Generational Accounting

Alan J. Auerbach
University of California, Berkeley
January 9, 2009

Motivation: The Government's Intertemporal Budget Constraint

$$B_t = \sum_{s=t+1}^{\infty} \left(\frac{1+r}{1+g} \right)^{-(s-t)} S_s^p$$

- Nothing ensures that current policy trajectory satisfies this constraint.
- One approach is ask what share of GDP, Δ, would have to be added to the primary surplus to ensure balance:

Motivation: The Government's Intertemporal Budget Constraint

$$B_t = \sum_{s=t+1}^{\infty} \left(\frac{1+r}{1+g} \right)^{-(s-t)} (S_s^p + \Delta)$$

- But this doesn't tell us how the burdens would be distributed among cohorts, which would be of interest for distributional analysis and macroeconomic considerations as well.

Generational Accounting

- Generational accounts break down all taxes and some spending components of the GIBC by generation:

$$\sum_{s=0}^{D} N_{t,t-s} + \sum_{s=t+1}^{\infty} (1+r)^{-(s-t)} N_{t,t+s} = \sum_{s=t}^{\infty} (1+r)^{(s-t)} G_s - W_t^g$$

An Alternative Approach to Measuring the Fiscal Gap

- Existing generations are assigned accounts based on current policy trajectory.

$$\sum_{s=0}^{D} N_{t,t-s} + \sum_{s=t+1}^{\infty} (1+r)^{-(s-t)} N_{t,t+s} = \sum_{s=t}^{\infty} (1+r)^{(s-t)} G_s - W_t^g$$

An Alternative Approach to Measuring the Fiscal Gap

- While future generations have accounts adjusted until the GIBC is satisfied.

$$\sum_{s=0}^{D} N_{t,t-s} + \sum_{s=t+1}^{\infty} (1+r)^{-(s-t)} N_{t,t+s} = \sum_{s=t}^{\infty} (1+r)^{(s-t)} G_s - W_t^g$$

- The difference between the accounts of future and current generations is another measure of the magnitude of the fiscal gap.

An Example: South Korea, 2000

Table 3. Generational Accounts

(Unit: 1,000 won, %)

0	56,025
5	62,689
10	67,649
15	67,707
20	77,218
25	73,675
30	64,700
35	39,226
40	36,720
45	32,425
50	22,226
55	12,788
60	14,370
65	8,448
70	6,407
75	5,837
80	2,818
85	541
90	-2,543
95	-1,508
99	-485
Future Gen.	122,341
Generational Imbalance(%)	118

Table 3. Generational Accounts

(Unit: 1,000 won, %)

0	56,025
5	62,689
10	67,649
15	67,707
20	77,218
25	73,675
30	64,700
35	39,226
40	36,720
45	32,425
50	22,226
55	12,788
60	14,370
65	8,448
70	6,407
75	5,837
80	2,818
85	541
90	-2,543
95	-1,508
99	-485
Future Gen.	122,341
Generational Imbalance(%)	118

Table 3. Generational Accounts

(Unit: 1,000 won, %)

0	56,025
5	62,689
10	67,649
15	67,707
20	77,218
25	73,675
30	64,700
35	39,226
40	36,720
45	32,425
50	22,226
55	12,788
60	14,370
65	8,448
70	6,407
75	5,837
80	2,818
85	541
90	-2,543
95	-1,508
99	-485
Future Gen.	122,341
Generational Imbalance(%)	118

Table 3. Generational Accounts

(Unit: 1,000 won, %)

0	56,025
5	62,689
10	67,649
15	67,707
20	77,218
25	73,675
30	64,700
35	39,226
40	36,720
45	32,425
50	22,226
55	12,788
60	14,370
65	8,448
70	6,407
75	5,837
80	2,818
85	541
90	-2,543
95	-1,508
99	-485
Future Gen.	122,341
Generational Imbalance(%)	118

An Example: South Korea, 2000

- Generational accounts are present values of remaining-life flows

Application 1: Accomplishing Generational Balance

- Suppose we raised taxes in 2010 by a large enough percentage to achieve equal lifetime burdens (as a share of income) for current newborns and future generations.
- How would burdens for different generations change?

Table 3. Generational Accounts

(Unit: 1,000 won, %)

0	56,025	78,213
5	62,689	86,595
10	67,649	93,105
15	67,707	93,125
20	77,218	100,687
25	73,675	95,177
30	64,700	83,229
35	39,226	55,231
40	36,720	49,463
45	32,425	42,015
50	22,226	28,907
55	12,788	17,574
60	14,370	17,699
65	8,448	10,608
70	6,407	7,576
75	5,837	6,313
80	2,818	2,842
85	541	546
90	-2,543	-2,543
95	-1,508	-1,508
99	-485	-485
Future Gen.	122,341	
Generational Imbalance(%)	118	

An Example: South Korea, 2000

- Generational accounts are present values of remaining-life flows
- Although these flows must be calculated first in order to compute the generational accounts, the individual flows themselves are not independent of the way in which government policy is implemented

Application 2: Public Pension Reform

- Suppose that the US implemented a policy that would
  - allow individuals a voluntary choice to redirect payroll taxes to private accounts
  - charge them a real interest rate of 3% on these diverted taxes, with principal and interest on this "loan" repaid through a reduction in future benefits from the public program.
- What would this policy's effects be?

Application 2: Public Pension Reform

- Policy would amount to making loans to individuals, repayable out of future benefits
- But officially would be a tax cut financed by a future benefit cut
- Under the tax cut/benefit cut measure, there would be changes in flows that offset in present value, so no changes in the generational accounts themselves

Application 3: Demographics and Fiscal Imbalances

- Auerbach-Kotlikoff-Liebfritz (1999): gaps are big for most developed countries.
- Not primarily attributable to current levels of national debt: setting current debt levels to zero leaves sizable gaps for most countries.

Table 4.8 Sources of Generational Imbalance (percentage imbalance)

Country	Base Case	No Demographic Change	Zero Debt
United States	51.1	−2.9	30.5
Japan	169.3	42.2	154.5
Germany	92.0	−4.7	47.5
Italy	131.8	12.9	60.2
Canada	0.0	−46.7	−41.0
France	47.1	4.0	20.0

Source: Auerbach, Kotlikoff and Leibfritz (1999)

Application 3: Demographics and Fiscal Imbalances

- Auerbach-Kotlikoff-Liebfritz (1999): gaps are big for most developed countries. US is not an outlier.
- Not primarily attributable to current levels of national debt: setting current debt levels to zero leaves sizable gaps for most countries.
- Gap due primarily to policies that are unsustainable in light of demographic change.

Table 4.8 Sources of Generational Imbalance (percentage imbalance)

Country	Base Case	No Demographic Change	Zero Debt
United States	51.1	−2.9	30.5
Japan	169.3	42.2	154.5
Germany	92.0	−4.7	47.5
Italy	131.8	12.9	60.2
Canada	0.0	−46.7	−41.0
France	47.1	4.0	20.0

Source: Auerbach, Kotlikoff and Leibfritz (1999)

Application 4: Immigration

- Is immigration a solution to the fiscal problems of advanced countries?
- Logic: in PAYG systems, the financing problem arises with a rise in the old-age dependency ratio. So, keep the ratio from growing by importing younger workers.

Application 4: Immigration

But:

- Young workers get older: need to look ahead.
- Dependency is not just an old-age phenomenon – children are dependents, too.
- Typical immigrants may have lower incomes than typical domestic residents, so if PAYG system is redistributive, this may worsen fiscal picture.

Auerbach-Oreopoulos (2000)

- Generational accounting analysis, looking at effects of changes in US immigration policy on fiscal burdens of current and future generations of natives.
- Divided each population cohort by age and by immigrant status:
  - first-generation immigrant
  - second-generation immigrant
  - native

Auerbach-Oreopoulos (2000)

- Used empirical tax and benefit profiles by age for each group.
- Considered changes in annual level and skill composition of immigrants, taking into account descendents of these immigrants as well.

Table 2. Generational Accounts: The Impact of Immigration

(in thousands of dollars; r=.06, g=.012)

Base Year = 1998

Age	Males	Females
0	106.9	71.0
5	133.9	86.7
10	165.3	105.4
15	204.9	128.7
20	249.9	155.0
25	277.6	169.1
30	277.0	164.8
35	264.1	154.3
40	236.8	132.6
45	185.7	91.4
50	117.6	39.0
55	36.2	-22.1
60	-49.0	-83.6
65	-111.9	-126.8
70	-118.3	-128.7
75	-107.6	-119.0
80	-91.4	-101.6
85	-78.2	-81.7
90	-59.0	-60.3

Burdens on Future Generations

(and percent changes in taxes and transfers)

Immigration Policy Assumption:	Males	Females
Baseline	120.1	80.9
% change		7.3
No Immigration after 2000	115.3	77.2
% change		4.6
No Immigration after 2000; defense a public good	123.6	83.5
% change		9.2

Table 5. Burdens on Newborns and Future Generations: Alternative Immigration Policies

(in thousands of dollars; r=.06, g=.012)

Base Year = 1998

Base Case

Newborns	106.9	71.0
Future Generations	120.1	80.9
% change	7.3	

All New 1st Generation Immigrants with education>HS

	106.9	71.0
Newborns		
Future Generations	101.1	66.3
% change	-3.4	

Application 5: Reunification

- What is the cost, and who pays, when countries reunify?
  - Germany
  - Korea
- Traditional approach:
  - focus on direct government spending costs (capital construction, etc.)
  - method of finance (debt vs. taxes) is specified, but not who bears ultimate burden

Application 5: Reunification

- Specify tax and benefit profiles for new population (East Germans, North Koreans), based on relative productivity and policy rules
  - similar to approach for analysis of immigration
- Also need assumptions regarding convergence of productivity levels
- Estimate costs of reunification using combined population versus home population

Estimates for Korea

- Auerbach, Chun and Yoo (2005)
- Likely to be higher cost than for Germany because
  - lower living standard in North Korea relative to South Korea (8% versus 37% for Germany)
  - higher relative population in North Korea (47% of South Korea, versus 26% in East Germany relative to West Germany)

Estimates for Korea

- With reunification in 2010, how much larger would the imbalance be?

Table 3. Generational Accounts

(Unit: 1,000 won, %)

Age	No Reunification	Unified Korea	
	S. Korea	S. Korea	N. Korea
0	56,025	55,804	-7,731
5	62,689	63,011	-8,208
10	67,649	69,025	-8,923
15	67,707	70,435	-9,086
20	77,218	80,097	-9,072
25	73,675	77,398	-11,559
30	64,700	68,465	-14,719
35	39,226	44,428	-15,070
40	36,720	39,181	-13,656
45	32,425	33,354	-15,719
50	22,226	22,551	-16,698
55	12,788	13,067	-16,880
60	14,370	14,381	-13,379
65	8,448	8,456	-9,928
70	6,407	6,411	-1,937
75	5,837	5,838	-572
80	2,818	2,815	-169
85	541	541	-147
90	-2,543	-2,543	-150
95	-1,508	-1,508	0
99	-485	-485	0
Future Gen.	122,341	147,617	40,982
Generational Imbalance(%)	118	165	-

Estimates for Korea

- With reunification in 2010, how much larger would the imbalance be?
- Can also ask how burdens on particular generations will be changed if generational balance is imposed both before and after reuinification

Table 6. GA 2 for South Korea
(Tax Adjustment[1)], unit: 1,000 won)

Age	No reunification	reunification
0	78,213	106,768
5	86,595	117,909
10	93,105	127,457
15	93,125	128,750
20	100,687	133,947
25	95,177	126,751
30	83,229	111,002
35	55,231	81,158
40	49,463	68,439
45	42,015	55,375
50	28,907	37,895
55	17,574	24,058
60	17,699	22,025
65	10,608	13,417
70	7,576	9,096
75	6,313	6,929
80	2,842	2,870
85	546	553
90	-2,543	-2,543
95	-1,508	-1,508
99	-485	-485