.4	56.4	211.4	211.4	-5.6	-5.6	-63.6	-63.6	66.2	64.9	29.0	29.0
55	4.0	4.0	120.9	120.9	-132.9	-132.9	-140.1	-140.1	7.4	7.0	22.2	22.2
60	-51.7	-51.7	14.5	14.5	-246.8	-246.8	-192.9	-192.9	-57.9	-57.2	17.2	17.2
65	-96.0	-96.0	-58.2	-58.2	-277.8	-277.8	-187.9	-187.9	-108.2	-106.8	13.3	13.3
70	-104.6	-104.6	-54.7	-54.7	-242.9	-242.9	-159.6	-159.6	-113.8	-112.3	10.0	10.0
75	-101.9	-101.9	-44.0	-44.0	-201.9	-201.9	-128.7	-128.7	-109.3	-107.8	7.5	7.5
80	-89.5	-89.5	-32.6	-32.6	-147.3	-147.3	-98.1	-98.1	-103.3	-101.9	5.4	5.4
85	-74.4	-74.4	-22.2	-22.2	-91.4	-91.4	-71.6	-71.6	-88.6	-87.5	3.6	3.6
90	-56.7	-56.7	-11.8	-11.8	-4.3	-4.3	-10.1	-10.1	-14.0	-13.9	1.8	1.8
Future generations	130.4	73.9	471.6	390.0	425.8	334.4	359.8	285.2	145.6	74.1	3.6	-5.4
Generational imbalance												
Absolute	44.1	45.3	296.5	300.9	204.0	203.9	204.6	197.1	0.3	3.4	-26.2	-26.5
In per cent	51.1	159.0	169.3	337.8	92.0	156.1	131.8	223.8	0.0	3.1	-88.0	-125.4

A. Education expenditure treated as government consumption.
B. Education expenditure treated as government transfers and distributed by age groups.

Table 4 (continued) 1995 Scaled Generational Accounts

(thousands of 1995 dollars)

Generation's age in 1995	Australia		Denmark		The Netherlands		New Zealand		France	
	A	B	A	B	A	B	A	B	A	B
0	113.4	70.4	106.7	-22.9	148.8	66.8	94.6	29.7	194.5	105.5
5	135.8	85.6	170.3	17.8	189.2	93.2	112.5	43.6	246.1	161.0
10	160.7	121.7	226.2	100.4	231.4	154.0	122.8	64.4	294.5	225.2
15	191.3	165.0	268.1	181.7	277.4	221.9	136.6	95.5	339.9	285.2
20	211.4	197.0	308.8	265.6	313.5	284.0	151.7	129.9	390.8	365.6
25	210.4	202.1	318.9	294.8	321.1	321.1	171.9	157.3	413.2	409.1
30	197.3	191.2	302.4	285.9	297.7	300.4	169.8	158.3	377.0	377.0
35	182.6	177.2	271.9	256.7	266.2	266.2	155.3	146.4	311.6	311.6
40	159.4	154.6	210.9	199.5	218.1	218.1	130.4	123.9	214.1	214.1
45	124.5	120.4	125.8	115.6	157.4	157.4	95.5	91.7	99.5	99.5
50	81.8	78.5	17.8	11.4	84.2	84.2	51.7	50.0	-16.0	-16.0
55	36.9	34.5	-77.5	-81.3	7.4	7.4	4.1	4.0	-172.9	-172.9
60	2.1	2.1	-181.7	-181.7	-62.9	-62.9	-43.4	-43.4	-252.9	-252.9
65	-18.1	-18.1	-218.6	-218.6	-123.7	-123.7	-82.8	-82.8	-256.6	-256.6
70	-25.1	-25.1	-236.3	-236.3	-139.9	-139.9	-92.1	-92.1	-194.5	-194.5
75	-22.9	-22.9	-246.5	-246.5	-152.9	-152.9	-88.6	-88.6	-208.1	-208.1
80	-19.7	-19.7	-256.7	-256.7	-160.8	-159.7	-77.7	-77.7	-120.5	-120.5
85	-16.1	-16.1	-256.7	-256.7	-157.8	-157.8	-73.4	-73.4	-132.1	-132.1
90	-13.4	-13.4	-62.3	-62.3	-150.1	-150.1	-59.9	-59.9	-121.2	-121.2
Future generations	149.9	104.6	157.6	33.0	262.2	185.4	91.3	26.4	286.0	207.2
Generational imbalance										
Absolute	36.5	34.2	50.8	55.9	113.3	118.5	-3.3	-3.3	91.5	101.7
In per cent	32.2	48.6	46.9	--	76.0	177.7	-3.4	-10.8	47.1	96.3

A. Education expenditure treated as government consumption.

B. Education expenditure treated as government transfers and distributed by age groups.

Table 4 (continued) 1995 Scaled Generational Accounts

(thousands of 1995 U.S dollars)

Generation's age in 1995	Norway		Portugal		Sweden		Argentina		Belgium		Brazil	
	A	B	A	B	A	B	A	B	A	B	A	B
0	130.8	1.7	131.5	92.6	268.3	177.3	73.7	45.1	116.4	53.9	71.5	51.0
5	138.1	-9.2	142.8	96.8	296.1	204.9	82.1	51.0	164.9	94.9	85.5	61.5
10	152.2	18.1	155.3	108.3	329.5	237.1	93.2	65.9	211.8	144.5	104.5	85.5
15	166.4	71.8	169.4	138.9	369.0	307.6	105.8	85.4	262.1	214.6	125.0	113.0
20	173.2	130.8	183.0	176.0	409.3	385.9	110.4	100.0	301.7	290.0	144.5	135.0
25	176.1	156.3	181.1	179.8	429.7	413.7	108.8	102.6	339.4	337.2	156.0	150.5
30	169.9	159.4	159.6	159.6	413.0	406.0	96.8	91.6	346.9	346.9	157.5	156.5
35	148.7	142.9	127.7	127.7	381.2	376.0	74.0	70.1	322.9	322.9	140.0	140.0
40	114.5	111.1	84.5	84.5	332.6	329.7	44.2	40.9	268.4	268.4	98.5	98.5
45	49.8	47.8	33.8	33.8	257.9	255.9	6.8	4.9	185.9	185.9	34.5	34.5
50	-27.1	-27.4	-22.6	-22.6	153.3	152.3	-35.7	-36.7	81.1	81.1	-31.5	-31.5
55	-89.8	-89.8	-72.1	-72.1	24.0	23.4	-81.8	-81.8	-43.1	-43.1	-90.5	-90.5
60	-166.1	-166.4	-100.2	-100.2	-96.5	-96.7	-129.5	-129.5	-162.6	-162.6	-140.0	-140.0
65	-209.8	-209.8	-105.1	-105.1	-161.3	-161.4	-139.3	-139.3	-206.4	-206.4	-166.5	-166.5
70	-221.2	-220.9	-90.9	-90.9	-142.4	-142.4	-139.6	-139.6	-214.7	-214.7	-164.5	-164.5
75	-209.1	-209.1	-70.9	-70.9	-116.0	-116.0	-133.8	-133.8	-203.9	-203.9	-110.5	-110.5
80	-190.8	-190.8	-52.8	-52.8	-84.6	-84.6	-111.4	-111.4	-190.7	-190.7	-70.5	-70.5
85	-171.5	-171.5	-32.8	-32.8	-48.3	-48.3	-105.5	-105.5	-172.6	-172.6	-48.0	-48.0
90	-150.8	-150.8	-8.7	-8.7	-9.5	-9.5	-23.1	-23.1	-148.2	-148.2	-13.5	-13.5
Future generations	213.4	70.5	210.0	155.7	208.9	122.0	117.2	78.9	184.1	111.5	135.0	110.5
Generational imbalance												
Absolute	82.7	68.8	78.5	63.2	-59.5	-55.3	43.5	33.8	67.5	57.7	63.5	59.5
In per cent	63.2	4091.8	59.7	68.3	-22.2	-31.2	58.6	74.8	58.0	107.0	88.8	116.7

A. Education expenditure treated as government consumption.

B. Education expenditure treated as government transfers and distributed by age groups.

Table 5   Official Deficits and Debts as a Share of GDP

Country	Deficit	Primary Deficit	Gross Debt	Net Debt
United States	2.0	-0.4	63.4	48.2
Japan	3.7	3.1	80.6	10.3
Germany	3.6	0.4	62.2	45.0
Italy	7.0	-3.1	124.7	110.2
Canada	4.1	-1.7	100.5	69.6
Thailand	-8.1a	na	na	na
Australia	2.0	-0.2	43.4	28.2
Denmark	1.9	-1.5	76.9	46.6
Netherlands	4.1	-1.0	79.5	46.1
New Zealand	-3.2	-4.7	na	na
France	5.0	1.7	60.7	36.1
Norway	-3.3	-3.9	42.8	-23.4
Portugal	5.0	-0.8	68.4	na
Sweden	7.7	5.2	80.3	32.9
Argentina	na	na	na	na
Belgium	4.1	-4.4	133.5	126.1
Brazil	13.3	na	na	na

Source (unless otherwise indicated): Organization for Economic Cooperation and Development. Notes: Deficits and debts are for general government (federal, state, local, and the social security sectors) and are derived from national income accounts. Primary deficit is the official deficit minus interest on net debt. Net debt refers to gross liabilities (gross debt) less financial assets.

na – not available. [a] Source is World Development Report 1997, The World Bank, central government current deficit. Negative values indicate surpluses.

Table 6 Generational accounts: Sensitivity to Growth and Discount Rates, Case A

(thousands of 1995 U.S. dollars)

Country	Productivity growth rate (per cent)	1			1.5			2		
	Discount rate (per cent)	3	5	7	3	5	7	3	5	7
United States	Newborn generation	149.1	86.7	48.9	147.4	86.3	48.8	145.6	85.9	48.7
	Future generation	243.7	146.7	93.9	203.5	130.4	86.2	163.6	114.2	78.5
	Absolute imbalance	94.6	60.1	45.0	56.0	44.1	37.4	18.0	28.3	29.8
Japan	Newborn generation	242.1	120.1	62.4	291.0	143.4	73.8	349.8	171.4	87.4
	Future generation	510.6	356.5	283.3	571.5	386.2	297.6	644.3	421.6	314.9
	Absolute imbalance	268.5	236.4	220.9	280.5	242.8	223.8	294.5	250.2	227.5
Germany	Newborn generation	255.7	140.2	72.6	292.3	165.0	86.7	329.1	193.1	103.0
	Future generation	431.8	284.3	196.7	472.8	316.8	214.6	504.3	353.3	235.8
	Absolute imbalance	176.1	144.1	124.1	180.5	151.8	127.9	175.2	160.2	132.8
Italy	Newborn generation	157.2	101.1	62.5	171.6	114.2	70.9	183.2	128.4	80.5
	Future generation	312.6	249.5	212.8	331.5	264.8	221.0	347.6	282.1	230.9
	Absolute imbalance	155.4	148.4	150.3	159.9	150.6	150.1	164.4	153.7	150.4
Canada	Newborn generation	190.1	93.1	44.8	231.9	113.8	54.8	281.8	138.5	66.9
	Future generation	198.3	94.2	44.3	232.8	114.0	49.6	271.9	129.6	57.2
	Absolute imbalance	8.2	1.1	-.5	.9	.2	-5.2	-9.9	8.9	-9.7
Thailand	Newborn generation	14.1	7.0	3.9	17.2	8.3	4.5	21.1	9.9	5.3
	Future generation	6.1	-0.1	-2.5	8.9	1.0	-2.0	12.6	2.4	-1.5
	Absolute imbalance	-8.0	-7.1	-6.4	-8.3	-7.3	-6.5	-8.4	-7.6	-6.8

Table 6 (continued) Generational accounts: Sensitivity to Growth and Discount Rates, Case A

(thousands of 1995 U.S. dollars)

Country	Productivity growth (per cent)	1			1.5			2		
	Discount rate (per cent)	3	5	7	3	5	7	3	5	7
Australia	Newborn generation	138	66	32	167	80	39	203	96	47
	Future generation	187	91	58	247	105	63	362	124	70
	Absolute imbalance	49	25	26	80	25	24	159	28	23
Denmark	Newborn generation	156	66	17	183	84	27	211	105	38
	Future generation	196	103	49	224	124	61	251	147	75
	Absolute imbalance	40	37	32	41	40	34	40	42	37
Netherlands	Newborn generation	191	92	41	222	110	50	257	131	61
	Future generation	299	170	111	344	194	122	396	222	136
	Absolute imbalance	108	78	70	122	84	72	139	91	75
New Zealand	Newborn generation	106.7	57.3	30.2	106.7	57.3	30.2	106.7	57.3	30.2
	Future generation	130.2	62.9	32.1	100.4	55.3	29.4	70.3	55.3	26.7
	Absolute imbalance	23.5	5.6	1.9	-6.3	-2	-0.8	-36.4	-2	-3.5
France	Newborn generation	205.1	134.4	71.7	222.1	151.5	82.5	236.8	169.9	94.5
	Future generation	350.6	202.4	105.3	377.8	222.8	116.9	404.6	245.5	130.0
	Absolute imbalance	145.5	67.9	33.6	155.7	71.3	34.4	167.8	75.6	35.5
Norway	Newborn generation	138.3	95.2	61.9	145.2	106.3	69.1	145.1	117.8	77.4
	Future generation	270.1	128.8	40.4	327.8	173.5	71.7	381.3	220.3	104.9
	Absolute imbalance	131.8	33.6	-21.5	182.6	67.2	2.6	236.2	102.5	27.5

Table 6 (continued) Generational accounts: Sensitivity to Growth and Discount Rates Case A

(thousands of 1995 U.S. dollars)

Country	Productivity growth (per cent)	1			1.5			2		
	Discount rate (per cent)	3	5	7	3	5	7	3	5	7
Portugal	Newborn generation	86.9	54.9	35.5	97.2	61.8	39.6	107.9	69.6	44.3
	Future generation	123.7	92.2	76.6	134.1	98.7	79.4	44.8	106.3	83.1
	Absolute imbalance	36.8	37.4	41.1	36.8	36.9	39.8	36.9	36.7	38.8
Sweden	Newborn generation	292.4	163.2	97.5	333.0	184.3	108.3	378.8	208.8	120.7
	Future generation	268.3	119.2	40.8	309.6	143.5	53.2	351.4	171.2	67.5
	Absolute imbalance	-24.1	-44.0	-56.7	-23.4	-40.9	-55.1	-27.3	-37.5	-53.2
Argentina	Newborn generation	28.0	20.6	13.5	28.3	22.7	15.1	26.6	24.9	16.9
	Future generation	50.1	32.3	22.7	55.5	36.1	24.6	60.8	40.4	26.8
	Absolute imbalance	22.1	11.7	9.3	27.2	13.4	9.5	34.1	15.5	10.0
Belgium	Newborn generation	243.9	138.9	73.9	272.5	162.4	87.5	295.8	188.6	103.2
	Future generation	369.7	229.4	158.6	415.2	258.8	171.4	462.1	292.8	188.0
	Absolute imbalance	125.8	90.5	84.7	142.7	96.4	83.9	166.3	104.2	84.7
Brazil	Newborn generation	21	12	7	23	14	8	24	17	9
	Future generation	41	23	14	47	27	16	54	31	18
	Absolute imbalance	20	11	7	24	13	8	30	14	9

Table 7 Generational Accounts: Sensitivity to Growth and Discount Rates, Case B

(thousands of 1995 U.S. dollars)

Country	Productivity growth rate (per cent)	1			1.5			2		
	Discount rate (per cent)	3	5	7	3	5	7	3	5	7
United States	Newborn generation	75.8	28.9	2.6	74.1	28.5	2.5	72.3	28.1	2.4
	Future generation	160.3	82.6	43.1	134.9	73.9	39.8	109.6	65.2	36.4
	Absolute imbalance	84.5	53.7	40.5	60.7	45.3	37.2	37.3	37.1	34.0
Japan	Newborn generation	159.7	53.3	7.4	203.8	73.0	16.0	257.5	97.1	26.7
	Future generation	431.3	293.6	232.5	487.2	319.4	243.9	554.7	350.9	258.1
	Absolute imbalance	271.6	240.3	225.1	283.4	246.4	227.9	297.2	253.8	231.4
Germany	Newborn generation	174.1	76.4	21.8	205.1	97.1	32.8	236	120.6	45.9
	Future generation	351.5	220.2	144.4	389.6	248.8	159.8	423	281.1	178
	Absolute imbalance	177.4	143.8	122.6	184.5	151.7	127.0	187	160.5	132.1
Italy	Newborn generation	99.2	54.3	24.2	110.3	64.8	30.6	118.3	76.3	38.0
	Future generation	249.2	197.5	169.5	264.4	209.9	175.4	276.5	224.1	182.9
	Absolute imbalance	150.0	143.2	145.3	154.1	145.1	144.8	158.2	147.8	144.9
Canada	Newborn generation	118.6	39.7	3.8	154.6	56.3	11.0	107.9	76.8	19.9
	Future generation	130.7	47.1	12.2	158.0	58.0	14.1	191.5	72.9	17.9
	Absolute imbalance	12.1	7.4	8.4	19.3	1.7	3.1	-6.4	3.9	-2.0
Thailand	Newborn generation	11.2	4.7	2.0	14.1	5.9	2.5	17.8	7.3	3.2
	Future generation	3.2	-2.4	-4.3	5.8	-1.5	-4.0	9.3	-0.3	-3.6
	Absolute imbalance	-8.1	-7.1	-6.3	-8.3	-7.4	-6.5	-8.5	-7.6	-6.8

Table 7 (continued) Generational accounts: Sensitivity to Growth and Discount Rates, Case B

(thousands of 1995 U.S. dollars)

Country	Productivity growth rate (per cent)	1			1.5			2		
	Discount rate (per cent)	3	5	7	3	5	7	3	5	7
Australia	Newborn generation	101	38	10	127	50	16	158	64	22
	Future generation	143	62	36	193	73	39	289	89	44
	Absolute imbalance	42	24	26	66	23	23	131	25	22
Denmark	Newborn generation	29	-29	-56	46	-18	-51	61	-5	-46
	Future generation	74	13	-20	93	26	-13	110	42	-4
	Absolute imbalance	45	42	36	47	44	38	49	47	42
Netherlands	Newborn generation	115	34	4	143	49	3	173	67	12
	Future generation	226	117	70	267	137	79	313	161	90
	Absolute imbalance	111	83	66	124	88	76	140	94	78
New Zealand	Newborn generation	54.1	18.0	-0.1	54.1	18.0	-0.1	54.1	18.0	-0.1
	Future generation	65.1	18.2	-1.1	50.2	16.0	-1.0	35.2	13.8	-0.9
	Absolute imbalance	11.0	0.2	-1.0	-3.9	-2.0	-0.9	-18.9	-4.2	-0.8
France	Newborn generation	125.3	66.6	15.9	140.3	82.2	25.6	153.1	99.0	36.5
	Future generation	264.9	147.5	187.2	285.1	161.5	99.3	304.4	178.5	94.2
	Absolute imbalance	139.6	80.9	171.3	144.8	79.2	73.7	151.4	79.5	57.7

Table 7 (continued) Generational accounts: Sensitivity to Growth and Discount rates, Case B

(thousands of 1995 U.S. dollars)

Country	Productivity growth rate (per cent)	1			1.5			2		
	Discount rate (per cent)	3	5	7	3	5	7	3	5	7
Norway	Newborn generation	9	-3	-14	5	1	-11	-6	5	-9
	Future generation	126	22	-41	170	57	-16	212	95	11
	Absolute imbalance	117	25	27	165	56	-5	218	90	20
Portugal	Newborn generation	64.5	37.9	22.4	73.1	43.5	25.6	82.0	50.0	29.4
	Future generation	93.9	68.0	56.7	102.7	73.2	58.5	111.8	79.4	61.0
	Absolute imbalance	29.4	30.2	34.2	29.7	29.7	32.8	29.8	29.4	31.6
Sweden	Newborn generation	214.9	103.2	49.7	251.8	121.8	58.8	293.5	143.5	69.4
	Future generation	191.2	62.3	-1.0	229.3	83.8	9.4	268.0	108.8	21.7
	Absolute imbalance	-23.7	-40.9	-50.7	-22.5	-38.0	-49.3	-25.5	-34.7	-47.6
Argentina	Newborn generation	17	12	7	17	14	8	14	15	10
	Future generation	35	21	14	39	24	16	43	28	17
	Absolute imbalance	18	9	7	22	10	8	29	13	7
Belgium	Newborn generation	170.2	80.9	27.5	193.9	100.8	38.4	212.0	123.1	51.2
	Future generation	286.4	162.4	104.7	327.5	187.8	114.4	370.2	217.7	127.6
	Absolute imbalance	116.3	81.5	77.2	133.6	87.0	76.0	158.2	94.6	76.4
Brazil	Newborn generation	16	9	4	17	10	5	18	12	6
	Future generation	35	19	11	41	22	12	47	26	14
	Absolute imbalance	19	10	7	24	12	7	29	14	8

Table 8 Sources of Generational Imbalance

(Percentage Imbalance)

Country	Base case		No demographic change		Zero debt	
	A	B	A	B	A	B
United States	51.1	159.0	-2.9	21.6	30.5	96.5
Japan	169.3	337.8	42.2	77.2	154.5	308.6
Germany	92.0	156.1	-4.7	-7.6	47.5	80.6
Italy	131.8	223.8	12.9	18.0	60.2	97.6
Canada	0.0	3.1	-46.7	-57.8	-41.0	-51.6
Thailand	-88.0	-125.4	-143.4	-174.6	-190.4	-228.8
Australia	32.0	48.6	20.0	62.4	18.0	25.1
Denmark	46.9	A	-13.6	-168.4	12.7	b
Netherlands	76.0	177.0	7.0	14.0	42.0	100.0
New Zealand	-3.4	-10.8	-5.0	-5.2	-15.9	-15.9
France	47.1	96.3	4.0	6.0	20.0	39.0
Norway	61.0	4378.6	-12.1	-91.8	69.3	5000.2
Portugal	48.7	68.2	17.5	24.9	16.2	22.0
Sweden	-22.2	-31.2	-51.2	-66.9	-31.0	-44.6
Argentina	58.6	74.8	-0.8	1.7	37.9	41.0
Belgium	58.0	106.8	29.3	63.2	-92.0	-217.6
Brazil	88.8	116.7	41.8	64.1	76.2	99.0

A: Education expenditure treated as government consumption.

B: Education expenditure treated as government transfers and distributed by age groups.

a: Percentage imbalanced is not defined. Newborn account is -$17,800 and future generation's account is $26,400. b: Percentage imbalance is not defined. Newborn account is -$17,800 and future generation's account is -$2,300.

Table 9
Alternative Ways to Achieve Generational Balance

Country	Cut in government purchases		Cut in government transfers		Increase in All taxes		Increase in income tax	
	A	B	A	B	A	B	A	B
United States	18.7	27.0	19.8	20.3	10.5	10.8	23.8	24.4
Japan	26.0	29.5	28.6	25.3	15.5	15.5	53.6	53.6
Germany	21.1	25.9	17.6	14.1	9.5	9.5	29.5	29.5
Italy	52.7	87.9	41.0	40.0	66.7	61.4	198.4	188.8
Canada	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.2
Thailand	-38.1	-47.7	-185.1	-114.2	-25.0	-25.0	-81.7	-81.8
Australia	8.8	10.2	12.1	9.1	5.1	4.8	8.5	8.1
Denmark	9.9	29.0	4.7	4.5	3.4	4.0	5.8	6.7
Netherlands	21.0	28.7	21.4	22.3	8.5	8.9	14.9	15.6
New Zealand	-1.0	-1.6	-0.8	-0.6	-0.4	-0.4	-0.8	-0.8
France	17.2	22.2	11.5	9.8	7.1	6.9	66.0	64.0
Norway	11.5	9.9	9.4	8.1	7.4	6.3	11.3	9.7
Portugal	7.6	9.8	9.6	7.5	4.2	4.2	13.3	13.3
Sweden	-7.6	-8.7	-7.7	-6.0	-3.4	-3.1	-9.3	-8.6
Argentina	24.6	29.1	16.8	11.0	10.7	8.4	97.1	75.7
Belgium	11.2	12.4	6.0	4.6	3.7	3.1	11.7	10.0
Brazil	23.8	26.2	21.3	17.9	12.4	11.7	78.9	74.0

na – not available
A. Education expenditure treated as government consumption.
B. Education expenditure treated as government transfers and distributed by age groups.