The characteristics of countries with generational account imbalances

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Abstract

This paper empirically tests competing explanations for intergenerational policy differences using a cross-section of generational accounts from Kotlikoff and Leibfritz (1999). Generational imbalance rises when a public transfer program is created that benefits living generations and harms future generations. Generational imbalance is greatest in countries with a large elderly population, high income growth rate, greater income inequality, and dispersed political parties. The results are consistent with successful rent seeking by the elderly and poor, and suggest that countries with a high income growth rate and coalition government are less able to resist intergenerational redistribution.

Keywords: generational accounting, intergenerational transfers, Social Security, fiscal policy, deficit, debt

JEL D7, H6

> "[T]he really important debts are "implicit." They consist of promises to current and future retirees--promises that the government will provide pensions under Social Security and medical care under Medicare…[Y]ou can't just wish away promises that have already been made. If the retirement programs had never existed there would be no implicit debt."
>
> Paul Krugman, *New York Times*, 2001

1. Introduction

The burdens and benefits of fiscal policy fall unevenly on living and future generations. Tax and transfer programs, such as public pensions and education subsidies, redistribute resources between cohorts of different birth years. Traditionally, public transfers between generations were associated with changes in government debt. An increase in debt involves an increase in transfers or reduction in taxes today coupled with a decrease in transfers or increase in taxes tomorrow. When government debt increases, resources are transferred from future to living generations.[1]

Federal government debt increased tremendously in the U.S. during the 1980s and through the first half of the 1990s. Many claimed that repaying the large debt would place an enormous burden on the country's children and grandchildren. For this reason and others, such as fears of crowding out private investment, legislation was passed that tried to control deficits. By the late 1990s U.S. deficits had disappeared, thanks mostly to a favorable economy rather than government fiscal restraint.[2]

However, despite the disappearance of large deficits, generational policy remains unbalanced in the U.S. and around the world. Public pensions and elderly medical care are two examples of government redistribution programs that have grown vastly over the past forty years. These programs tax workers in order to pay benefits to the elderly. Current workers expect, in turn, to receive similar benefits, paid for by future workers, when they reach old age. Public pensions and elderly medical care therefore contain large *implicit* promises of future payments and large implicit government debt. These obligations are in jeopardy, however, given reductions in fertility rates and the accompanying population aging. Given projected economic growth, today's fiscal promises to current generations can be honored only if taxes are raised or benefits reduced for future generations. Both changes imply that fiscal policy will be less generous to future generations than to current generations. This imbalance is the result of unsustainable policy.

A large literature on intergenerational transfers has developed. See Persson and Tabellini (2000, Chapter 13) and Mulligan and Sala-i-Martin (1999a, 1999b) for excellent reviews. In many models, debt and pay-as-you-go public pensions are equivalent. However, many programs besides pensions will redistribute resources across generations. Some authors attempt to explain the joint political foundation of public intergenerational transfer programs rather than focusing exclusively on debt. Boldrin and Montes Alonso (1998) show that public intergenerational transfers may be efficient if credit markets are not functioning. Children "borrow" from parents to fund their education then "repay" the loan later through taxes that support public pensions. Boldrin and Montes suggest that intergenerational transfer programs develop jointly, at least informally, to increase efficiency. Rangel (1999) shows that if generations are selfish, transfers

to future generations, such as education subsidies, are sustainable only when linked, through social norms, to transfers to current generations, such as public pensions. This suggests that it is important to consider *all* public tax and transfer programs rather than focusing solely on debt.

In fact, Auerbach, Gokhale, and Kotlikoff (1991) show that official debt is a poor indicator of the generational stance of fiscal policy. Generational accounts are a more comprehensive way to gauge cohort redistribution than debt or public pensions. Kotlikoff and Leibfritz (1999) collect generational accounts for seventeen countries. Generational accounts consider the intergenerational incidence of all public transfers systems including education, welfare, and taxes. The next section will show that large imbalances exist between living and future generations for most countries. However, the imbalances are not uniform and some countries have an essentially balanced generational policy.

What explains the large differences in generational policy between countries? Mulligan and Sala-i-Martin (1999a, 1999b) review both "efficiency" and "political" models of Social Security, which are typically the largest transfer programs for most countries. In the first case, policy increases output and is Pareto improving. For instance, government may transfer from future generations with higher expected lifetime incomes to current generations. In the second case, policy may create inefficiencies if generational imbalances are the result of the political process. For instance, large elderly cohorts may vote for transfer programs that benefit themselves at future generations' expense. As the paper will show, both efficiency and political models are supported by the data.

The explanation for generational policy differences will help one to understand where and why budgetary crises in public pension systems are likely to develop. It may also help to suggest a remedy for intergenerational transfers that are spiraling out of control. This paper contributes to the literature by showing how the creation or expansion of policies that benefit a current generation will manifest itself in the generational accounts and create generational imbalance. Second, it describes the characteristics of highly imbalanced countries and suggests which models of transfers best describe the data. It will be shown that the percent elderly, income growth rate, concentration of political parties, and income inequality are important determinants of generational imbalance. The paper proceeds as follows. The next section describes generational accounts and the link to generational imbalance. Following that, models of intergenerational transfers are reviewed. Next, implications of these models are tested against the data and the last section concludes.

2. Generational Accounting and Generational Imbalance

The introduction suggested that generational accounts are a better way than debt or Social Security to assess the generational impact of policy. Generational accounting was developed to measure the net fiscal burden on a birth cohort (see Auerbach, Gokhale, and Kotlikoff, 1991, and 1994 and Kotlikoff, 1999). A generational account is the present value of remaining net taxes that the average member of a birth cohort can expect to pay to all levels of government over his remaining lifetime.[3] Net taxes are taxes paid minus transfers received. The advantage of using generational accounts to gauge fiscal policy, rather than simply looking at debt or Social Security, is that the accounts cover most tax and transfer programs that have an intergenerational transfer component.[4] Generational accounts are typically negative for elderly cohorts since they can expect to receive over their remaining lifetime, on average, more transfers than they pay in

taxes. Generational accounts of young adult cohorts are typically the largest since their net tax "paying years" are directly ahead of them and their net transfer "receiving years" are many years in the future.

The generational accounts of future cohorts are calculated as a residual from the government budget constraint. Generational accounting assumes a long-run government budget constraint that balances the present value of government consumption against government net wealth and the present value of net tax payments by current and future generations (see Auerbach and Kotlikoff, 1999).[5] In other words, government must pay for spending with either its assets or the net taxes it collects from living and future generations. In order to calculate the sum of generational accounts of future generations, one subtracts net government wealth plus the generational accounts of living generations from the present value of government consumption. To determine government consumption, taxes, and transfers, fiscal policy is assumed to remain constant for living generations but net taxes are expected to change for future generations in order to satisfy the budget constraint. Thus, if the government is not taxing current generations enough to pay for transfers and consumption, then future generations must pay the bill. Future generations, therefore, are assumed to absorb the full impact of policy changes that are needed in order to balance the long-run budget constraint.[6]

As a simple example, consider an overlapping-generations model where every generation has a constant population of one and lives for two periods. In any given year, there are two living generations. The first line of Table 1 shows that the young in year zero were born in year zero while the elderly were born in year (-1). If the government does not collect taxes or make

transfer payments in year zero, then net taxes paid by the young and old are each zero. The elderly are in the last year of life and the generational account of those born in year (-1) is zero. If no future taxes or transfers are anticipated, then the generational accounts are also zero for those born in year zero. To simplify, assume that government net wealth is zero, no government consumption is expected in the future, and the discount rate is zero. Then the government's long-run budget constraint says that the sum of generational account of living generations must be equal to the negative of the sum of generational accounts of future generations. Since the sum of generational accounts of living generations is zero, the sum of generational accounts of future generations must also be zero.

[Table 1 about here]

Now suppose that the government begins a transfer program in year one, such as Social Security, that transfers resources from the young to old. The young pay T in taxes and the old pay $-T$ in taxes (receive positive transfer payments, which are considered *negative* taxes). If the program is expected to continue in the future, then the current young expect to receive a transfer of T when they are elderly. Thus, the generational account of the young in year one is zero since their taxes are T in year one and are $-T$ in year two. The generational account of the old in year one is $-T$. Since the sum of generational accounts of living generations is $-T$, the sum of generational accounts of all future generations must be T.[7]

The creation of this transfer program will redistribute resources between birth cohorts. The old in year one receive an increase in lifetime resources since they receive a transfer but paid no

taxes. This is shown in the bottom panel of Table 1, which lists total, as opposed to remaining, lifetime net taxes paid. The initial young, those born in year one, are unaffected by the creation of the transfer program since they expect to both pay taxes and receive transfers over their lifetime. The initial elderly are therefore a *winning* generation in the sense that they receive the transfer but paid no tax.

If the initial young do not pay for the transfers to the initial elderly, then some future generation must pay. The government's budget deficit is zero in every year, since it raises enough taxes, T, to pay for the transfers, $-T$.[8] However, the government's long-run budget constraint dictates that some future generation(s) must pay T in lifetime net taxes. Suppose, for example, that the government ends the program unexpectedly in year three. The young and old in year three pay no taxes and receive no transfers. Since no taxes or transfers are expected in the future, the generational accounts of the young, old, and sum of future generations is now zero. Lifetime net taxes of those born in year three remain zero. However, lifetime net taxes for those born in year two rise to T, since they paid taxes when they were young, in year two, but receive no transfers in old age. Thus, starting a transfer from young to old creates both explicit transfers to initial elderly *and* implicit tax obligations for future workers.[9]

The example in Table 1 shows that the creation or expansion of a program that creates a winning generation will increase the generational account of future generations.[10] In fact, the generational accounts of future generations will be greater in *every* year thereafter, since generational accounts do not take into account past net taxes. Table 1 shows that the generational accounts of the young, old, and sum of future cohorts is the same in year two as in

year one. As long as the program is expected to continue, the elderly generational account in *any* year will be -*T*. Thus, the presence of large negative elderly generational accounts does not imply that *current* elderly were the initial winning generation. Generational accounts do not indicate which cohort received the greatest transfer in resources over its lifetime.

One measure of *generational imbalance* is the difference between the generational account of current newborns and future generations. Kotlikoff and Leibfritz (1999) report generational imbalance in both absolute and percent terms for seventeen countries in 1995. Their work is reproduced in Table 2. The most imbalanced country is Japan, where the typical member of a future generation can expect to pay $246 thousand dollars, or 338 percent, more in lifetime net taxes than the typical newborn in 1995. In many countries, future generations can expect to pay more, both in absolute terms and in relative terms, than current newborns. However, Canada has no imbalance and future generations in New Zealand, Thailand, and Sweden can actually expect to pay less than newborns.[11] The last column scales the absolute generational imbalance by the ratio of U.S. per capita GDP to the country per capita GDP.[12] For instance, Portugal's absolute imbalance is only thirty thousand U.S. dollars, but after adjusting for standard of living, the imbalance is equivalent to sixty-two thousand dollars. Japan remains the most imbalanced country at $308 thousand dollars. More than half of the countries have greater scaled generational accounts that the U.S. and six have a generational imbalance that is twice as large as that facing the U.S.

[Table 2 about here]

One can group countries in the sample according to the degree of generational imbalance. High-generational-imbalance countries include those in which future generations can expect to pay, on average, significantly more in lifetime taxes than current newborns. For these countries, generational imbalance averages $129,160. They include Japan, Italy, the Netherlands, Belgium, and France.[13] Moderate imbalance countries have an average imbalance of $31,443 and include Norway, Portugal, Denmark, Brazil, US, Australia, and Argentina. Low-imbalance countries are those in which future generations are not expected to pay significantly more than current newborns in lifetime taxes. These countries include Canada, New Zealand, Thailand, and Sweden. For this group, the average absolute imbalance is -$11,250.

Kotlikoff and Leibfritz (1999) document enormous differences in generational imbalance between countries, which indicates that some countries have created substantial intergenerational transfer programs while others have not. Before these differences are explained, the next section reviews the literature on transfer programs.

3. Models of Intergenerational Transfers

The previous section showed that if a current or past generation benefited from the creation of a public transfer system, then the generational account of future generations grows and generational imbalance will increase. Much of the literature explaining transfers from future to current generations uses government debt as a measure of the degree to which current generations are transferring resources to themselves away from future generations. In many of the following models, debt issue and pay-as-you-go public pensions are equivalent and the circumstances that lead to more debt will also increase generational imbalance. Debt is issued

because spending (transfers) takes place now while taxes are promised in the future. When the generational imbalance rises, transfers take place now and taxes will be raised in the future.[14]

What are the main factors that influence generational imbalance? The creation of a public intergenerational transfer system is the outcome of a political process. In some models, current voters take into account the welfare of future generations because, for instance, they care for their children. In the models of Cukierman and Meltzer (1989), Gordon and Varian (1988), Van Velthoven, Verbon, and van Winden (1993), and Mulligan and Sala-i-Martin (1999b), the resulting intergenerational redistribution potentially benefits all generations. The models of Tabellini (1991, 1990) and Persson and Tabellini (2000), however, predict that public redistribution may benefit some generation at the expense of others. What follows is a brief description of these models and identification of the key variables that may influence generational imbalance.

Current generations may wish to transfer resources from future generations to themselves. Cukierman and Meltzer (1989) develop an overlapping-generations model in which parents care for their children's welfare and public debt is preferred even if it leaves the present value of taxes unchanged. First, generations differ in labor productivity and lifetime wages. Parents with very low lifetime wages would like to transfer income to themselves from their children who have higher lifetime wages. However, private "negative bequests" are not socially enforceable. Instead, negative-bequest-constrained individuals prefer a reduction in current taxes to be paid for by increased taxes on future generations. Second, Cukierman and Meltzer allow for general equilibrium effects. Since public debt crowds out capital, the return on capital rises and the wage

rate falls as the capital-labor ratio falls. Thus, in addition to negative-bequest-constrained individuals, those who receive a high portion of total income from capital income may also be in favor of public debt. Cukierman and Meltzer conclude that transfers from future to current generations are larger when the expected *length of retirement* increases, the expected rate of *economic growth* rises, and wealth and *income inequality* rise.[15]

Risk-averse households prefer to insure against income uncertainty. The government may be able to provide insurance, through programs such as public pensions and Medicare, if the private sector cannot. Gordon and Varian (1988) show that public intergenerational transfers can reduce a generation's income variance. In their model, every generation faces stochastic income with the same mean and variance and independent shocks. The transfer program takes a constant fraction of income from one generation and gives it to another. A generation's consumption therefore depends on both its own income and the income of other generations, which reduces the variance of lifetime resources. Since the need for insurance is greatest in countries with greater income variability, and since the creation of programs such as public pensions create generational imbalance, one expects the imbalance to be larger in countries with greater *income variance*.

If consumers are myopic or liquidity constrained, then current transfers will increase consumption (see Van Velthoven, Verbon, and van Winden 1993 and Mulligan and Sala-i-Martin 1999b). Believing this, Keynesian-type policy makers will issue debt, or transfers to current generations, which will provide fiscal stimulus and may be welfare enhancing. This suggests that generational imbalance will rise where policy makers find more frequent spells of

inadequate aggregate demand. If this is true, then the average *unemployment rate* may be positively correlated with generational imbalance.

Tabellini (1991, 1990) argues that voter coalitions determine whether current generations will honor past policy by making payments to previous generations. In Tabellini (1991) all elderly hold debt, although wealthy elderly hold more debt. The transfer from workers to the elderly comes in the form of taxes that are used to retire outstanding debt. The elderly (parents) and the young (workers) vote on how much to tax debt interest payments, which is equivalent to debt repudiation. The coalition that favors repaying the debt includes all elderly and the children of wealthy parents. Because of the intragenerational transfer (from poor to rich workers), the intergenerational transfer (from young to old) takes place. Honoring the debt comes about with higher expected *income growth.*

Tabellini (1990) notes that the public-pension aspect of Social Security redistributes resources from high- to low-income households because it is somewhat progressive. Thus, Social Security involves both an intragenerational and intergenerational redistribution. However, unlike in Tabellini (1991), the transfer is from rich to poor households. Since children care about their parents, the coalition for honoring public-pension promises is the elderly and children of poor parents. The size of Social Security increases with larger *income inequality* and a greater *percent of elderly* in the population.

Political concentration, on the other hand, may be inversely related to generosity to current voters (see Persson and Tabellini 2000, Chapter 13). For example, a coalition government with

conflicting constituencies may not fully internalize the future costs of today's spending and will tend to make more generous payments to current generations. This is because coalitions in government can take credit for spending but may be able to blame others for the resulting taxes. The result is increased transfer payments. Thus, generational imbalance will be greater when the *largest political party's percent of the vote* is smaller.

The desire to be elected may also lead to transfers to current generations if politicians believe that voters will respond favorably. This may be true if the costs of spending today, which may be taxes on future generations, are not fully internalized by today's voters. Thus, more frequent *elections* may cause politicians to more frequently increase benefit levels.

These models suggest that many factors that will influence transfers from future to current generations.[16] Generational imbalance is predicted to be positively correlated with 1) expected income growth, 2) income inequality, 3) expected income variance, 4) average unemployment rate, 5) greater share of elderly in the population, and 6) more frequent elections, and negatively correlated with 7) the percent of vote received by the largest political part. The next section determines which of these factors best explain generational imbalance.

4. Empirical Evidence

The first three columns of Table 3 reports group averages for high-, moderate-, and low-generational imbalance countries, respectively. The fourth column of Table 3 reports the simple correlation between absolute generational imbalance and each variable. Countries with greater generational imbalance have more elderly. The average unemployment rate is greater, although the correlation is very weak.[17] The income per capita growth rate is positively correlated with

generational imbalance, while the standard deviation of the income per capita growth rate and Gini coefficient are negatively correlated with imbalance. The number of parliamentary elections seems unrelated to imbalance, while countries with a less dominant winning party have a larger generational imbalance.

[Table 3 about here]

Only the percent elderly, income growth rate, and votes received by the dominant party are strongly correlated with generational imbalance in a way predicted by theory. However, in order to determine the marginal effect of an explanatory variable, it is important to hold the impact of all other factors constant. Unfortunately, the small sample size relative to the potential influential variables makes it difficult to discriminate directly between competing models of intergenerational transfers. However, if one is interested in determining which variable influence generational imbalance, one can model generational imbalance as a linear function of the independent variables suggested by theory. Suppose that

$$GI = \alpha + B\boldsymbol{X} + \varepsilon \qquad (1)$$

where GI is absolute generational imbalance, $\boldsymbol{X}$ is the vector of independent variables and ε is an error term. The independent variables are the percent of the population over sixty-four (ELDERLY), income per capita average annual growth rate since 1965 (GROWTH), the standard deviation of income growth rate since 1965 (STANDARD), the Gini coefficient (GINI), the average unemployment rate since 1985 (UNEMPLOYMENT), the number of parliamentary

elections since 1980 (ELECTIONS), and the average percent of votes received by the largest party since 1980 (PARTY). If the standard assumptions of the classical linear regression model hold, equation (1) can be estimated using Ordinary Least Squares (OLS). The first column in Table 4 presents the results from estimating (1) using OLS. While the signs of the coefficients are generally as expected, except for GINI, the data do not appear to fit the model very well. The R-squared is only 0.34 and the adjusted R-squared, which adjusts for the large number of variables relative to the sample size, is actually negative. The F-test, which tests whether the variables can jointly explain changes in generational imbalance, fails at the five percent level of significance. More importantly, the standard errors of the variables are very large and the t-ratios are very low. The critical value at a five percent level (two-tailed) with eight degrees of freedom is 2.306. None of the variables are significantly different from zero at the five percent level.

[Table 4 about here]

Improvements can be made to the simple model, however. First, OLS weights outlier observations relatively strongly. In small samples such as this, it is important to check whether one or two countries are driving the results. Inspection of residuals reveals that Japan has a far greater absolute generational imbalance than predicted by the model and consequently its OLS residual is far greater than any other country's. Sweden, on the other hand, has a much lower imbalance than is predicted by the model and its absolute OLS residuals are the second largest of any country's.[18] Additionally, Kotlikoff and Leibfritz (1999, p. 86 f.n.) report that updated calculations for Sweden indicate a positive generational imbalance. Column (2) in Table 4

reports the regression results when Japan is omitted from the sample. The adjusted R-squared is 0.62 and the t-ratios increase substantially. The critical value at the five percent level for seven degrees of freedom is 2.365. At this level, the significant variables are GINI and PARTY. GI rises by $5,525 for each point increase in GINI, while GI falls by $3,178 for each percentage point increase in PARTY. Column (3) reports the results with both Japan and Sweden removed from the sample. The adjusted R-squared climbs somewhat and none of the coefficients change sign. ELDERLY joins GINI and PARTY as being significant. GI rises by $15,181 for each percentage point increase in ELDERLY.

Another difficulty with the simple model is that cross-sectional data often have heteroskedastic error terms. This makes the standard errors biased and significance tests inappropriate.[19] Two corrections are attempted. First, all variables are scaled by the square root of income.[20] The fourth and fifth columns of Table 4 show that the results of weighted least squares regressions are similar to the second and third columns. The adjusted R-squared is high and GINI and PARTY continue to be significant. GROWTH is significant if Japan is removed from the sample. GI increases by $183 for each percentage point increase in GROWTH. ELDERLY is significant if both Japan and Sweden are removed.[21] A second, more general correction for heteroskedasticity is to use White's standard errors (White 1980). Doing this does not change the coefficients or R-squared but produces consistently unbiased standard errors. Columns (2) and (3) of Table 4 report significance levels using White's standard errors. ELDERLY, GINI, and PARTY are significant. GROWTH is significant if Sweden is included. For the first time, STANDARD is significant at the five percent level. However, the coefficient is negative, while Gordon and Varian (1988) predict a positive coefficient.

Regression analysis shows that four variables influence generational imbalance in a way predicted by theory. GINI and PARTY are significant and have the predicted sign in all regressions. In some specifications, ELDERLY and GROWTH are significant and have the predicted sign. STANDARD is significant in some specifications, but it has the wrong sign. In no specifications are UNEMPLOYMENT or ELECTIONS significant.

How well do the percent of the population over sixty-four, the Gini coefficient, income per capita growth rate, and the percent of the vote received by the largest party predict, when taken together, a country's generational imbalance? One can cluster countries based on the four influential variables and check whether this clustering is the same as groupings based on generational imbalance. Cluster analysis considers each observation a point in space with coordinates equal to the value of the four variables. An excellent discussion of cluster analysis is Everitt, Landau, and Leese (2001). Initially there are fourteen groups, with each country comprising a group.[22] The two most similar countries, in terms of the four variables, are then joined to form a group with two members. Next, depending on similarity, a third country is either joined with another country or added to the first group. This process continues one country at a time, with countries either forming new pairs or joining existing groups.

Table 5 presents three- and four-cluster partitions.[23] Italy, The Netherlands, Belgium, France, Norway, and Denmark are "similar" with respect to percent of the population over sixty-four, the Gini coefficient, income per capita growth rate, and the percent of the vote received by the largest party. A second grouping consists of the US, Portugal, Australia, Argentina, Canada, and

New Zealand. Finally, Thailand and Brazil form a small cluster. When countries are divided into four clusters, Argentina and New Zealand drop out of the second group to form their own cluster.

[Table 5 about here]

Everitt, Landau, and Leese (2001, chapter 4) note that different clustering methods may group observations differently, and that no method is always superior to others.[24] The results in Table 5 appear to be robust since two different methods returned the same clusters for all partitions.[25] The average absolute generational imbalance for these clusters is shown in Table 5. The four influential variables, taken together, appear to distinguish countries based on their generational imbalances fairly well. The average generational imbalance is much greater for the first clustering than for the second in both partitions, and the last cluster(s) have a much lower generational imbalance in both partitions. As a more exact test, the kappa coefficient can be used to quantify the correlation between clusterings based on the four variables and clusterings based on generational imbalance. The simple kappa coefficients are 0.44 and 0.33, and the weighted kappa coefficients are 0.53 and 0.55, for the three- and four-cluster partitions, respectively. These numbers indicate a significant correlation.[26]

5. Conclusions

Generational accounts are a more complete way to gauge the generational stance of fiscal policy, compared to debt or the size of Social Security, since they take all tax and transfer programs, including education subsidies and pension payments, into account. Generational imbalance is the difference between what future cohorts and newborns will pay in lifetime net taxes. The

cross section of countries in Kotlikoff and Leibfritz (1999) reveals large imbalances in some countries and no imbalances in others. This paper first shows that generational imbalance grows when a transfer program, such as public pensions, is created and an initial generation receives benefits in excess of taxes paid. Thus, generational imbalance grows when a *winning* generation is created. Second, the paper shows that generational imbalance rises with the size of the elderly population, income inequality, income per capita growth, and falls with the percent of votes cast for the largest party. Other variables, such as the unemployment rate, the frequency of elections, and income variability, are not correlated with generational imbalance in a way suggested by theory.

The data are consistent with the theory that the elderly and poor are effective rent seekers and able to transfer resources to themselves from future generations. In countries with greater expected income growth, society appears to be more willing to allow these transfers to take place. This may be because, as in Cukierman and Meltzer (1989), current generations want to share in the higher expected incomes of their children. Society's willingness to transfer resources grows even stronger when political parties are dispersed and must build coalition governments. Less centralized political power may imply, as in Persson and Tabellini (2000) that the largest political party will find it easy to blame other parties when raising taxes on future generations. Since public intergenerational transfers do not rise when income variance rises, intergenerational risk-sharing, as in Gordon and Varian (1988), does not appear to be a motivation for transfers. It also appears that transfers are not created to provide fiscal stimulus, as in Van Velthoven, Verbon, and van Winden (1993) and Mulligan and Sala-i-Martin (1999b).

Further research would benefit greatly from more cross-sectional generational account data. This would increase the sample size and allow more extensive testing of competing theories. Another extension would be to collect time-series generational account data in order to pinpoint exactly when the initial winning elderly were created. As Section 2 showed, the fact that large generational imbalances exist today does not imply that the current elderly received large lifetime net transfers.

Policy makers will be more aware of the generational redistribution of fiscal policy if official generational accounts are published and updated often. However, they may find it difficult to reduce generational imbalance due to political considerations. Additionally, the trend toward increased income inequality and the ageing of populations in the developed world imply that generational imbalance will continue to rise.

6. Appendix: Data Sources

The 1995 generational account data are from Kotlikoff and Leibfritz (1999, table 4.7). They convert amounts to 1995 U.S. dollars using average exchange rates. Generational imbalance is the absolute difference in generational accounts between future and newborn generations. The percent of the population nineteen and under and sixty-five and over in 1995 comes from the U.S. Census Bureau's International Data Base (Census 2001). Per capita Gross Domestic Product, GDP per capita growth 1965-95 and the standard deviation of annual per capita GDP growth rates 1965-95 come from The Penn World Tables Version 6 (Heston, Summers, and Aten 2001). The standard deviation of annual per capita GDP growth rates measures GDP fluctuations around a constant growth rate. While there are many potential measures of GDP variability, Romer (1999, p. 24) notes that "…a major change in the volatility of growth rates

would signal an important change in short-run fluctuations." The average unemployment rate 1985-95 comes from The International Labor Organization (ILO 2001). The Gini coefficient for most countries comes from The World Bank (World Bank 2001, Table 2.8). Data for Argentina and New Zealand come from Deininger and Squire 1996. Data on parliamentary elections 1980-95, which includes the total number of elections and the average fraction of votes going to the largest political party in the election, come from IDEA (2001).

Notes

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[1] An intergenerational transfer will not take place if the debt is repaid by taxing the initial living generation.

[2] See Auerbach (2000) for an excellent overview of U.S. fiscal policy over the past twenty-five years and Lindert (2001) for a long-run look at fiscal policy.

[3] If the year of death is *D* and the discount rate is *r*, then the generational account of someone in year *t* is

$$GenerationalAccount_t = NetTax_t + \frac{NetTax_{t+1}}{(1+r)} + \frac{NetTax_{t+2}}{(1+r)^2} + ... + \frac{NetTax_D}{(1+r)^{D-t}}$$

where net taxes are taxes paid minus transfers received. Note that generational accounts are forward looking in the sense that past net taxes are not included.

[4] Taxes include income, capital, property, payroll, excise, and other taxes. Transfers include Social Security, medical payments, welfare, unemployment benefits, education expenditures, and other transfers. Generational accounting does not distribute the benefits of government consumption, such as spending on roads, defense, or park services, to any particular birth cohort.

[5] The government's long-run budget constraint is

$$P.V.Gov.Consumption = Gov.NetWealth + P.V.\sum_{living} G.A. + P.V.\sum_{future} G.A.$$

where G.A. is the generational account. This simply says that in the long-run, the government must pay for consumption out of net wealth and through taxing living and future generations.

[6] Future generations, therefore, are assumed to absorb the full impact of policy changes that are needed in order to balance the long-run budget constraint. This assumption creates the largest imbalance between future and current generations. It is likely, however, that current generations will bear some of the fiscal burden of adhering to the long-run government budget constraint. Generational accounts therefore represent the worst-case scenario for future generations. A large generational imbalance indicates that a country will face strong budgetary pressures for policy reform.

[7] Generational accounting distributes these taxes to future generations such that taxes of each successive future generation are constant on a per capita growth-adjusted level. In the given example with a zero discount rate, the increase in net taxes to any individual future generation approaches zero. With a positive discount rate, however, the increase in net taxes to an individual future cohort may be substantial.

[8] For this reason, Auerbach, Gokhale, and Kotlikoff (1991, 94) and Kotlikoff (1999) argue that current deficits are a poor measure of intergenerational policy.

[9] In contrast, consider the creation of a transfer scheme with an initial "losing" generation. Suppose that the government started a program, like education, that transferred *T* from the old to the young. The generational account of the young would be unaffected because they must pay an equal tax, *T*, when they are elderly. However, the initial elderly lose since they did not receive a benefit when they were young. In this example, the generational accounts of future generations will fall.

[10] Issuing debt has the same effect. Consider the case where government consumption is unchanged but the government issues debt equal to *T* in year 1. The new debt reduces government net wealth and requires an increase in the generational accounts of either living or future generations. If living generations are not taxed in order to retire debt, then future generations must be. The generational accounts of future generations will also rise, *ceteris paribus*, if the population or income growth rate declines.

[11] The very large percentage imbalance for Norway is due to the fact that current newborns can expect to pay almost nothing over their lifetime (about one thousand dollars). Denmark's percentage imbalance is negative since current newborns can expect to pay negative net taxes over their lifetime while future generations can expect to pay positive net taxes.

[12] Per capita GDP is measured on a purchasing power parity basis in The Penn World Tables Version 6 from Heston, Summers, and Aten (2001).

[13] Kotlikoff and Leibfritz (1999) report generational imbalance for Germany. However, comparable data on East and West Germany prior to unification are not available. Therefore, Germany is not included in this analysis.

[14] In both cases future taxes are uncertain and indeed may not be levied. In the first case debt is repudiated, while in the generational imbalance case, future benefits are cutback.

[15] Chen (2000) uses a panel of 87 countries from 1972-92 to empirically test Cukierman and Meltzer's negative bequest model of deficits. After controlling for other variables, including those that test Barro's (1979) tax-smoothing model, Chen finds no strong evidence in support of Cukierman and Meltzer. Expected income growth is correlated with deficits only for developed countries while income distribution is not statistically significant. Finally, his measure of increased life expectancy is negatively correlated with deficits. Despite these empirical failings,

Chen argues that the results are ambiguous once extensions are made to Cukierman and Meltzer's original model.

[16] Comparable and reliable data do not exist on average length of working life.

[17] The simple correlation coefficient, which lies between (-1) and (1), indicates the degree of linear association between generational imbalance and a variable. It is possible, however, that a variable has a correlation coefficient near zero yet is still associated with imbalance, once the influence of other variables is removed.

[18] Japan's studentized residual is 6.98 and its DFFITS is extremely large at 6.47. Sweden's studentized residuals and DFFITS are each -1.67. See Maddala (1992, chapter 12) for a discussion of these residuals.

[19] Various tests for heteroskedasticity were applied to the first specification. The Breusch and Pagan chi-squared test statistic is 17.14 which is significantly different from zero at five percent one-sided level. While heteroskedasticity is implied, this test is an asymptotic test and may not be reliable for small sample sizes. Glejser tests were mixed. When the absolute value of the predicted residual was regressed on the square of predicted generational imbalance, the coefficient is significant at the five percent two-tailed level. However, the coefficient was not significant for other powers of predicted generational imbalance. All tests fail to reject homoskedasticity when Japan is dropped from the sample. See Maddala (1992, chapter 5) for a discussion of heteroskedasticity.

[20] This is appropriate if the error variance is proportional to country income level. If the error variance is proportional to income squared, it's appropriate to scale variables by income level. Results are the same when scaling by either income or the square root of income.

[21] Income per capita was also tried as an explanatory variable, but it was usually insignificant, the regression fit was not improved, and the same independent variables were generally significant. This is not surprising, given that the difference in average income per capita between high- and low-generational imbalance countries is only four thousand dollars.

[22] Japan and Sweden are omitted from the sample.

[23] SAS version 8 for Windows forms the similarity matrix based on Euclidean distance. Variables must be standardized since they are measured in different units. Two procedures are used. First, variables are divided by their sample ranges. Second, variables are standardized to mean zero and variance one. The groupings are the same using either technique.

[24] Everitt, Landau, and Leese (2000, chapter 4.2.5) note that single linkage is often less robust than other clustering methods.

[25] The agglomerative hierarchical methods used are Ward's method and complete linkage. See Everitt, Landau, and Leese (2001, table 4.1) for definitions and properties.

[26] For the simple kappa coefficient, a value of one indicates perfect positive agreement, while a value of zero represents no agreement. When significance of the simple kappa coefficient is tested, the three-cluster-partition coefficient is significantly different from zero at the five percent, two-sided level, while the four-cluster-partition coefficient is significantly different from zero at the six percent, two-sided level. When the significance of the weighted kappa coefficient is tested, the three-cluster-partition coefficient is significant at the two percent level, while the four-cluster-partition coefficient is significant at the one percent level. All significance levels were calculated using exact, rather than asymptotic, computations, since the number of observations is small.

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TABLE 1

Effect on Cohort Generational Accounts and Lifetime Net Taxes
of a Tax and Transfer Program Created in Year 1

	Cohort Birth Year		Net Taxes		Generational Account		
Year	young	old	young	old	young	old	sum of future
0	year 0	year -1	$0	$0	$0	$0	$0
1	year 1	year 0	T	-T	0 (= T-T)	-T	T
2	year 2	year 1	T	-T	0 (= T-T)	-T	T

Cohort Birth Year	Lifetime Net Taxes
year -1	0
year 0	-T
year 1	0
.	.
.	.
.	.
future	T

Notes: Each generation lives for two periods and has population one.
See text for further assumptions.
The generational account is the sum of remaining lifetime cohort net taxes.
In year 1, the government begins a permanent program of taxing the current young by $T in order to pay benefits of -$T to the current elderly.
This permanently raises generational accounts of future generations, raises the generational imbalance, and creates an initial "winning" generation of elderly.

TABLE 2

Absolute, Percent, and Scaled Generational Imbalance in 1995

		Absolute	Percent	Scaled
High	Japan	246	338%	308
	Italy	145	224%	209
	Netherlands	88	180%	119
	Belgium	87	86%	116
	France	79	96%	111
Moderate	Norway	56	5600%	66
	US	45	159%	45
	Denmark	44	-244%	53
	Portugal	30	68%	62
	Australia	23	46%	29
	Brazil	12	120%	50
	Argentina	10	71%	28
Low	Canada	2	3%	2
	New Zealand	-2	-11%	-3
	Thailand	-7	-125%	-30
	Sweden	-38	-31%	-51

Notes: Absolute generational imbalance is the difference between future and newborn generational accounts in thousands of 1995 U.S. dollars.
Percent generational imbalance is the absolute imbalance as a fraction of the newborn generational account.
Scaled generational imbalance is absolute imbalance multiplied by the ratio of U.S. per capita GDP to the country per capita GDP.
Source: Author's calculations using Kotlikoff and Leibfritz (1999) Table 4.7 and Summers, Heston, and Aten (2001).

TABLE 3

Means for High, Moderate, and Low Generational Imbalance Countries and Correlation of Variables with Generational Imbalance, 1995

	High	Moderate	Low	Correlation[a]
Absolute generational imbalance	$129,160	$31,443	-$11,425	-
Percent population over sixty-four	12	10	10	0.33
Average unemployment rate since 1985	8.2	6.7	5.9	0.04
Income per capita annual growth rate since 1965	2.8	2.4	2.5	0.32
Standard deviation of income growth rate	2.4	3.5	3.2	-0.20
Gini coefficient	29	38	35	-0.43
Number of parliamentary elections since 1980	4.8	5.9	4.8	0.00
Average percent votes received by largest party since 1980	31	42	43	-0.30

[a]Simple correlation between absolute generational imbalance and each variable.

Notes: High imbalance countries are Japan, Italy, the Netherlands, Belgium and France. Modertate imbalance countries are Norway, Portugal, Denmark, Brazil, US, Australia, and Argentina. Low imbalance countries are Canada, New Zealand, Thailand, and Sweden. Absolute generational imbalance is the difference between future and newborn generational accounts in thousands of 1995 U.S. dollars.

Source: Author's calculations using Kotlikoff and Leibfritz (1999) Table 4.7 and Summers, Heston, and Aten (2001). See data appendix for additional sources.

TABLE 4

Regression of Absolute Generational Imbalance on Independent Variables

	OLS			Weighted	
	1	2[a]	3[b]	4[a]	5[b]
CONSTANT	-59041	-255601[d]	-212796	-222339	-173169
	(395399)	(152538)	(137239)	(134762)	(128230)
ELDERLY	6246	12795[d]	15181[c, d]	11322	13226[c]
	(16297)	(6250)	(5701)	(5285)	(5025)
GROWTH	259	200[d]	142	183[c]	130
	(234)	(89)	(86)	(77)	(79)
STANDARD	3981	-16898[d]	-15337[d]	-14600	-13710
	(22069)	(8886)	(7914)	(7964)	(7352)
GINI	-805	5525[c, d]	5082[c, d]	4838[c]	4455[c]
	(5592)	(2306)	(2057)	(1890)	(1757)
UNEMPLOYMENT	2012	8461	3875	8843	4287
	(10348)	(4031)	(4457)	(4067)	(4812)
ELECTIONS	10251	4671	2218	5218	2783
	(20002)	(7626)	(6896)	(7857)	(7409)
PARTY	-1991	-3178[c, d]	-2988[c, d]	-3242[c]	-3125[c]
	(3404)	(1302)	(1157)	(1306)	(1204)
R-squared	0.34	0.81	0.84	0.81	0.83
Adjusted R-squared	-0.23	0.62	0.65	0.62	0.63

[a]Sample excludes Japan.

[b]Sample excludes Japan and Sweden.

[c]Significant at the 0.05 percent level using OLS standard errors.

[d]Significant at the 0.05 percent level using White's heteroskedastically consistent standard errors.

Notes: See text for definitions. OLS standard errors shown.
OLS columns show results from ordinary least squares regression.
Weighted columns results are obtained from weighting each variable by the square root of income.

TABLE 5

Clusterings of Countries Based on Four Influential Variables
and Average Absolute Generational Imbalance by Cluster

Group	Countries	Average Absolute Generational Imbalance
Three-Cluster Partition		
1	Italy, Netherlands, Belgium, France, Norway, Denmark	83
2	US, Portugal, Australia, Argentina, Canada, New Zealand	18
3	Thailand, Brazil	2.5
Four-Cluster Partition		
1	Italy, Netherlands, Belgium, France, Norway, Denmark	83
2	US, Portugal, Australia, Canada	25
3	Argentina, New Zealand	4
4	Thailand, Brazil	2.5

Notes: Four influential variables are the percent of population over sixty-four, the gini coefficient, income per capita growth since 1965, and the percent of the vote received by the largest party.
The clustering methods are Ward's method and complete linkage.
Clusters are the same regardless of the method.
Absolute generational imbalance is the difference between future and newborn generational accounts in thousands of 1995 U.S. dollars.
Source: Author's calculations.
Generational Imbalance data are from Kotlikoff and Leibfritz (1999) Table 4.7