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Fiscal and Generational Imbalances in the U.S. Federal Budget

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ABSTRACT

The Penn Wharton Budget Model's microsimulation, which projects detailed future demographic changes consistent with past trends, is used to construct estimates of the U.S. federal fiscal and generational imbalances. The federal government's fiscal imbalance (FI) calculated under current fiscal laws and purchases policies over the next 75 years equals $104.3 trillion, which is 8.0 percent of the present value of projected GDP (PVGDP) over that time horizon. Calculated in perpetuity, FI equals $244.8 trillion, which is 10.2 percent of PVGDP, also calculated in perpetuity. The FI/PVGDP ratio in perpetuity would be 11.5 percent under extension of provisions that are scheduled to expire under the Tax Cuts and Jobs Act of 2017.

Over the next 75 years, current-law FI as a share of the present value of federal expenditures equals 31.2 percent. As a share of the present value of federal revenues, it equals 41.5 percent. These figures are 35.5 percent and 52.7 percent, respectively, when calculated in perpetuity. When estimated in perpetuity, total federal debt outstanding ($27.5 trillion) accounts for 1.1 percent, Social Security plus Medicare Part A ($106.6 trillion) for 4.4 percent, and public purchases ($143.2 trillion) for 5.9 percent of FI as a share of PVGDP. Other federal transfer programs net of all non-payroll-tax receipts ($32.5 trillion) contribute a surplus of 1.4 percent of FI as a share of PVGDP.

The generational imbalance (GI) measure for Social Security and Medicare Part A – which shows the present value of net benefits in excess of taxes paid by past and currently alive generations equals $60.2 trillion. The imbalance on account of future-born generations equals $46.4 trillion. The paper provides a detailed breakdown of the distribution of prospective taxes net of transfers in present value (generational accounts) for population groups by birth-year, gender, race, and education.

Key Words: Taxation, Government Spending, National Debt, Fiscal Imbalance, Generational Accounting
JEL Classification Numbers: H2, H5, H6

1. Introduction

The United States' federal government performs many functions: delivering public goods and services such as national defense and social insurance to the population and safety net transfers to the economically vulnerable. A key question about federal finances is whether government spending commitments could be met out of resources generated under current fiscal laws. If projected government spending significantly exceeds government receipts under current laws, those laws contain a structural imbalance, which we call the fiscal imbalance (FI).

The measurement of FI involves comparing the present discounted value of all projected social transfers and federal purchases of public goods and services with the sum of the government's net assets plus the present discounted value of government receipts (taxes, tolls, fines, premiums etc.). Budget balance need not hold in every year: Expenditures may be partly funded out of borrowing. But the debt created must be repaid or serviced through future surpluses of receipts over non-interest expenditures. Comparing projected non-interest expenditures and receipts in present-value terms and including the government's current net assets accounts for the interest costs on government debt.

Our projection of government expenditures and resources produces a value of FI equal to $244.8 trillion, which is 10.2 percent of the present value of GDP when both figures are calculated in perpetuity. This federal resource shortfall must eventually be addressed by changing laws governing federal expenditures and receipts. The size of FI relative to the present value of national output (alternatively, of expenditures or receipts) indicates the extent of fiscal adjustments needed. The following sections describe the construction of the FI for the U.S. government and report its size. The measurement of FI is based on federal expenditures and receipts projected by assuming that current fiscal laws and public goods share of national output will remain unchanged through the measurement's time horizon. As such, it does not represent an unconditional forecast of future fiscal outcomes.[1]

[1] For instance, lawmakers may change fiscal laws upon learning that current laws imply a large FI, thereby invalidating the basis of the pre law-change FI measurement.

2. The Fiscal Imbalance Measure

Our construction of FI is based on U.S. demographic and economic projections of PWBM"s microsimulation, which projects the evolution of the U.S. population along many dimensions.[2] In addition, calculations are based on data on federal debt from the U.S. Treasury, budget projections from the U.S. Congressional Budget Office (CBO), and profiles of tax and transfer distributions by age, gender, race, and lifetime educational attainment. The latter are developed from various U.S. micro-data surveys. The construction of each of these elements is described in the Appendix. Federal budget projections and FI measures are compared to GDP projections, which are also based on PWBM's microsimulation as described in the Appendix.

From these inputs, we calculate FI as the sum of four components: The first is the government's initial net assets. Since federal debt outstanding – the sum total of annual budget deficits accrued from the past – is positive, the government's initial net asset position is negative. United States' federal debt stood at 79.2 percent of annual U.S. Gross Domestic Product (GDP) at the end of 2019. Debt-funded expenditures to counter the negative economic effects of Covid-19 during 2020-21 boosted federal debt to beyond 100 percent of annual GDP by the end of 2021.[3]

The second component of FI is the present value of the government's expenditure obligations net of dedicated resources for two of the largest social insurance programs: Social Security Old Age,

[2] The PWBM microsimulation projects future births, deaths, immigration, immigration status (legal and undocumented), fertility, emigration, spatial population distribution and migration within the United States, family formation and dissolution (marriage and divorce), family size distributions, race and ethnicity, education, employment type (wage worker or self-employed), labor supply (hours worked), labor earnings, disability, retirement, and many other demographic features. A detailed technical description of the microsimulation is available at: https://budgetmodel.wharton.upenn.edu/microsim/documentation.

[3] The onset of Covid-19 during early 2020 prompted the federal government to enact massive economic-support packages to curb surging unemployment, sustain production, produce and purchase vaccines, and develop therapies to strengthen infection and disease mitigation. Anti-Covid-19 legislation enacted since early 2020 includes P.L. 116-123: Coronavirus Preparedness and Response Supplemental Appropriations Act of 2020; P.L. 116-127: Families First Coronavirus Response Act (FFCRA); P.L. 116-136: Coronavirus Aid, Relief, and Economic Security Act (CARES Act); P.L. 116-139: Paycheck Protection Program and Health Care Enhancement Act (PPPHCE Act); P.L. 116-260: Consolidated Appropriations Act, 2021 (CAA); and P.L. 117-2: American Rescue Plan Act of 2021 (ARP). The debt-to-GDP ratios cited in the text are those reported by the Congressional Budget Office.

Survivors and Disability Insurance and Medicare Hospital Insurance (collectively OASDHI). Expenditures on OASDHI benefits are paid for out of dedicated resources: Payroll taxes, income taxes on OASDHI benefits, and redemptions, when needed, of treasury securities held in those programs' trust funds. The FI measure includes the present valued difference between current-law OASDHI expenditures and current-law resources dedicated to OASDHI.[4]

A noteworthy feature of the OASDHI component is Medicare Part A's expenditure growth. Historically, prices of health care goods and services have increased faster than those of other goods and services. The differential rate of health care price increases relative to general inflation is 1.9 percent per year. [5, 6] The key reasons for faster price increases of health care goods and services are in rising demand from income growth, broader coverage under government health insurance programs, and population aging. In addition, technological advances that generate better but more expensive health care treatments promote faster price increases in the health care sector. Since these factors appear unlikely to abate in the near future, we assume that faster health care inflation will continue through the year 2040. Thereafter, excess health care costs per capita are assumed to decline gradually until 2060. After year 2060, health care expenditures per capita are assumed to grow at the same rate as other federal expenditures – at the rate of labor productivity growth. The eventual reduction in excess health care cost growth is predicated on limits to technological advancements, eventual reluctance by consumers to spend ever-larger shares of their budgets on health care goods and services, and the adoption of cost control measures by policymakers to prevent health care expenditures from crowding out other federal spending.[7]

[4] The FI measure encompasses all federal accounts. The OASDHI component of FI includes assets (nonmarketable treasury securities) held in OASDHI trust funds. However, those trust fund assets, being liabilities of the U.S. Treasury, cancel out under federal-government-wide calculation of FI.

[5] Calculated from the U.S. Bureau of Economic Analysis between 1982 and 2021. These data suggest that inflation in health care goods and services has exceed general inflation at the rate of 1.87 percent per year since the early 1980s.

[6] This study's projections assume that excess growth of Medicare Part A and other health care outlays (Medicare Parts B, C, and D and Medicaid) will grow at the same rate through 2030 as incorporated in CBO's 10-year budget projections (from February 2021). Excess health outlay's cost growth is assumed to be 1.87 percent through 2040 and then to decline linearly to zero by the year 2060.

[7] These assumption of continuing excess health care cost growth in the near term and its eventual abatement are similar to those made by other budget-projection studies, notably those of the Congressional Budget Office.

The third component of FI includes the difference between federal non-OASDHI transfers and non-OASDHI receipts: Non OASDHI transfers are governed by current laws about eligibility and benefit levels but are funded out of federal general-account tax revenues, program-specific premiums ("offsetting receipts") and other non-tax receipts.[8] FI includes the difference between projected non-OASDHI expenditures and general-account (non-OASDHI) receipts, both projected under current fiscal laws.

One noteworthy feature of the Congressional Budget Offices' projections of several non-OASDHI expenditures is the inclusion of expenditures not yet appropriated by Congress. For example, the Supplemental Nutritional Assistance Program is scheduled to expire in 2023 but is expected to be reauthorized in 2022. Such expenditures are included in CBO's baseline 10-year projections under the assumption that "*current laws governing taxes and spending would generally remain in place*" during the current fiscal year and for the ensuing 10 years.[9] We use CBO's baseline budget projections during the first decade for distribution across PWBM's projected U.S. population by race, gender, and lifetime education.

The fourth component of FI is the present value of "discretionary" public goods and services purchases. These include expenditures on national defense, infrastructure, research and development, administration, foreign affairs, and other government functions. These "public purchases" levels are determined by Congress and the Administration through the annual appropriations process. We characterize current policy on purchases as increasing spending per capita at the rate of projected labor productivity growth.[10] Since labor productivity growth is the main driver of GDP growth, projected growth in federal public purchases (under our characterization of current policy) keeps pace with GDP

[8] They include programs such as Supplemental Nutrition Assistance (SNAP), Supplemental Security Income (SSI), Supplementary Medical Insurance (SMI) and Medicare Prescription Drug program (Medicare Part D), Medicaid, education subsidies, and many others.

[9] See "CBO's Process for Developing and Reviewing Baseline Projections" https://www.cbo.gov/publication/53532. The CBO reports supplemental information on the budgetary effects of programs that require reauthorizations in the future.

[10] Per capita purchases growth is maintained at labor productivity growth only for non-Covid-19 related expenditures.

growth. The present value of public goods and services purchases is netted against particular (mostly non-tax) receipts associated with that provision (service charges, tolls, fines, premiums etc.).

2.1 U.S. Fiscal Imbalance Measured under Current Law

Table 1 shows our estimates of FI and its components as present discounted values in constant 2021 dollars. Present discounted values are calculated over two time horizons – through 2095 and in perpetuity. The Table also shows FI and its components as a share of the present discounted value of projected U.S. Gross Domestic Product (PVGDP). PWBM's projection of GDP and its discounted present value (PVGDP) are based on its projections of annual efficiency-adjusted labor hours and the U.S. productive capital stock as described in the Appendix.[11]

	Assets(+)/ Debt(-) (A)	**75-year Projections**			**Assets(+)/ Debt(-) (A)**	**Infinite Horizon Projections**		
		Receipts (R)	**Expendi-tures (E)**	**FI** (E-R-A)		**Receipts (R)**	**Expendi-tures (E)**	**FI** (E-R-A)
	Present values in trillions of constant 2021 dollars*							
U.S. Treasury	–27.5***			27.5	–27.5***			27.5
OASDHI	3.0**	86.8	126.2	36.3	3.0**	159.7	269.4	106.6
non-OASDHI	3.1**	162.9	128.9	-37.0	3.1**	301.8	272.3	-32.5
Public Purchases		1.8	79.3	77.5		3.4	146.6	143.2
Net Value	–21.4	251.5	334.5	104.3	–21.4	464.9	688.4	244.8
Memo: OASDI	2.9	63.2	87.9	21.8	2.9	116.7	183.4	63.9
	As a percent of PVGDP*							
U.S. Treasury	–2.1***			2.1	–1.1***			1.1
OASDHI	0.2**	6.7	9.7	2.8	0.1**	6.6	11.2	4.4
non-OASDHI	0.2**	12.5	9.9	-2.8	0.1**	12.5	11.3	-1.4
Public Purchases		0.1	6.1	6.0		0.1	6.1	5.9
Net Value/PVGDP	–1.6	19.3	25.7	8.0	–0.9	19.3	28.6	10.2
Memo: OASDI	0.2**	4.9	6.8	1.7	0.1**	4.8	7.6	2.7
Memo: PVGDP	1,300.3				2,410.0			

Table 1: 75-year and infinite horizon FI measures under current fiscal laws and purchases policies.
Source: Authors' calculations.
* Present values calculated at a nominal discount rate of 4.4 percent.
** Intragovernmental debt for Social Security, Medicare, and other programs.
*** Gross federal debt.

[11] See the Appendix, section A5, for details on projecting U.S. GDP.

FI Measured over the next 75 Years

According to our estimates, the federal government faces a financial shortfall equal to $104.5 trillion through the next 75 years (2021-95), or 8.0 percent of the present value of GDP (PVGDP) over that time span. The *programmatic* view of components of the total shortfall is obtained by considering entries under the FI column of Table 1. Consider, first, projections through 2095. Public purchases at current rates out of GDP constitute the largest amount – $77.5 trillion in present value through 2095 or 6.0 percent of PVGDP. This provision would be paid for out of resources that remain after funding all federal transfer commitments under current fiscal laws. The OASDHI component, however, contains a resource shortfall ($36.3 trillion or 2.8 percent of PVGDP). The balance on current-law non-OASDHI transfers net of non-payroll tax and non-tax revenues (except the small amounts of offsetting receipts on public purchases) generates a surplus ($37.0 trillion, or 2.8 percent of PVGDP). This amount simply offsets the shortfall on account of OASDHI with nothing remaining to pay for debt service and public purchases at current levels as a share of GDP. The total resource shortfall amounts to $104.3 trillion or 8.0 percent of PVGDP.

The *unified budget* view of FI is obtained by considering column totals shown in the "Net Value" row. Outstanding debt held by the public ($21.4 trillion or 1.6 percent of PVGDP) plus federal expenditures on all FI components ($334.5 trillion or 25.7 percent of PVGDP) amounts to $355.8 trillion (27.3 percent of PVGDP) whereas all tax and non-tax revenues generate only $251.5 trillion (19.3 percent of PVGDP) in federal resources under current federal fiscal laws and public purchases policy.

Comparison of the 75-year FI measure with Federal Agency Estimates

Our FI measure calculated over 75 years (through 2095) is slightly larger than that reported in the Financial Report ("Report") of the federal government for fiscal year 2021.[12] The Report's Statement of Long-Term Fiscal Projections (SLTFP) shows that the "present value (PV) of total "noninterest

[12] See United States Department of the Treasury (2022).

spending over the next 75 years under current policy is projected to exceed the PV of total receipts by $97.6 trillion." This estimate is reasonably close to that reported in this study ($104.3 trillion).[13]

Our measure of OASDHI's FI can be split into those for OASDI and HI. Our 75-year FI estimate for OASDI is $21.8 trillion (or 1.7 percent of the 75-year PVGDP; see Memo lines in Table 1) – similar in magnitude to the $19.8 trillion reported by the Social Security Trustees in 2021.[14] Finally, our 75-year FI estimate for Medicare Part A is $14.5 trillion, considerably larger than the official estimate of –$10.0 trillion reported by the Medicare Trustees.[15]

Fiscal Imbalance Measured in Perpetuity

The FI measure calculated in perpetuity – which presents a comprehensive measure of the budget's structural resource shortfall – is even larger. The infinite horizon FI equals $244.8 trillion or 10.2 percent of PVGDP. Over the longer horizon, the non-OASDHI surplus of 32.5 trillion is woefully inadequate to cover the shortfalls in OASDHI ($106.6 trillion), public purchases at current rates ($143.2 trillion) and outstanding federal debt ($27.5 trillion). The reasons for the larger total shortfall over the longer time horizon becomes clear when we consider trajectories of accruing annual budget shortfalls even just though the year 2095.

[13] The Financial Report's estimate of the FI as a share of PVGDP is smaller because its estimate of the latter – $1,724.4 trillion – is considerably larger than our estimate of $1,300.3 trillion. However, the Financial Report does not describe its GDP projection method.

[14] See Social Security Board of Trustees (2021), Table VI.F1. Again, however, FI as a share of PVGDP reported by the Social Security Trustees is smaller than ours because their estimate of the latter -- $1,698 trillion is larger than our estimate of $1,300.3. The Trustees Report does not contain a description of the methodology used to project GDP.

[15] See Annual Report of the Medicare Board of Trustees (2021), Table V.G2. The Medicare trustees' estimates for all parts of Medicare are qualified by the statement of actuarial opinion at the end of their Annual Report. That opinion strongly questions the sustainability of the current system of Medicare provider reimbursements, implying that official estimates severely understate the sizes of Medicare's 75-year and infinite horizon financial shortfalls. However, Medicare's actuaries do not provide FI estimates in present valued dollars or as a share of PVGDP under their illustrative alternative scenario.

Panel-A of Figure 1 shows time profiles of projected annual federal non-interest expenditures, receipts, and deficits through year 2095 (non-interest expenditures minus receipts) as percentages of annual GDP. Panel-B of the Figure shows annual deficits as a share of annual non-interest expenditures and receipts.

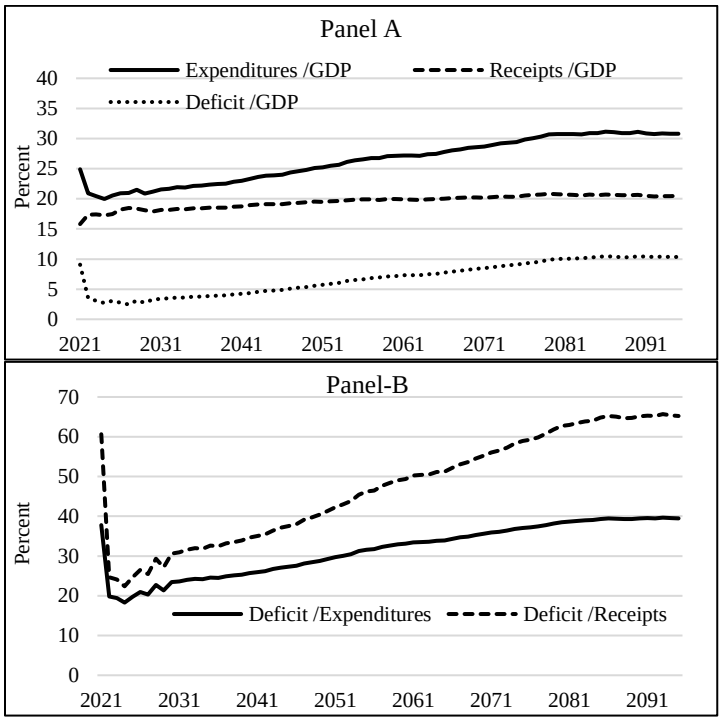

Figure 1: Projected federal deficits as shares of GDP, federal receipts, and noninterest expenditures under current fiscal laws and purchases policy.
Source: Authors' calculations.

The high GDP shares of non-interest expenditures and the deficit and the low GDP share of revenues during 2021 resulted from anti-Covid-19 federal spending and depressed employment and income. The Congressional Budget Office projects that the post-Covid-19 economic recovery will reduce the deficit-GDP ratio during the next few years. However, a structural misalignment in projected long term expenditures and receipts is evident from Panel-A of Figure 1. Continuing population aging combined with current laws on taxes, transfers, and purchases lead to increasing deficit-GDP ratios for many decades after the mid-2020s

Panel-B of the Figure shows that the deficit-expenditure and deficit-revenues shares continue to increase after the mid-2020s. The deficit-expenditure share increases from a (projected) low of 11.7 percent in 2026 to 33.6 percent by 2095. And the deficit-revenue share increases from 13.3 percent in 2027 to 50.5 percent by 2095. Each year's deficit-expenditure and deficit-revenue ratios indicate the annual percentage changes in each (expenditure cuts or revenue increases) that would be needed to maintain budget balance for each year relative to their projected trajectories under current laws and purchases policy. Increases in both ratios imply that U.S. treasury debt would increase over time. Under PWBM's fiscal projections, debt held by the public would increase as a share of GDP from 97.3 percent in 2021 to 236 percent by 2050 and 839 percent by 2095.[16]

Panel-A of Figure 1 shows slower growth of the expenditure-to-GDP and receipts-to-GDP ratios during the latter part of the 75-year horizon. This causes the deficit-to-GDP ratio (also shown in Panel A of Figure 1) to also stabilize after the 2070s. The assumed abatement and eventual elimination of excess health care cost growth is the reason for this result. Although the deficit-to-GDP ratio stabilizes, it remains large and positive for a long time after 2095, causing the infinite horizon FI measure to exceed the 75-year measure.

Because projection uncertainty increases over time, the infinite horizon FI estimate is more uncertain than FI calculated over a finite time horizon. However, larger uncertainty of longer-horizon FI estimates does not necessarily imply that those estimates, which are also anchored upon the continuation of current laws and policies, should be ignored. They provide useful information about the sustainability of current laws and of policy adjustments that target achieving budget balance over a limited time horizon.[17]

[16] The CBO's 2051 projection of the ratio of debt held by the public to GDP is 202 percent (See CBO's Long Term Budget Projections, February 2021). The debt-to-GDP ratio for 2095 is not an unconditional forecast but a projection under the assumption that current laws and purchases policy are maintained through year 2095.

[17] When deficits continue to accrue beyond any finite time window, policy adjustments that achieve present-valued budget balance over that time window would be thrown out of balance simply because of the passage of time.

Fiscal Imbalance under continuation of fiscal laws and purchases policy applicable in 2021 ("no-sunset" of expiring provisions).

	Assets(+)/ Debt(-) (A)	75-year Projections			Assets(+)/ Debt(-) (A)	Infinite Horizon Projections		
		Receipts (R)	Expendi-tures (E)	FI (E-R-A)		Receipts (R)	Expendi-tures (E)	FI (E-R-A)
	Present values in trillions of constant 2021 dollars*							
U.S. Treasury	–27.5***			27.5	–27.5***			27.5
OASDHI	3.0**	86.9	126.2	36.3	3.0**	159.8	269.4	106.6
non-OASDHI	3.1**	146.1	128.9	-20.2	3.1**	270.1	272.3	0.9
Public Purchases		1.8	79.3	77.5		3.4	146.6	143.2
Net Value	–21.4	234.8	334.5	121.1	–21.4	433.3	688.4	276.4
Memo: OASDI	2.9	63.2	87.9	21.8	2.9	116.7	183.4	63.8
	As a percent of PVGDP*							
U.S. Treasury	–2.1***			2.1	–1.2***			1.1
OASDHI	0.2**	6.7	9.7	2.8	0.1**	6.6	11.2	4.4
non-OASDHI	0.2**	11.2	9.9	-1.6	0.1**	11.2	11.3	0.0
Public Purchases		0.1	6.1	6.0		0.1	6.1	5.9
Net Value/PVGDP	–1.7	18.1	25.7	9.3	–0.9	18.0	28.6	11.5
Memo: OASDI	0.2**	4.9	6.8	1.7	0.1**	4.8	7.6	2.6
Memo: PVGDP	1300.3				2410.0			

Table 2: 75-Year and infinite horizon FI measures under continuation of fiscal laws and purchases policies applicable in 2021 ("no-sunset" of expiring provisions).
Source: Authors' calculations.
* Present values calculated at a discount rate of 4.4 percent
** Intragovernmental debt for Social Security, Medicare, and other programs
*** Gross federal debt.

Table 2 shows FI under the alternative assumption that fiscal laws and purchases policy applicable in 2021 are continued in perpetuity. Under this "no-sunset" alternative, future changes by way of expirations of particular tax policies – mostly those enacted under the Tax Cuts and Jobs Act (TCJA) of 2017 that are built into today's fiscal laws – are left unimplemented.[18] The non-expiration of expiring TCJA tax provisions would reduce federal revenues relative to those under current fiscal laws.[19] Under

[18] Taxes that are scheduled to expire under current fiscal laws are detailed in Appendix, section A6. Under CBO's methodology described earlier, projected budget effects of yet-to-be-reauthorized non-OASDHI expenditures are included in its 10-year budget projections. Table A8.3 in Appendix section A8 lists the direct budget effects of reversing the expiration of TCJA provisions as estimated by PWBM staff.
[19] An alternative policy relative to current laws are likely to alter the time paths of households' labor supply and saving and, hence, tax bases, total federal revenues and annual deficits. Such feedback effects under the "no-sunset" policy are not included in the estimates reported in the text.

the “no-sunset” case, FI through 2095 equals $121.1 trillion or 9.3 percent of PVGDP. Under the infinite horizon projection the FI is estimated to be 276.4 trillion, which equals 11.5 percent of the PVGDP.

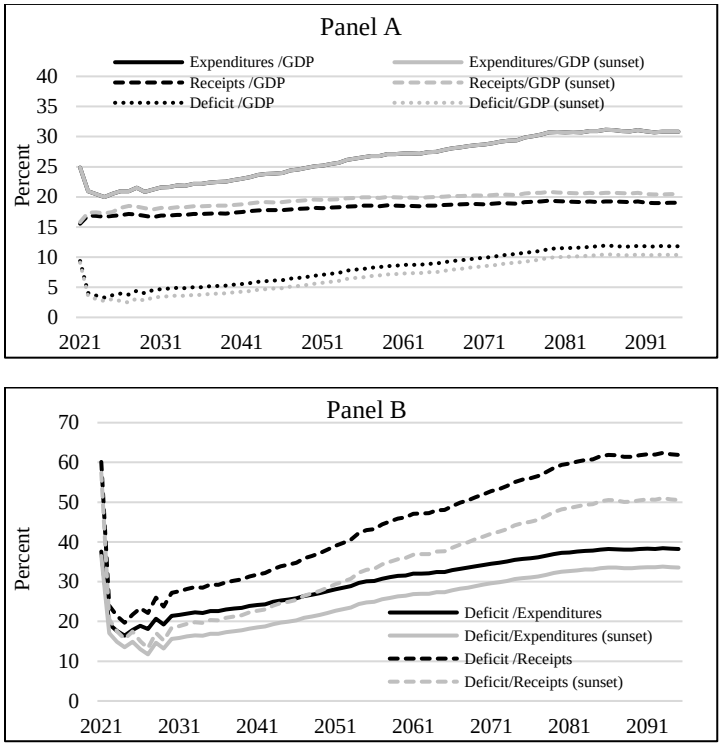

Figure 2: Projected federal deficits as shares of GDP, federal receipts, and non-interest expenditures under continuation of fiscal laws applicable in 2021 (“no-sunset” of expiring provisions).
Source: Authors’ calculations.

Panel-A of Figure 2 shows projected annual federal receipts, non-interest expenditures and deficits as a share of GDP under the “no-sunset” alternative. Under it, annual budget deficits are larger, as are deficit-GDP ratios compared to current-law-and-purchases-policy (“sunset”) scenario. The latter projections are shown in gray lines for comparison in Figure 2. Expenditure time series under the “sunset” and “no-sunset” cases overlap as there are no expiring expenditure provisions. All of the deficit increase under the “no-sunset” policy emerges from maintaining the revenue changes enacted under TCJA laws.

Panel-B of Figure 2 shows that “no-sunset” deficit-expenditure and deficit-revenues shares are considerably higher compared to those under current-laws-and-purchases policy. The deficit-to-expenditure share now reaches 38.2 percent of GDP by 2095 (compared to 33.6 percent under current-laws-and-purchases policy). And the deficit-receipts share reaches 61.9 percent by 2095 (compared to 50.5 percent under current laws and purchases policy). The increase in the deficit ratios through time

indicates that, absent policy adjustments, U.S. treasury debt will increase to 273 percent of GDP by 2050 (instead of 236 percent under the current law and purchases policy), and to 976 percent by 2095 (compared to 839 percent under the current law and purchases policy).[20]

Figure 3 splits projected annual deficits (as shares of GDP) under current fiscal laws and purchases policy into three components – those arising from OASDHI and non-OASDHI transfers net of receipts and from discretionary public goods' purchases net of premiums, tolls and other receipts associated with those purchases. In the Figure, time profiles under current-law-and-purchases policy ("sunset" case) are shown in darker lines and those under continuation of fiscal laws applicable in 2021 ("no-sunset" of expiring provisions) are shown as light gray lines in corresponding line styles (unbroken, dashed, dotted etc.).

The non-OASDHI component (dotted lines in Figure 3) contributes a surplus that, under current laws and purchases policy, declines over time from just over 5 percent of GDP during the late-2020s to 2.9 percent in 2050 and to 1.2 percent by 2095. An important reason for the reduction of non-OASDHI surplus is growing health care costs on account of Medicare (excluding Part A) and Medicaid programs.[21]

In contrast, OASDHI's deficit-GDP ratio (short dashed lines Figure 3, which are identical under both the "sunset" and "no-sunset" cases), increases rapidly from just under one percent of GDP during the early 2020s to 2.5 percent by 2050 and to 5.3 percent by 2095. Finally, public goods and services purchases in GDP (also identical under the two cases) decline from recent highs to hold steady at just above 6.0 percent of GDP through 2095.[22] These projections show that non-OASDHI component's surplus is insufficient to cover the combined deficit emerging from OASDHI and public goods purchases. As a result, the total deficit (unbroken line in Figure) as a share of GDP under current law and purchases policy ("sunset" case) increases from a low of 2.5 percent during the mid-2020s to 10.3 percent by 2095.

[20] See footnote 16.
[21] Non-OASDHI projections of revenues and expenditures includes those for the Supplementary Medical Insurance (Medicare Parts B), Medicare Advantage (Part C) and the Medicare Prescription Drug program (Medicare Part D).
[22] Purchase of discretionary public goods and services (net of minor associated receipts) are held at levels projected by the CBO through year 2030. Purchases are distributed equally across the U.S. (projected) population and per-capita amounts are assumed to increase at the rate of labor productivity growth after year 2030.

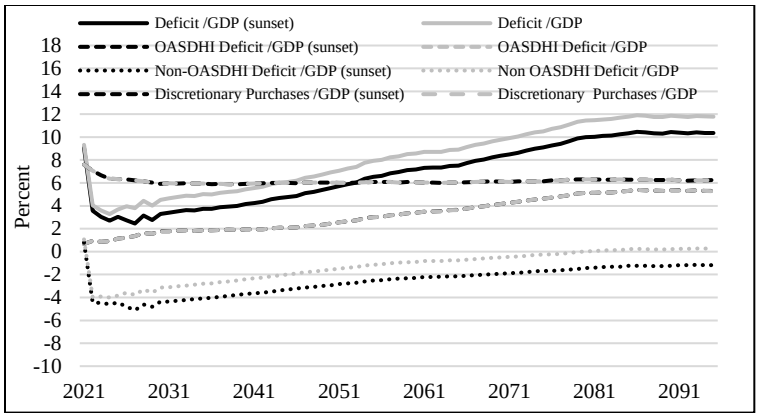

Figure 3: Deficit components as shares of GDP: OASDHI, non-OASDHI, and public purchases under current laws including scheduled expirations ("sunset") and under continuation of fiscal laws applicable in 2021 ("no sunset" of expiring provisions).
Source: Authors' calculations.

The gray lines of Figure 3 show the evolution of these components under continuation of fiscal laws applicable in 2021 ("no-sunset" case without expiration of certain tax and spending provisions). Here, near-term non-OASDHI surpluses decline faster and switch to a 0.3 percent deficit as a share of GDP by 2095. As a result, the total deficit (unbroken line) as a share of GDP increases from a low of 3.3 percent during the early-2020s to 11.8 percent by 2095.

Panel-A of Figure 4 shows OASDHI receipts, expenditures, and deficit as a share of GDP under current-law OASDHI benefits and tax projections. Panel-B of the Figure shows the same information for non-OASDHI transfers and receipts. The increase in OASDHI deficit result from a faster growth of benefits relative to the growth of OASDHI receipts. As noted above, a key contributors to the increasing resource gap in OASDHI is the (assumed) continuation of excess growth in Medicare Part A expenditures per capita through year 2060. In contrast, receipts exceed expenditures in the non-OASDHI component but the surplus is projected to decline during the next several decades under current fiscal laws and purchases policy.

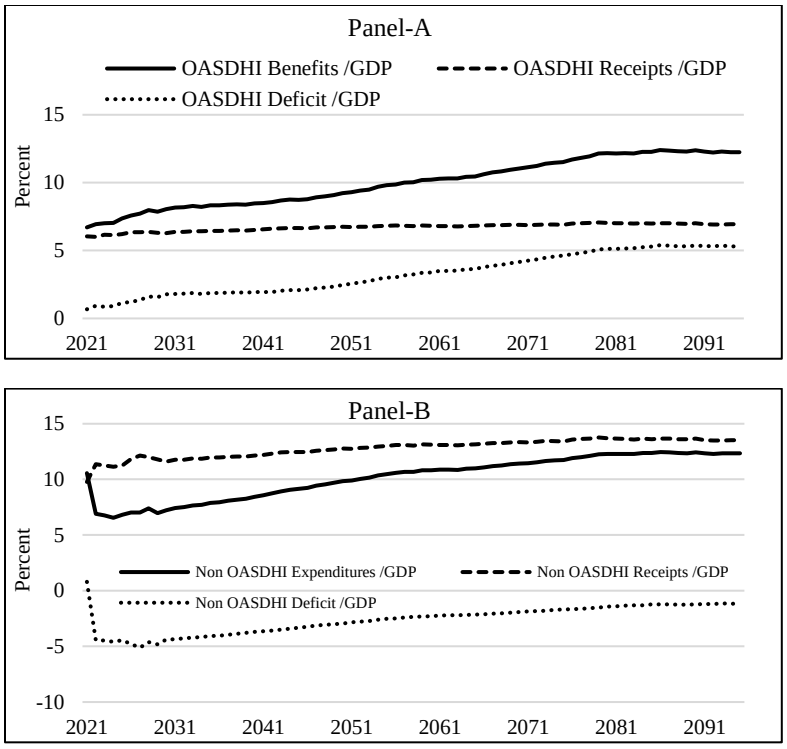

Figure 4: Federal receipts, expenditures, and deficits in OASDHI and non-OASDHI programs as shares of GDP under current laws.
Source: Authors' calculations.

3. The Generational Imbalance Measure for OASDHI

OASDHI expenditures are funded solely out of dedicated payroll tax revenues and income taxes on Social Security benefits of high income retirees. OASDHI revenues and expenditures can both be allocated to particular cohorts (by birth year, gender, race, and education levels) that pay those taxes and receive Social Security and Medicare benefits. By assigning OASDHI trust funds' assets to net tax payments of past cohorts and adding prospective net tax payments of those currently alive, we can calculate the portion of OASDHI's FI that arises from taxes and transfers of the "closed group" of past and current generations.

		Present Values in Trillions of Constant 2021 Dollars				As a Percent of PVGDP			
		Trust Fund	Receipts	Expend-itures	Fiscal imbalance	Trust Fund	Receipts	Expend-itures	Fiscal imbalance
		Panel-A: Through the Infinite Horizon							
Social Security (OASDI)	FI	2.9	116.7	183.4	63.9	0.1	4.8	7.6	2.7
	GI	2.9	46.6	85.3	38.8	0.1	1.9	3.5	1.6
	FI-GI	0.0	70.1	98.1	25.1	0.0	2.9	4.1	1.0
Medicare Part A (HI)	FI	0.1	43.1	86.0	42.8	0.0	1.8	3.6	1.8
	GI	0.1	16.8	38.3	21.5	0.0	0.7	1.6	0.9
	FI-GI	0.0	26.2	47.7	21.3	0.0	1.1	2.0	0.9
Social Security and Medicare Part A (OASDHI)	FI	3.0	159.7	269.4	106.6	0.1	6.6	11.2	4.4
	GI	3.0	63.4	123.6	60.2	0.1	2.6	5.1	2.5
	FI-GI	0.0	96.3	145.8	46.4	0.0	4.0	6.0	1.9
		Panel-B: Through 2095							
Social Security (OASDI)	FI	2.9	63.2	87.9	21.8	0.2	4.9	6.8	1.7
	GI	2.9	23.1	56.0	32.9	0.2	1.8	4.3	2.5
	FI-GI	0.0	40.1	31.9	-11.1	0.0	3.1	2.5	-0.9
Medicare Part A (HI)	FI	0.1	23.6	38.3	14.5	0.0	1.8	2.9	1.1
	GI	0.1	8.0	24.3	16.3	0.0	0.6	1.9	1.3
	FI-GI	0.0	15.6	14.0	-1.7	0.0	1.2	1.1	-0.1
Social Security and Medicare Part A (OASDHI)	FI	3.0	86.8	126.2	36.3	0.2	6.7	9.7	2.8
	GI	3.0	31.1	80.3	49.2	0.2	2.4	6.2	3.8
	FI-GI	0.0	55.7	45.9	-12.8	0.0	4.3	3.5	-1.0

Table 3: OASDHI's FI attributable to past and current generations (GI) and future generations (FI-GI).
Source: Authors' calculations.

We call the closed group's contribution to the overall FI the Generational Imbalance (GI). By construction, the imbalance accruing to future generations (under current OASDHI laws) equals FI–GI. Table 3 shows the decomposition of OASDHI's FI into GI and FI-GI, both overall and separately for Social Security (OASDI) and Medicare Part-A (HI).

Panel-A of Table 3 shows that FI for OASDHI as a whole equals $106.6 trillion over the infinite horizon – the sum of $63.9 trillion on account of Social Security and $42.8 trillion on account of Medicare Part A. Past and current generations contribute $38.8 trillion on account of Social Security and $21.5 trillion on account of Medicare Part A to total FI. These GI amounts represent excess benefits in present value that the closed-group cohort will receive over the present value of their payroll taxes and income taxes on Social Security benefits assuming maintenance of current OASDHI laws and income tax laws on Social Security benefits during their remaining lifetimes. Keeping those laws in place indefinitely implies granting net benefits to future generations as well (FI-GI), to the tune of $25.1 trillion on account of Social Security and $21.3 trillion on account of Medicare Part A.

OASDHI's net benefits to past, current, and future generations under current laws amount to 4.4 percent of PVGDP through the infinite horizon – 2.7 percent on account of Social Security and 1.8 percent on account of Medicare Part A. Of the total OASDHI imbalance of 4.4 percent of PVGDP, 2.5 percent arises on account of past and current generations and 1.9 percent on account of future ones. Panel-B of Table 3 shows that one-third of the total OASDHI imbalance ($36.3 trillion out of $106.6 trillion), accrues during the next 75 years. Of this amount, 40 percent ($14.5 trillion) accrues on account of Medicare Part A.

4. Generational Accounts by Education, Gender and Race

FI and GI measures are a version of generational accounting (GA), which estimates the direct incidence of lifetime net taxes on various population cohorts distinguished by their attributes. A generational account shows the actuarial present value of prospective net taxes (taxes minus transfers) per person, again under the assumption that current federal fiscal laws will remain unchanged in the future. Previous generational accounting studies separated cohorts by birth year (or age as of the base year, here 2021) and gender.[23] The GAs reported here identify population subgroups by birth-year, gender, race (white, nonwhite) and highest education attained over the lifetime (less than college, college or more).[24] The advantage of a more granular decomposition lies in more accurately capturing correlations between lifetime taxes and transfers with average longevity.[25]

FI and FI – GI measures reported above for OASDHI programs are the most parsimonious generational accounting measures as they show how total federal indebtedness on account of those programs is distributed across only two groups: past and current generations and all future generations.

[23] See Auerbach, Gokhale, and Kotlikoff (1991).
[24] It is possible to identify highest lifetime education because the PWBM's projection of the future population provides prospective life-histories of all simulated individuals.
[25] For example, distinguishing by gender alone would not capture (1) correlation between average transfers and longevity by race and education and (2) correlations between average taxes and longevity by race and education.

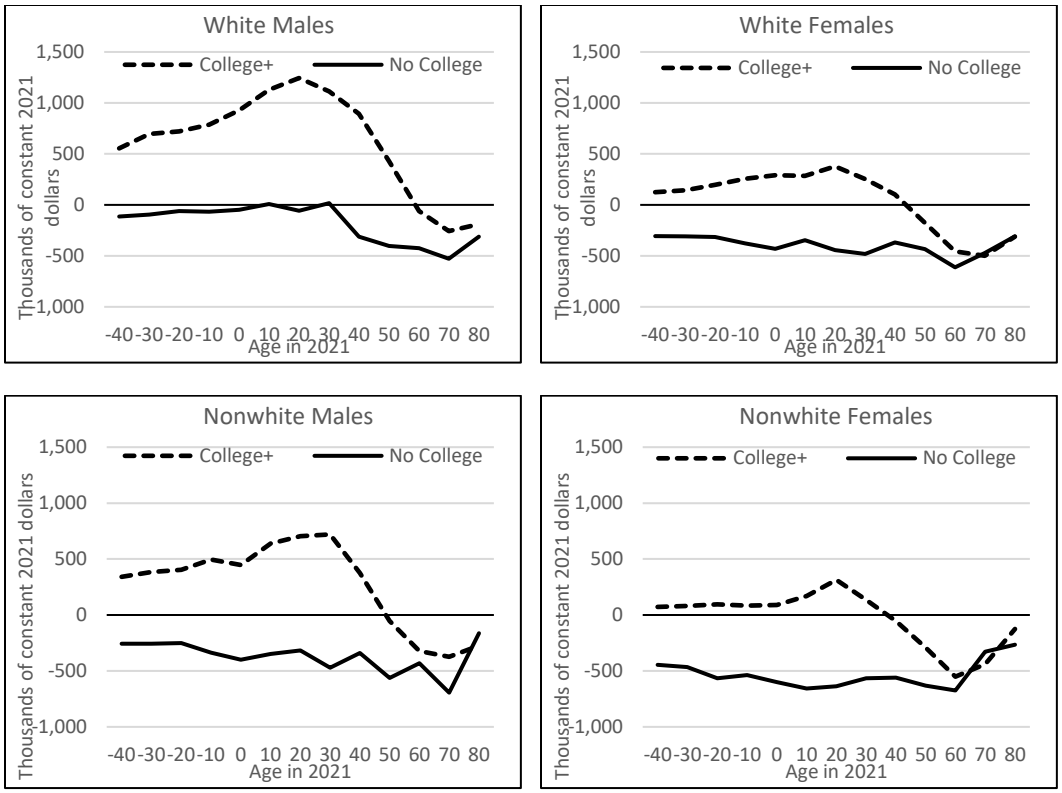

Figure 5: Generational accounts: Present values of projected net taxes per capita for current and future generations by birth year, gender, race, and lifetime educational attainment.
Source: Author's calculations.
Negative ages on the X-axis indicate future birth years. For projected future-born cohorts, present values are calculated by actuarially discounting annual net tax payments back to birth year and discounting the result back to 2021 using the nominal productivity discount rate of 3.5 percent per year.

In general, GA metrics are designed to reveal how much each cohort (by birth-year, gender, and other attributes) would contribute under current federal tax and transfer laws during its expected (remaining) lifetime toward funding the government's prospective provision of public goods and services at current rates out of GDP. Each cohort's projected net tax payments (taxes minus transfers) per capita are actuarially discounted back to the cohort's birth year. Actuarial calculations take account of differential mortality rates across demographic groups by race, gender, birth-year and education levels. For future-born generations, age-0 present values are additionally discounted back to the base year (2021 in this study) at the rate of annual productivity growth to account for the fact that they would be alive during future periods when labor productivity levels are higher than for those born earlier. Calculation details for GA metrics are provided in the Appendix.

Figure 5 shows GA profiles for population subgroups distinguished by birth-year, gender, race, and lifetime educational attainment. Negative ages indicate cohorts born after the base year 2021. Table 4 shows the dollar values (in constant 2021 dollars) underlying the charts of Figure 5. A detailed breakdown of each cohort's GA is provided in Appendix (section A9). In general, Figure 5 and Table 4 show that college educated cohorts pay positive amounts of net taxes and the non-college-educated receive transfers, on net, during their prospective lifetimes; that those in the early stages of their working lifetimes pay the highest net taxes in present value, and those in pre-retirement lifecycle stages receive the highest net transfers in present value. The following paragraphs describe GA differences by particular demographic attributes.

A. College educated white and non-white males

Among the college educated, white and non-white males in early-career stages are slated to pay significant amounts of federal net taxes during their remaining lifetimes. The top left chart of Figure 5 shows that "early-career" white college-educated males (aged 10-30 in 2021) may expect to pay more than $1 million (in constant 2021 dollars) over their lifetimes in net taxes. The bottom left Panel of Figure 5 shows that similarly-aged non-white college-educated males would pay about one-half of the net taxes of their white counterparts. The reason for their lower net taxes are lower career labor-force attachments, lower efficiency-adjusted work hours and, therefore, lower earnings than white college-educated males (see Tables A9.1 and A9.5 in the Appendix). The working- and tax-paying lifecycle stages of college-educated cohorts' (age 10-30) is current or close in time and their benefit-receipt lifecycle stages – late career and retirements – are in the distant future. As expected, both white college- and non-college-educated males in their late fifties and older receive benefits on net. Comparing Appendix Tables A9.1 and A9.5, which provide detailed decompositions of GAs into present discounted taxes and transfers shows that college educated white males, although they receive more in Social Security benefits, pay even more income and other taxes during retirement compared to their college educated non-white counterparts.

B. White college- and non-college-educated males

Working aged white males with less than college education receive relatively small amounts of transfers on net in present value. Appendix Tables A9.1 and A9.3 show that compared to college educated white males, non-college-educated white males pay fewer income, payroll, indirect, estate, and other taxes. Although the latter also receive fewer health care and other transfers (because of shorter lifespans) their GAs are smaller or negative compared to their college-educated white counterparts.

C. Nonwhite college and non-college educated males

Younger non-college educated non-white males receive considerable transfer benefits whereas their college-educated counterparts pay substantial amounts in net taxes. The contrast is highlighted among newborns in 2021: College educated nonwhites would expect to pay more than $400,000 in net taxes whereas the non-college-educated would receive almost $400,000 in net transfers during their lifetimes.

D. College educated white and nonwhite females

White college educated females pay more in net taxes compared to nonwhite college-educated females, mainly because of earnings differences. Both cohorts currently have about the same degree of labor force attachments, and receive comparable amounts in social and health care transfers. But college educated women provide more efficiency-adjusted hours, earn more, and pay more taxes than non-college educated women.

E. White college- and non-college-educated females

Among white females, college education confers, prospectively, higher earnings and positive net tax payments whereas not having a college degree leads to receipt of substantial transfers. The difference is starkest for those aged 20 in year 2021: College education begets a lifetime net tax burden of almost $400,000 whereas non college status confers net transfers of more than $400,000. Most of the difference emerges from the earnings premium accruing to those with at least a college education.

F. Nonwhite college- and non-college-educated females

Similar to their educated white counterparts, younger college educated nonwhite females enjoy higher earnings and pay more taxes compared to younger non-white females without a college education. The latter, in contrast, receive substantially more in federal transfers. Indeed, whereas college educated nonwhite women aged 20 in 2021 pay almost $1 million in taxes and receive about $700,000 in transfers, on average. Their non-college-educated counterparts, in contrast, pay just $300,000 in taxes but receive well above $900,000 in transfers, on average, mostly from Social Security, Medicare, and Medicaid.

Birth Year	Age in 2021*	White				Nonwhite			
		College+		No College		College+		No College	
		Male	Female	Male	Female	Male	Female	Male	Female
2061	-40	553,958	123,040	-115,093	-306,322	341,885	72,198	-257,371	-443,991
2051	-30	696,546	142,235	-95,171	-309,613	385,430	80,482	-255,939	-465,550
2041	-20	721,564	195,202	-60,287	-315,316	402,703	95,097	-249,730	-564,616
2031	-10	787,592	255,910	-68,330	-376,674	494,565	83,550	-337,624	-537,297
2021	0	926,766	289,357	-47,857	-431,198	447,887	89,258	-398,648	-600,551
2011	10	1,127,559	286,015	8,021	-345,547	639,524	168,274	-348,618	-657,898
2001	20	1,244,020	377,594	-57,933	-444,567	704,605	313,991	-315,764	-637,677
1991	30	1,111,613	253,534	17,107	-480,063	720,079	135,516	-470,458	-564,994
1981	40	894,904	103,922	-312,663	-368,391	374,077	-54,361	-338,836	-561,102
1971	50	428,203	-177,068	-402,570	-433,947	-54,787	-291,563	-563,276	-631,038
1961	60	-61,473	-454,880	-423,416	-612,142	-323,224	-551,101	-430,450	-674,387
1951	70	-257,178	-499,277	-528,312	-472,427	-373,589	-440,018	-693,929	-328,248
1941	80	-188,691	-313,136	-312,778	-307,053	-273,758	-123,898	-162,917	-265,301
1931	90	-270,126	-351,237	-103,555	-93,920	-311,993	-328,442	-464,934	-190,446

Table 4: Generational Accounts: Present values of future net taxes per capita in constant 2021 dollars by birth year, race, gender, and lifetime educational attainment.

Source: Author's calculations.

* Negative ages indicate birth in the future. For projected future born cohorts, present values calculated by actuarially discounting net taxes to birth year and discounting the result back to 2021 using the productivity discount rate of 3.5 percent per year.

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Appendix

Calculating Generational Accounts and Fiscal and Generational Imbalance Measures

A1. Overview

Fiscal imbalance and generational accounting metrics take as their starting point the government's present-valued (intertemporal) budget constraint. This constraint may be written as

(A1.0) $\mathrm{PVG_t} = \mathrm{NWG_t} + \mathrm{PVTL_t} + \mathrm{PVTF_t}$.

Equation (A1.0) is a financing constraint. It says that at time t (the initial year), the present value of all prospective government purchases of goods and services, PVG_t, must be paid for out of its total resources: the net wealth of the government, NWG_t plus the present value of prospective net tax payments by current generations, PVTL_t, and plus the present value of aggregate net tax payments by future-born generations, PVTF_t. Net taxes are calculated as tax payments net of transfer receipts in each period.

Equation (A1.0) may be satisfied under many different configurations of government tax and spending laws. For example, low (high) $\mathrm{PVG_t}$ implies that prospective net tax payments of living and future generations must be correspondingly lower (higher) for the two sides of (A1.0) to balance; and given $\mathrm{PVG_t}$, low net taxes levied on living generations must be offset by higher net tax levies on future ones, and so on.

In general, prospective government spending and net taxes of living and future generations under *current law* (denoted as PVG_t^c, PVTL_t^c, and PVTF_t^c), which includes scheduled future changes such as expirations of particular spending, tax, and transfer laws, the two sides of (A1.0) usually would not be equal. The present valued difference between the government's current-law spending and resources equals the current-law fiscal imbalance, $\mathrm{FI_t^c}$.

(A1.1) $\mathrm{FI_t^c} = \mathrm{PVG_t^c} - [\mathrm{NWG_t} + \mathrm{PVTL_t^c} + \mathrm{PVTF_t^c}]$.

Since resources actually on hand today, NWG_t, are already accounted for and fixed from past accruals, the present valued dollar amount, $\mathrm{FI_t^c}$, shows the *additional* resources needed for the government to fully fund current-law purchases, PVG_t^c. A positive value of $\mathrm{FI_t^c}$ indicates a funding shortfall that must

be resolved either by levying additional net taxes (increasing taxes or cutting transfers from current-law levels) or by reducing government purchases themselves below current-law levels. That is eliminating the imbalance shown in (A1.1) involves changing fiscal laws to establish equality of the two sides of equation (A1.0).

A2. Computation Method

Estimation of the two present-valued terms within square brackets in equation (A1.1) can be accomplished by calculating generational accounts. A "generational account" (GA) is the dollar amount, defined as the actuarially discounted present value of per capita net tax payments (under a given fiscal policy) of a population cohort over the rest of its expected lifetime.[26] Adding up the population-weighted GAs of all birth cohorts alive today yields the term PVTL_t^c. Similarly, calculating the GAs of yet-to-be-born population cohorts over their expected lifetimes (by using future population projections) and adding their population-weighted present-discounted values yields the term PVTF_t^c.[27] Generational accounts and fiscal imbalance measures can be calculated under any given set of fiscal laws or policies, *p*, to reveal the extent of tax- and spending-law adjustments needed to restore intertemporal budget balance ($\text{FI}_t^p = 0$). It also reveals the extent of trade-offs in distributing the adjustments on spending and net taxes on living and future generations.

The term NWG_t is simply total contractual asset/debt position of the government vis-à-vis the rest of the world.[28] As noted above, the sum of generational accounts over all members of living generations yields the term PVTL_t^c. This sum is

(A2.2) $\text{PVTL}_t^c = \sum_{j_t=0}^{D} \sum_x \left(GA_{j_t,t}^{c,x} p_{j_t,t}^x \right)$,

[26] In this study population cohorts are distinguished by birth year, gender, race, and lifetime educational attainment.
[27] The latter calculation is extended sufficiently far into the future so that the present discounting procedure results in a stable value of PVTF_t^c.
[28] The U.S. Treasury department reports this as "debt held by the public." It includes outstanding Treasury Bills, Notes, Bonds, Inflation protected, and other securities issued by the federal government and held by individuals, corporations, state and local governments, Federal Reserve banks, and foreign entities. As of year-end 2020 it stood at $21.6 trillion.

where, x represents a combination of gender, education, and race attributes [gender (male, female), education (college degree, no-college degree) and race (white, non-white)], D is the maximum age of life (assumed to be 120 years), $p^{x}_{j_t,t}$ represent the populations of type x aged j in year t, and $GA^{c,x}_{j_t,t}$ represents current-law generational account in year t of person-types *x* aged j in year t (indexed by j_t) – that is, the present values as of year t of the per capita net taxes that each generation would pay under current law during its expected lifetime.

The generational account, $GA^{c,x}_{j_t,t}$ is calculated as

(A2.3) $GA^{c,x}_{j_t,t} = \frac{1}{p^{x}_{j_t,t}} \sum_{s=t}^{t+D-j_t} \sum_x p^{x}_{j_t,s} \left(\sum_{i=1}^{k} q^{c,x}_{i,j_t,s} \right) R^{s-t}$,

where $R = 1/(1 + r)$, and r is the discount rate. Equation (A2.3) expresses the actuarially discounted value of prospective per capita net payments of a generation aged j at year t. The account for each generation is calculated by (1) finding the algebraic sum of the per capita taxes and transfers paid in each year, s, by the members surviving in that year (including people of that age and person-type who have immigrated since year t), (2) multiplying that sum by the population in year s, (3) discounting the result back to year t, (4) aggregating such discounted values over the generation's lifetime, and (5) dividing the result by the generation's population in the initial year, t. In equation (A2.3), $q^{c,x}_{i,j_t,s}$ stands for the current-law per capita payment (or receipt, when q is negative) of type i in year s $(> t)$ by a generation of person-type x aged j in year t. The per capita net payment—after accounting for all (k) types of taxes and transfers in year s—is given by the sum in parentheses in (A2.3). This term, multiplied by the population of such persons in year s, $p^{x}_{j_t,s}$ yields the aggregate net payment that individuals of type x aged j in year t make in year s. U.S. population projections are taken from PWBM's microsimulation, which is calibrated to many features of the United States demography and demographic projections. Summing such discounted values for each year s over the remaining life of individuals aged j in year t (from t to $+D-j_t$) yields the discounted value of their aggregate net tax payments. Division by $p^{x}_{j_t,t}$, the population of such persons in year t, converts this actuarially discounted sum to a per capita amount and

represents the generational account of the generation of person-type x, aged j in year t, under current fiscal laws (denoted by superscript c).

Prospective per capita payments of each type of tax (or transfer) are estimated by distributing projected aggregate payments of that type by age and person-type categories. In making the distribution, generational accounting begins with projections of the U.S. population and of aggregate federal taxes and transfers. To each type of aggregate tax or transfer projection, it applies a relative profile by age and person-type normalized to a 40-year-old male. The exception is child-SCHIP benefits that are allocated only to children aged 0-17 with relative profiles normalized to male children aged 12.[29] The relative profile value for a 38-year-old woman is the ratio of her per capita payment to that of a 40-year-old man.

Relative profiles for various taxes and transfers are estimated from survey data and the latest available profiles are used to distribute projected aggregate payments by age and person-type in future years. For the United States, these estimates are taken from the Census Bureau's Current Population Survey (Annual Social and Economic Survey), the Social Security Administration's Annual Statistical Supplement to the Social Security Bulletin, the Federal Reserve's Survey of Consumer Finances and the Census Bureau's Survey of Consumer Expenditures.

The Congressional Budget Office's projections of aggregate payments are available only through the year 2030. For years 2021-2030, the relative tax/transfer profiles are used to distribute by age and person-type, projected aggregate federal revenues and transfer expenditures. This yields per capita payments by age and person-type for those years. Per capita values for later years are obtained by growing per capita values for the last available year (2030) at the rate of labor productivity (g). Hence, if the last available tax and expenditure aggregate if for year l,

(A2.4) $q^{c,x}_{i,j_t,l+u} = q^{c,x}_{i,j_t,l} * (1+g)^u, \quad i = 1,..k; \quad u = 1,...T.$

Relative tax and transfer profiles and associated aggregate payments and receipts specify the pattern of prospective per capita taxes levied on and receipts provided to various generations living at

[29] No education attributes are assigned to children aged 0-17.

year t and, therefore, collectively embody the generational pattern of fiscal policy at year t. Because all relative profiles are normalized to average payments by z-year-old males (40-year-old males in general and 12-year-old male children in the case of SCHIP benefits), the per capita payment of the z-aged normalizing individuals can be expressed as

(A2.5) $$q_{i,z,t}^{c,m} = \frac{Q_{i,t}^{c}}{\sum_{j_t=0}^{D}\left(r_{i,j_t,t}^{m} \cdot p_{j_t,t}^{m} + r_{i,j_t,t}^{f} \cdot p_{j_t,t}^{f}\right)}.$$

In (A2.5), $r_{i,j_t,t}^{m}$ represents the per capita payment (or receipt, if negative) of type i that a person aged j in year t makes relative to the payment of a 40-year-old male in year t, and $Q_{i,t}^{c}$, t represents the aggregate current-law payment or receipt of type i made in year t. Of course,

(A2.6) $$q_{i,j_t,t}^{c,x} = q_{i,z,t}^{c,m} \cdot r_{i,j_t,t}^{x}.$$

PVG_t is estimated by discounting prospective aggregate government purchases back to year t. If projections of aggregate purchases are unavailable or need to be extended, they are estimated by distributing, according to age, the per capita purchases in the last year (actual or projected) for which an aggregate figure is available, by making the per capita purchases by age grow at the same rate as labor productivity, and finally, by using a population projection to aggregate the per capita figures. Many yearly government purchases, such as for defense and general administration, cannot be assigned to specific age groups and are prorated to all individuals alive in that year. Note that generational accounting methodology uses estimates of government purchases by age only to mechanically extend the projections of those purchases. It does not try to assign the benefits of such purchases by age and person-type. As with the per capita distribution of taxes and transfers, the estimates for purchases assume a constant relative profile by age—a set of empirically determined ratios that represent an element of the current generational stance of fiscal policy.

Government net wealth, NWG_t, can be estimated by cumulating the sum of past government surpluses (or deficits, if negative). The government's existing tangible assets, such as parks and infrastructure, are excluded from NWG_t, and their prospective service flows, which represent the consumption of public goods, are excluded from PVG_t^c. If these assets were included in NWG_t, their

service flows would have to be included in PVG_t^c. Because the value of the assets must, by definition, equal the present value of their service flows, they would cancel each other if they were included in equation (A1.1). Thus, the exclusion of these items does not affect the trade-off between PVTL_t^c and PVTF_t^c .

A3. Generational Imbalance (GI)

Programs such as Social Security and Medicare Part 1 (Hospital Insurance) are purely redistributive in that all dedicated payroll and other taxes are eventually paid out as benefits.[30] The social insurance these programs provide occasions an on-going redistribution from workers to retirees and other beneficiaries. Generational accounting estimates and incorporates the dollars paid and received by various birth-cohorts.[31]

The fiscal imbalance for such programs can be written as the negative of existing assets in the program's trust fund ($NWTF_t$) and the sum of the actuarially discounted present values of net payroll and other taxes projected for living and future generations: negative lifetime net tax payments (taxes−benefits<0 in present value over remaining lifetime) increase the program's fiscal imbalance.

(A3.1) $\quad \text{FI}_t^c = -(\text{NWTF}_{\,t} + \text{PVTL}_t^c + \text{PVTF}_t^c).$

Calculations of the terms PVTL_t^c and PVTL_t^c are restricted to program revenues and expenditures and follow the same steps as described above. In the case of programs with dedicated revenue sources, the term $-(\text{NWTF}_{\,t} + \text{PVTL}_t^c)$ on the right hand-side of (A3.1) shows the Generational Imbalance (GI_t^c) on account of past and living generations.[32]

A positive FI_t^c indicates a shortfall of resources that must eventually be made up through a change in current tax and benefit laws. Given $\text{NWTF}_{\,t}$, which is fixed from the past, the change in GI_t^c following a change in the laws indicates how much of the policy adjustment is levied on living generations. For

[30] Government purchases of program-administrative services are not included in these accounts.
[31] Evaluating social insurance provision as a separate benefit is not within the scope of Generational Accounting.
[32] The term $\text{NWTF}_{\,t}$, which shows the accumulated assets or debt of the program through year t, records the overall effect of past net payments of past and current generations.

example, a change in laws that results in a large reduction in FI_t^c but little change in GI_t^c would show that most of the adjustment cost is levied on future generations of program participants under the new laws.

A4. PWBM's Estimation of FI, GI and GAs.

Generations are distinguished by single-year of birth, age, gender, race (white and non-white) and educational attainment (college degree and no college degree). Relative tax and transfer profiles are calculated from micro-data surveys, one for each combination of these attributes. That is, for each age, we distinguish 12 person-types as shown in Table A4.1. Earlier generational accounting calculations distinguished generations by age and gender only. That's because demographic projections of the Social Security Administration that are used in those studies do not decompose population projections by race and education. The PWBM microsimulation, which is calibrated to demographic and economic features of the United States, projects race and education (among other) attributes of the projected population.

Name	Gender (M)	Education (C1, C2)	Race (W, NW)
MC1W	Male	Less than college degree	White
MC2W	Male	College degree or more	White
FC1W	Female	Less than college degree	White
FC2W	Female	College degree or more	White
MC1N	Male	Less than college degree	Nonwhite
MC2N	Male	College degree or more	Nonwhite
FC1N	Female	Less than college degree	Nonwhite
FC2N	Female	College degree or more	Nonwhite

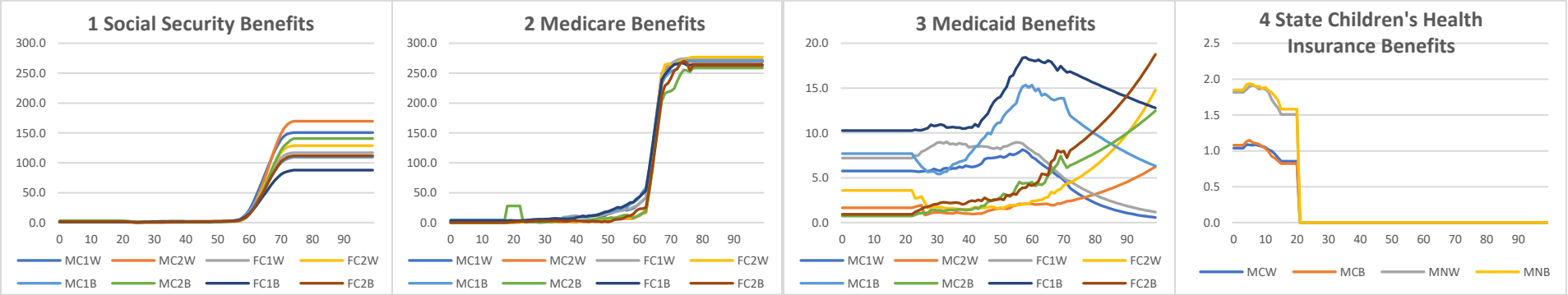
Table A4.1. *Person-Type Characteristics Distinguished for Calculating Labor Efficiency*

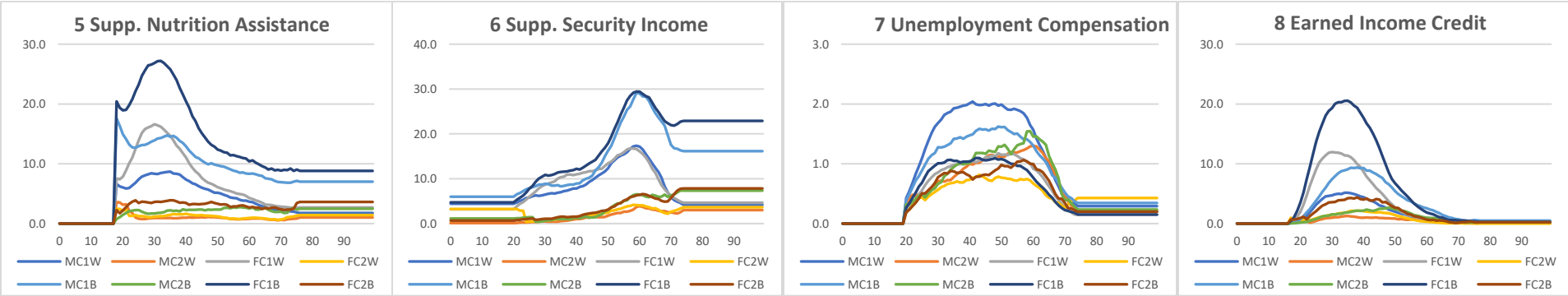
Because mortality, fertility, and immigration rates (and their evolution through many interactive socio-economic processes such as ages and frequencies of marriage, childbearing, and divorce, patterns of assortative mating, and processes of family formation and dissolution etc.) differ significantly across individuals by race and education, the demographic composition of the future population is projected to change according to trends in those variables observed in the past. The PWBM microsimulation builds in those trends to deliver an evolving future demographic profile.

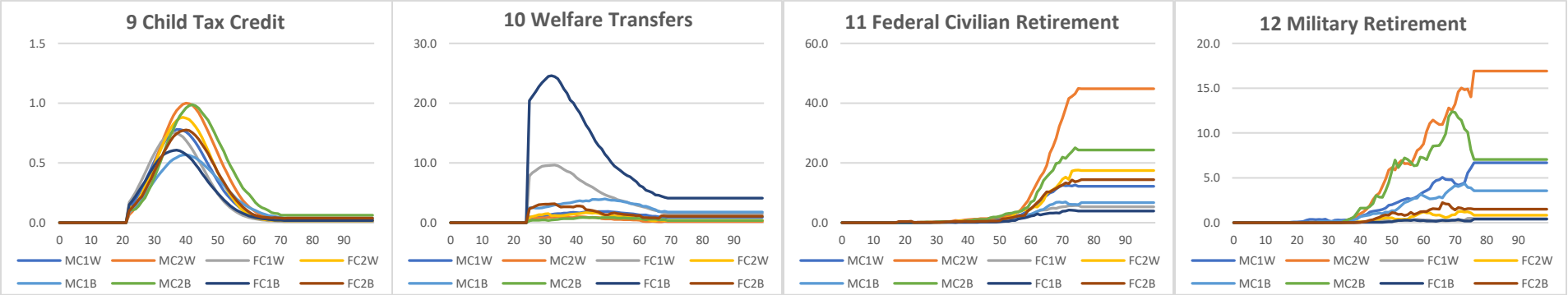
Differential base-period tax and transfer distributions by race and education in addition to age and gender, interact with differential sub-population growth and mortality rates. Table A.1 shows the classification of sub-populations by gender, race, and education (maximum attainment over the lifetime). Fiscal Imbalance and generational account calculations made under a more granular demographic decomposition yield estimates that account for the correlation between benefit receipts, tax payments, and survival rates. It turns out that within each gender, sub-populations that predominantly receive benefits, on net, during their lifetimes (nonwhite and the less educated) are also those with higher mortality rates. And subpopulations that earn more, retire later, and pay taxes, on net, during their lifetimes (white and with more education) experience greater longevity. Distinguishing age profiles of relative taxes and benefits by gender alone would miss this correlation between the size of lifetime net taxes and longevity.

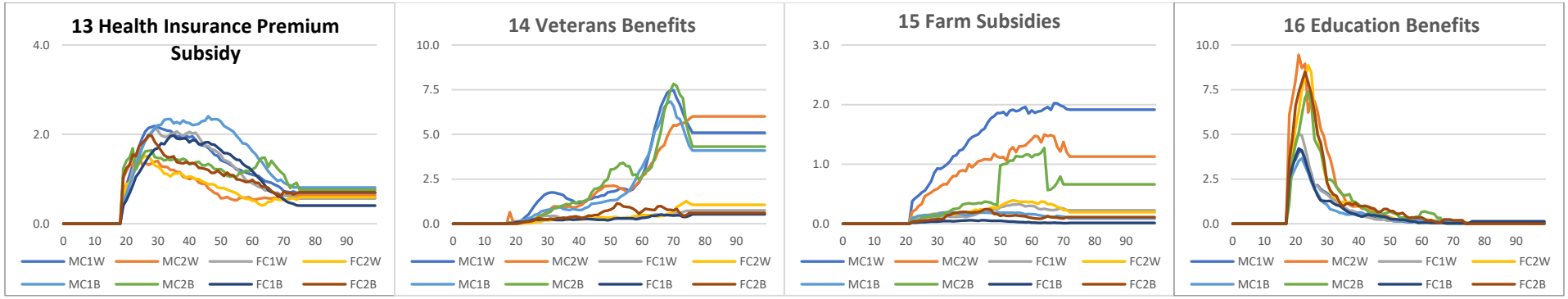
Figure A4.2 shows relative tax and benefit profiles by age estimated from micro-data surveys and used to allocate federal taxes and benefits for 37 tax and benefit programs in the federal budget items.[33] Several age-benefits profile charts in the figure, especially those related to means tested benefits such as Medicaid (3), Supplementary Nutritional Assistance (5), Supplemental Security Income (6), Unemployment Compensation (7) Earned Income Credit (8) and other welfare transfers (10), rental subsidies (25), child nutrition (26), disability insurance (27), pandemic relief (28), indicate higher benefit awards per capita to nonwhites (orange and blue lines) and those with lowest education (dotted lines). On the other hand, the age-profiles for taxes such as labor income taxes (21), Social Security payroll taxes (22), Medicare payroll taxes (23), capital income taxes (32), real-estate taxes (34), corporate income taxes (35), deposit insurance premiums (36), indirect taxes (39), etc. show higher relative values for whites (red and green lines) and those with high-education (unbroken lines). Moreover, the profile for labor force attachment (24) shows lower levels for nonwhite and less educated individuals.

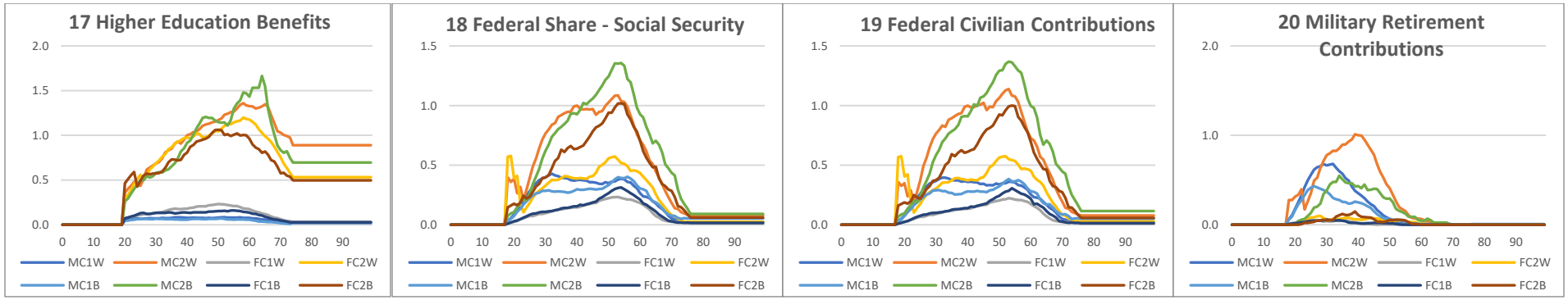
[33] The tax and benefit aggregates and 10 year projections that are allocated by the relative age-profiles are taken from the Congressional Budget Office's Budget and Economic Outlook, February, 2021.

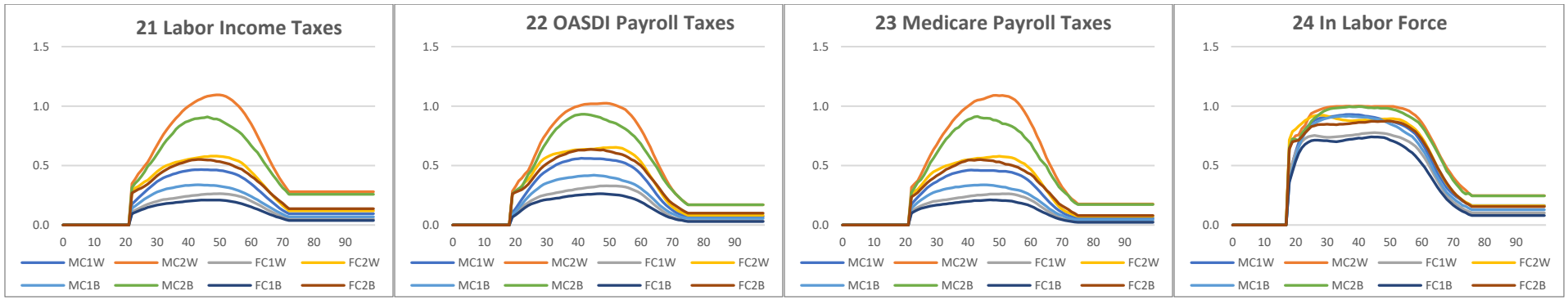

1 Social Security Benefits
2 Medicare Benefits
3 Medicaid Benefits
4 State Children's Health Insurance Benefits
MC1W MC2W FC1W FC2W
MC1B MC2B FC1B FC2B
MCW MCB MNW MNB

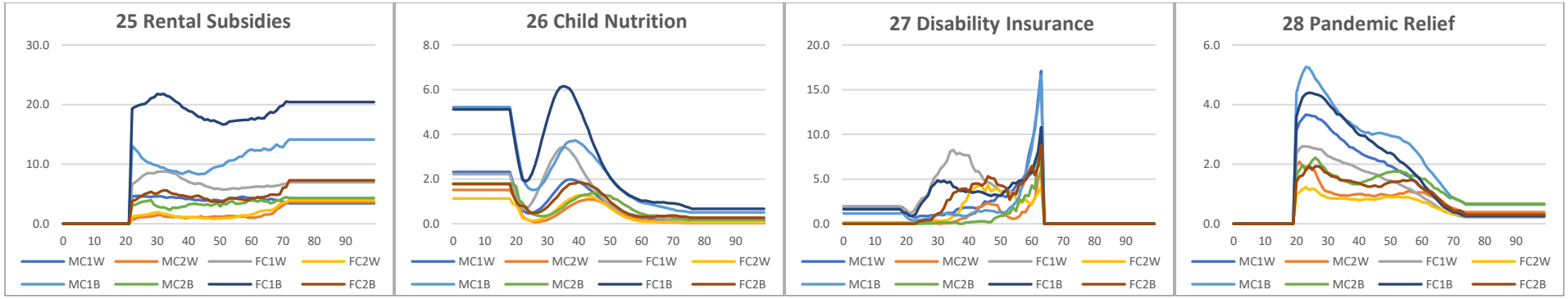

5 Supp. Nutrition Assistance
6 Supp. Security Income
7 Unemployment Compensation
8 Earned Income Credit
MC1W MC2W FC1W FC2W
MC1B MC2B FC1B FC2B

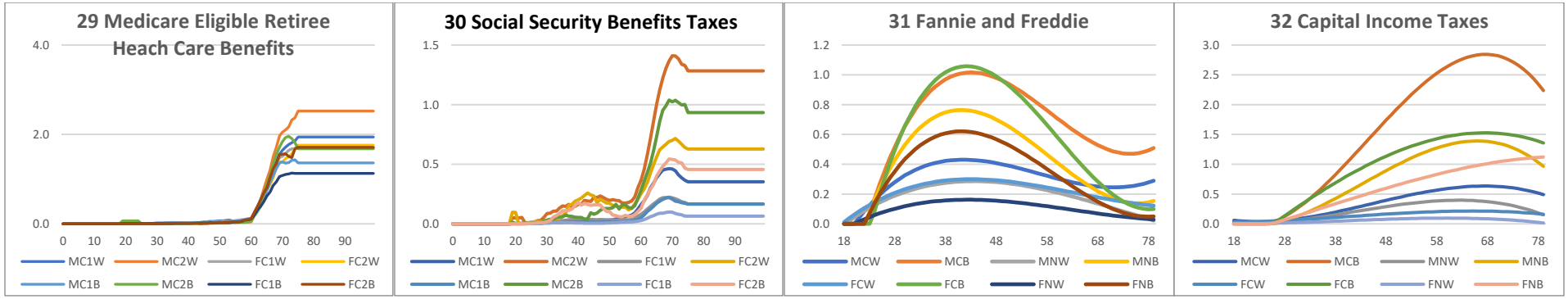

9 Child Tax Credit
10 Welfare Transfers
11 Federal Civilian Retirement
12 Military Retirement
MC1W MC2W FC1W FC2W
MC1B MC2B FC1B FC2B

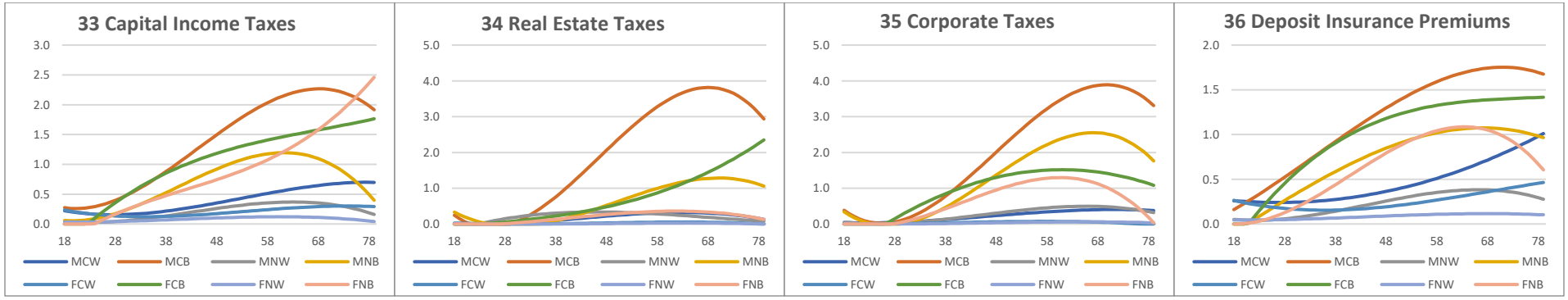

13 Health Insurance Premium Subsidy
14 Veterans Benefits
15 Farm Subsidies
16 Education Benefits
MC1W MC2W FC1W FC2W
MC1B MC2B FC1B FC2B


17 Higher Education Benefits
18 Federal Share - Social Security
19 Federal Civilian Contributions
20 Military Retirement Contributions
MC1W MC2W FC1W FC2W
MC1B MC2B FC1B FC2B


21 Labor Income Taxes
22 OASDI Payroll Taxes
23 Medicare Payroll Taxes
24 In Labor Force
MC1W MC2W FC1W FC2W
MC1B MC2B FC1B FC2B


25 Rental Subsidies
26 Child Nutrition
27 Disability Insurance
28 Pandemic Relief
MC1W MC2W FC1W FC2W
MC1B MC2B FC1B FC2B


29 Medicare Eligible Retiree Heach Care Benefits
30 Social Security Benefits Taxes
31 Fannie and Freddie
32 Capital Income Taxes
MC1W MC2W FC1W FC2W
MC1B MC2B FC1B FC2B
MCW MCB MNW MNB
FCW FCB FNW FNB


33 Capital Income Taxes
34 Real Estate Taxes
35 Corporate Taxes
36 Deposit Insurance Premiums
MCW MCB MNW MNB
FCW FCB FNW FNB

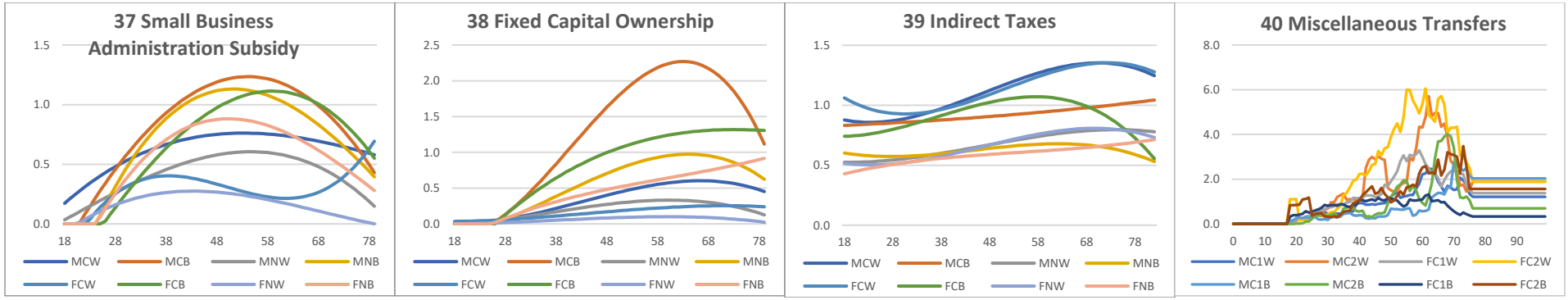


Figure A4.2: Relative tax and transfer profiles by single year of age.

Sources: Annual Social and Economic Supplement to the Current Population Survey – 2020; Survey or Consumer Finances from the Federal Reserve Board of Governors – 2019; Consumer Expenditure Survey from the U.S. Bureau of Labor Statistics – 2019

Legend labels: M=Male, F=Female, C=College Degree, N=No College Degree, W=White, B=Non-White.

A5. Projecting U.S. Gross Domestic Product (GDP)

A. Production Function Framework

PWBM's projection of U.S. GDP utilizes a production function framework that specified how inputs of labor and capital are convert to output each year. The production function for each year t, is given by equation (A5.1)

(A5.1) $Y_t = P_t A_t K_t^{\alpha} {L_t}^{1-\alpha}$

Y_t = Nominal national output

P_t = Price level

A_t = Multifactor productivity

K_t = Capital services input

L_t = Efficiency adjusted labor services input

α = Output elasticity of capital

Decompose $L_t = h_t \times H_t$

H_t = total hours (FTEH) and h_t is average worker efficiency per FTEH to get

(A5.2) $Y_t = P_t A_t K_t^{\alpha} (h_t H_t)^{1-\alpha}$

Total labor productivity, η_t, which is output per hour, is given by

(A5.3) $\eta_t = \frac{Y_t}{H_t} = A_t K_t^{\alpha} {h_t}^{1-\alpha} {H_t}^{-\alpha} = A_t k_t^{\alpha} {h_t}^{1-\alpha}$, where $k_t = K_t / H_t$.

Expressed in terms of growth rates:

(A5.4) $\frac{d\eta_t}{\eta_t} = g^{\eta} = \frac{dA_t}{A_t} + \alpha \frac{dk_t}{k_t} + (1-\alpha)\frac{dh_t}{h_t} = g^{A} + \alpha g^{k} + (1-\alpha) g^{h}$,

Equation (A5.4) shows the components of labor productivity growth. Of these, multifactor productivity growth dA_t/A_t , is measured as the excess growth in GDP from technological improvements after accounting for growth of labor and capital inputs. This growth component is assumed

to continue at its historical rate of 0.63 percent per year.[34] The output elasticity of capital is also estimated from BLS productivity data and set at 0.367.

B. Production Factor Inputs:

Labor productivity growth from higher capital intensity, k_t, is measured by the growth of the productive capital stock relative to labor hours. Productive capital equals non-residential fixed assets (equipment, structures, and intellectual property products) plus non-owner-occupied and other residential structures owned by households, corporates, sole-proprietorships and partnerships, and non-profit institutions. The total for 2020 is $40.6 trillion.

Capital Stock projections are made by distributing the initial year's (2021) capital stock ($40.6 trillion) among holders of claims on the nation's capital. The distributions of holdings by the 12 person-types are calculated by using the Federal Reserve's 2019 Survey of Consumer Finances. This survey identifies the distribution of asset holdings. Liquid assets, which represent transactions balances (cash and money market accounts and other liquid assets) are excluded and remaining assets are distributed across the 12 person types noted earlier. Figure A5.1 shows these distributions.

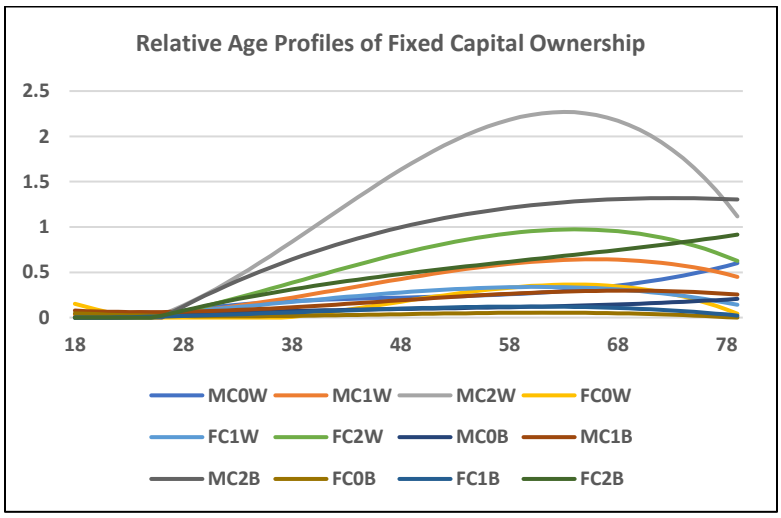


Figure A5.1: Relative Age Profiles of Fixed Capital Ownership by Person Type.
Source: The Survey of Consumer Finances.

[34] Calculated from Bureau of Labor Statistics' report on multifactor productivity growth index 1987-2020. The BLS series used is Multifactor Productivity for Private Business Sector (NAICS 11-81), Index 2012 = 100.000

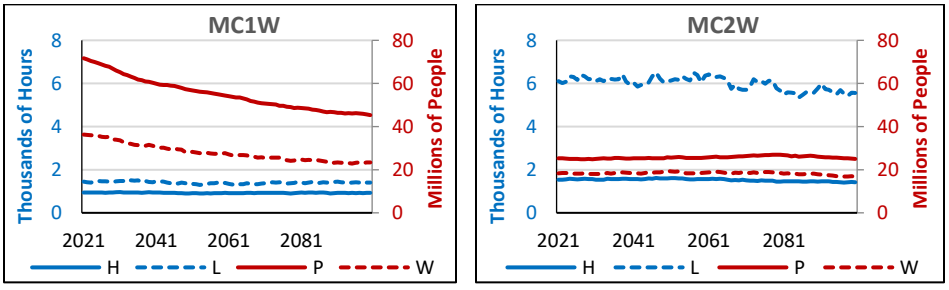
Projection of the productive capital stock for future years assumes that relative holding patterns of claims on that stock will remain constant and changes in population's size and in the relative proportions of person-types in the population will drive the evolution of the stock. Projecting aggregate productive capital in this manner yields an average annual growth rate of 1.3 percent per year through the year 2100. In the very long term, that growth rate averages to just over 1 percent per year.

Efficient labor, L, growth is calculated by first finding relative average hourly wages in the base year (2021) by person-type from the PWBM Microsim's annual wage and work hours variables. These relative average hourly wages are considered to be the efficiency rates of the different person types. Table A5.1 provides the relative ratios, normalized to the average hourly wage of a non-white female with less than high-school education (FC1N).

Person Type	MC1W	MC2W	FC1W	FC2W	MC1N	MC2N	FC1N	FC2N
Average Wage: $ Per Hour	26.41	67.90	19.83	42.35	21.00	51.47	17.05	35.70
Relative Labor Efficiency Index FC1N=1	1.549	3.982	1.163	2.483	1.232	3.018	1.000	2.093

Table A5.1: Index of Relative Work-Efficiency per Hour by Person type in 2021: FC1N=1.0.
Person type Legend: Gender: M=Male F=Female; Education: C1=Less than College, C2=College or More; Race: W=White, N=Nonwhite.

Growth in total hours through the year 2100 is projected by the Microsim to be almost zero – a consequence of growth in the relative proportion of worker-types with low attachment to the labor force, population aging and a shift in the age distribution of workers toward older (pre-retirement) ages, and a general trend toward reduced hours by all groups of workers. The countervailing factor is an increase in the share of better educated workers in the overall work force. Figure A5.2 show projected changes in the U.S. total and worker populations (right axis) by person-type and changes in their total hours and efficiency-adjusted hours worked (left axis).



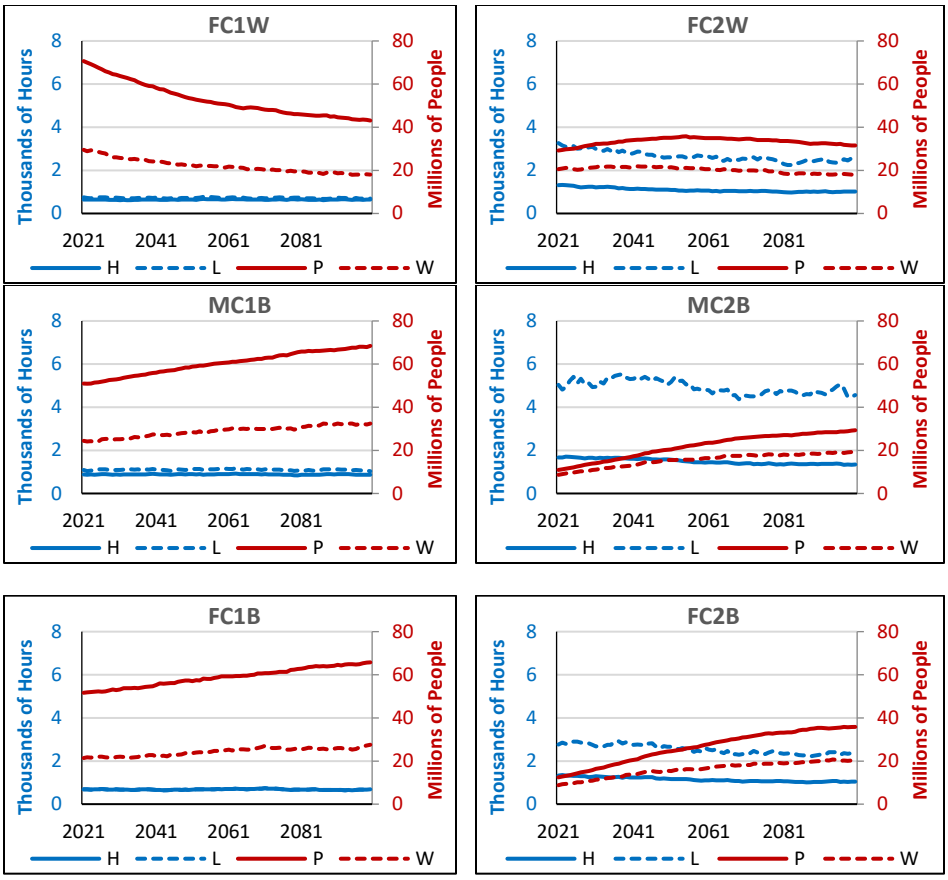


Figure A5.2: Projected total population (P), worker population (W), average hours per worker (H), and average efficiency-adjusted hours per worker (L) by person type through 2095.
Source: Author's calculations from the PWBM Microsim.
Title legend: Person types: Gender: M=Male F=Female; Education: C1=Less than College, C2=College or More; Race: W=White, N=Nonwhite.

As is evident from Figure A5.2, total and worker populations (red lines) of whites of both genders with less than college education levels is projected to decline and the populations of whites with college or more education are projected to remain stable. The latter have greater labor force attachment as seen in the hours/worker and efficiency-hours per worker profiles (blue lines). Projected shifts in total and worker populations result from lower projected fertility and immigration and also higher education attainment over time for whites. In contrast, populations of both college and less than college educated nonwhites are projected to increase over time from

higher fertility and immigration rates. Among non-whites, each gender-education group has lower hours and efficiency-adjusted hours relative to their white counterparts.[35]

A6 Projecting production function parameters and U.S. GDP from PWBM's Microsimulation.

The PWBM Microsim's output includes the "class of worker" variable, which distinguishes between private sector, federal, and state and local workers. Since the Microsim reports nominal wages for all workers and not total compensation, the latter is estimated by estimating the benefits component of employee compensation from historical data. A power regression of the ratio of total benefits to total wages using U.S. national income and product accounts data (U.S. Bureau of Economic Analysis, Table 2.1) is implemented to extrapolate the benefits/wages ratio for future years.[36] The benefits/wages ratio stood at 21.8 percent in 2021. Extrapolating the share using estimated power regression coefficients has the ratio increasing to 23.2 percent by 2050 and to 24.5 percent by 2095. These projected benefits/wages ratios are applied to microsim private and government sector total wages to obtain projected future private and government sector total compensation series.

The private sector contribution to GDP is calculated via equation (3). Government sector's GDP contribution is assumed to equal the sum of government employee compensation plus government capital depreciation. The latter is projected in two steps: First, government capital depreciation is estimated using a time-trend power regression on the depreciation rate

[35] The microsimulation's hours projections are predicated on many variables beyond race, gender and education = such as legal status, years of residence in the United States, labor force status (full- and part year and full- and part-time), marital status, disability status, number of children, and so on. The projections shown in Figure A.3 arise from hours regressions conditioned on these additional factors as well.

[36] The power regression $S = at^b$, where S is the benefits-to-wages ratio and t is the time trend variable, implemented on BEA data spanning the years 1982-2021 yields coefficient estimates $\hat{a} = 0.1926$ and $\hat{b} = 0.0558$.

using historical data on the ratio of government capital depreciation to government capital stock.[37] Next a power regression is estimated on the historical ratio of the government capital stock to total government employee compensation.[38] Both ratios are historically quite stable and the power regressions point to stable long-term values for both. The depreciation rate is estimated to decrease very slightly from 3.9 percent in 2020 to 3.8 percent by 2050 and to 3.7 percent by 2095. The ratio of the government capital stock to government employee compensation is projected to increase slightly from 1.28 percent in 2020 to 1.29 percent by 2050 and to remain at that value thereafter.

The product of projected government compensation and the capital-compensation ratio yields the projected stock of government capital. And the product of the capital depreciation rate with the government capital stock yields projected government depreciation. Finally, total U.S. GDP is projected as the sum of private sector and government contributions to GDP.

Figure A6.1 depicts projected U.S. nominal GDP through the year 2095. To calculate FI in perpetuity, The PWBM simulation was implemented through the year 2500 – long enough to allow present discounted values of out-year deficits to not influence the present valued FI measure. The simulation through year 2500 also enables the calculation of GDP in perpetuity.[39]

[37] Historical data on government capital depreciation and the government capital stock are taken from the U.S. Bureau of Economic Analysis. The power regression implemented is $D^g = at^b$, where the government-capital-depreciation rate is D^g and t is the time trend variable. The estimated coefficients are $\hat{a} = 0.0511$ and $\hat{b} = -0.0654$.

[38] The power regression in this case is $KW = at^b$, where the ratio of government capital to government employee compensation is KW and t is the time trend variable. The estimated coefficients are $\hat{a} = 1.2741$ and $\hat{b} = 0.003$.

[39] The sensitivity of FI and the ratio of FI to PVGDP is discussed in the Appendix, section A11.

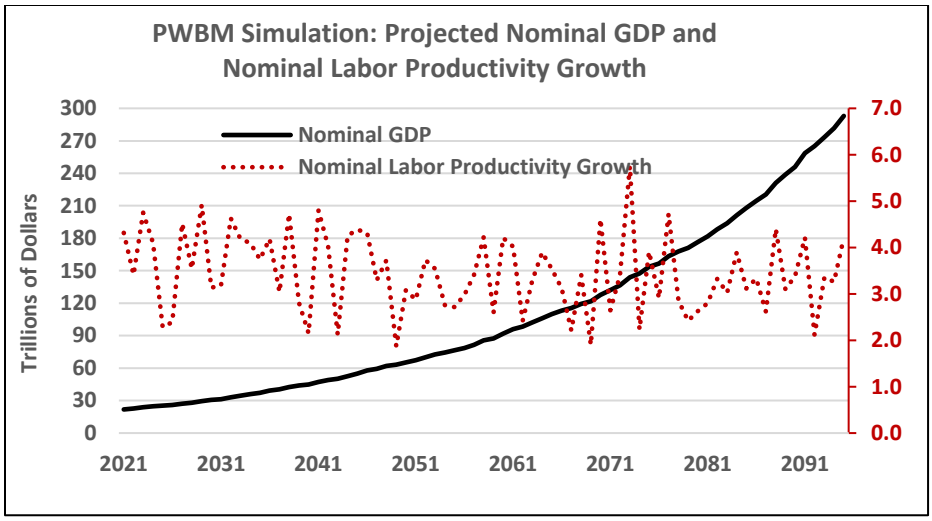


Figure A6.1: Projected nominal GDP and nominal labor productivity growth.
Source: Author's Calculations from the PWBM microsimulation.

Finally, nominal projected GDP values are discounted using the interest discount factor of 4.4 percent per year. Table A6.1 below reports PVGDP, estimated as described above (in trillions of constant 2021 dollars) over two alternative time horizons: 2020-95 and 2020-2500.

Present discounted value of projected U.S. GDP in trillions of constant 2021 dollars		
Microsim (15K households in 2015 Scaled to the U.S. household population in 2015)	Through 2095	Through the infinite horizon
	1,300.3	2,410.0

Table A6.1: *Present Value of Projected GDP under Current Fiscal Laws.*

A7. Adjusting Generational Accounts for the Incidence of Taxes on Owners of Capital

Tax policy changes introduced by the Tax Cuts and Jobs Act of 2017 imply changes to the incidence of capital income taxes across generations. That law reduced the corporate tax rate from 35 percent to 21 percent and introduced investment incentives by way of expensing of equipment and software, amortization of research expenditures, expansion of bonus depreciation, and other provisions that alter the timing of capital income accruals relative to tax payments. In addition, future taxes may be capitalized into asset values and changes in tax rates and expensing provisions for new investments may shift tax burdens away from (or toward) future capital owners – who pay the taxes – and toward (or away from) current holders of capital who bear capital losses (or enjoy capital gains). For example, prior scheduled depreciation deductions no longer apply under TCJA's accelerated depreciation schedule as implied by full expensing provisions: Under pre-TCJA law many capital investments that would have been depreciated gradually over the following decade are taken at once, producing lower effective tax rates immediately. On the other hand, expensing provisions for new investments would induce tax arbitrage to reduce the value of older capital assets, imposing losses on current capital owners. Auerbach, Gokhale, and Kotlikoff (1991) describe the adjustments needed to GAs in order to correctly allocate capital taxes to generations that bear them rather than those who pay them. The adjustments needed depend upon the particular configurations of capital taxation provisions, applicable parameters on investment growth, depreciation rates, after-tax interest rates and other factors. The adjustments require estimates of two rates, Q and Δ, the former indicating the amount of additional tax burdens on current owners of capital from capital asset revaluations,

and the latter showing the percentage reduction in projected capital income taxes paid by future capital owners.[40] The formulae for the two adjustment factors are:

(A1) $Q = \tau z \left(1 - \frac{n+\delta}{n+\tau+\varphi}\right)$

(A2) $\Delta = (r+\delta)\tau z \left[1 - \frac{(r+\pi+\varphi)(n+\delta)}{(n+\pi+\varphi)(r+\delta)}\right]$.

Table below provides the legend and rates of the parameters used to calculate Q and Δ:

Parameter	Description	Value
r	Post-tax rate of return	2.3%
δ	Economic depreciation rate	8.0%
π	Inflation rate	2.0%
τ	Investor marginal tax rate	21.0%
n	Growth rate of investment	1.1
z	Present value of depreciation allowances $\delta/(r+\delta)$	0.65
φ	Geometric rate of investment write-off $(r+\pi)z/(1-z)$	0.12

These parameters generate a value of Q=0.08 and $\Delta = .001$. Hence, GAs reported in the text are calculated by distributing a capital loss of 8 percent on current owners of capital (those alive in 2021) and a reduction in future flows of capital income taxes by 0.001 percent. [41]

[40] See the Appendix in Auerbach, Gokhale, and Kotlikoff (1991) for the derivation of the formulae for Q and Δ.
[41] The private capital stock reported by the Bureau of Economic Analysis equals $31.8 trillion making the capital loss for currently alive generations equal to $2.717 trillion. The reduction in capital tax flows for future generations equals $32.6 billion per year inflated according to the assumed rate of GDP inflation of 2.05 percent per year.

A8. Receipts and Expenditures Distributed Across Population Cohorts by Birth Year, Gender, Race, and Lifetime Education

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Individual Labor Income Taxes	1051	1259	1283	1314	1366	1513	1644	1691	1748	1806
Individual Capital Income Taxes (adjusted)	556	667	679	695	723	801	871	895	925	956
One time Capital Levy	2717	0	0	0	0	0	0	0	0	0
OASDI Payroll Taxes (see NIPA sheet)	931	920	999	1034	1064	1100	1129	1163	1199	1238
Medicare Part A (see NIPA sheet)	334	373	389	407	426	449	472	492	512	532
Total Income taxes on SS benefits	59	75	82	89	97	118	132	143	155	167
Other SocIns Taxes (UI; see NIPA sheet)	60	59	64	66	68	71	72	75	77	79
Corporate Income Taxes (CBO 02/2021)	164	252	304	328	355	365	361	369	377	385
Excise taxes	79	86	86	90	90	90	91	91	92	93
Estate and gift taxes	22	24	24	25	26	28	40	43	45	47
Federal Reserve	103	118	127	134	119	102	97	88	78	73
Customs duties	82	89	90	92	95	97	99	100	101	102

Table A8.1: *Federal Receipts (CBO February 2021 Budget and Economic Outlook)*

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Old Age and Survivors Insurance	991	1,047	1,108	1,175	1,245	1,319	1,396	1,484	1,573	1,664
Disability Insurance	145	152	161	170	177	185	192	195	201	207
Hospital Insurance (Medicare A)	337	382	405	412	456	483	514	574	552	610
Supplementary Medical Insurance (Medicare B)	397	450	492	512	580	628	679	770	756	847
Prescription Drugs (Medicare D)	97	110	120	124	136	145	155	173	167	185
Medicaid	507	514	492	504	533	563	597	632	667	705
Health Insurance Premium tax credits	56	55	53	53	53	53	55	59	64	68
Medicare-eligible Retiree HC Fund (MERHCF)	11	12	12	13	14	14	15	16	17	17
Children's' Health Insurance (CHIP)	15	15	15	16	16	17	17	18	18	19
Supplemental Nutrition Assistance Program	132	99	78	76	75	75	74	74	73	72
Supplemental Security Income	57	64	61	59	66	68	70	78	68	77
Unemployment Compensation	242	40	37	36	34	33	34	36	38	41
Earned Income, Child, and Other Tax Credits	268	90	92	93	93	92	78	78	79	79
Family Support and Foster Care	34	34	33	34	34	34	35	35	35	35
Child Nutrition	23	27	28	29	30	31	33	34	35	37
Civilian Retirement	110	114	117	120	124	127	131	135	138	142
Military Retirement	63	71	68	64	72	74	76	84	75	84
Other Retirement	2	2	3	2	-2	8	5	5	4	4
Veterans Income Security	119	134	129	122	137	142	147	164	144	162
Veterans Other Benefits	17	18	17	17	18	18	19	20	19	21
Agriculture	40	15	17	17	17	17	17	17	17	17
Fannie Mae and Freddie Mac	0	6	6	6	7	7	8	8	8	8
Higher Education	7	4	3	4	5	5	6	7	7	8
Deposit Insurance	-3	-1	-4	-4	-4	-5	-6	-7	-8	-8
Small Business Administration	303	5	0	0	0	0	0	0	0	0
Coronavirus Relief Fund	0	0	0	0	0	0	0	0	0	0
Emergency Rental assistance	24	1	0	0	0	0	0	0	0	0
Medicare SMI Premiums (offsetting receipts)	-142	-160	-173	-186	-204	-219	-238	-257	-269	-289
Other Spending	89	76	77	75	72	71	72	75	75	73
Federal Share Social Security	-20	-21	-22	-23	-24	-25	-26	-27	-28	-29
Federal Share Civil Service Retirement and Other	-46	-48	-49	-50	-52	-53	-55	-57	-59	-61
Federal Share Military Retirement	-25	-26	-26	-27	-27	-28	-28	-29	-29	-30
Receipts Related to Natural Resources	-10	-10	-10	-11	-11	-11	-11	-12	-12	-13
Receipts Related to MERHCF	-9	-10	-10	-11	-11	-12	-12	-13	-13	-14
Receipts Related to Fannie Mae and Freddie Mac	-5	0	0	0	0	0	0	0	0	0
Receipts Related to Other	-35	-109	-38	-30	-40	-31	-30	-28	-28	-28
Discretionary Expenditures (Public Goods)	1,668	1,610	1,593	1,590	1,620	1,654	1,694	1,734	1,778	1,822

Table A8.2: *Federal Expenditures (CBO February 2021 Budget and Economic Outlook).*

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Individual Income Tax	0	0	0	0	0	-139	-161	-158	-161	-163
Payroll Tax	0	0	0	0	0	0	1	1	1	1
Corporate Income Tax	0	-34	-53	-59	-62	-70	-77	-70	-59	-55
Estate And Gift Taxes	0	0	0	0	0	-1	-9	-12	-13	-13
Income Security Offsets (-)	0	0	0	0	0	10	13	13	14	14
Total revenue loss	1	34	53	59	62	219	260	252	245	244

Table A8.3: *Budgetary effects of extending provisions that expire under the Tax Cuts and Jobs Act (2017); In billions of dollars.*
Source: PWBM staff estimates.

Table A8.3 shows PWBM staff estimates of budget effects during the 2020s of permanently extending expiring TCJA provisions. TCJA's full investment expensing provision is also extended and its effects are included in Table A8.3.

A9.1 Detailed Decomposition of Generational Accounts Reported in Table 4.

Year of Birth	Age in 2021	Generational Account	Present Values of Remaining Lifetime Taxes						Present Values of Remaining Lifetime Transfers					
			Income	Payroll	Indirect	Estate	Other Taxes	All Taxes	Social Security	Medicare*	Medicaid	Welfare	Other	All Transfers
2061	-40	553,958	566,418	302,343	10,548	13,549	47,493	940,351	157,026	131,007	26,202	19,410	52,748	386,393
2051	-30	696,546	675,316	362,657	12,411	15,865	56,121	1,122,370	172,201	141,981	30,030	22,965	58,646	425,824
2041	-20	721,564	820,407	426,048	15,020	20,310	68,109	1,349,893	258,236	218,246	36,068	26,904	88,875	628,329
2031	-10	787,592	902,160	466,819	16,558	22,452	75,042	1,483,032	290,905	235,450	38,932	29,587	100,566	695,440
2021	0	926,766	961,863	506,338	17,850	22,988	81,896	1,590,935	275,842	220,646	38,057	32,179	97,444	664,169
2011	10	1,127,559	1,112,934	585,388	20,082	26,934	90,021	1,835,360	288,006	246,955	34,246	35,668	102,927	707,802
2001	20	1,244,020	1,218,116	640,864	22,060	29,417	97,935	2,008,393	311,914	269,982	30,117	37,990	114,371	764,373
1991	30	1,111,613	1,113,063	558,781	17,891	27,522	86,721	1,803,977	283,106	245,406	22,724	31,270	109,858	692,365
1981	40	894,904	1,158,729	498,347	17,483	32,447	89,509	1,796,514	373,920	319,697	23,302	28,030	156,660	901,610
1971	50	428,203	921,871	337,415	14,060	27,569	73,481	1,374,396	406,361	326,150	20,939	20,452	172,292	946,194
1961	60	-61,473	766,131	227,199	12,585	24,994	67,347	1,098,256	541,613	370,032	18,206	16,545	213,333	1,159,730
1951	70	-257,178	433,855	96,125	7,597	13,090	40,128	590,795	418,731	250,673	11,260	8,324	158,986	847,974
1941	80	-188,691	270,836	54,023	4,965	7,096	26,808	363,728	276,037	150,445	8,447	5,421	112,069	552,419

Table A9.1: The Composition of Generational Accounts for White College-Educated Males by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.
* Net of Supplementary Medical Insurance premiums.

Year of Birth	Age in 2021	Generational Account	Present Values of Remaining Lifetime Taxes						Present Values of Remaining Lifetime Transfers					
			Income	Payroll	Indirect	Estate	Other Taxes	All Taxes	Social Security	Medicare*	Medicaid	Welfare	Other	All Transfers
2061	-40	123,040	374,084	217,500	12,858	5,544	42,572	652,559	201,850	222,308	55,944	20,398	29,020	529,519
2051	-30	142,235	433,689	251,160	14,832	6,441	49,149	755,270	234,545	258,279	62,936	23,407	33,867	613,035
2041	-20	195,202	468,461	274,644	15,966	6,775	53,126	818,972	237,716	259,630	66,385	25,568	34,470	623,770
2031	-10	255,910	477,814	288,355	16,425	6,572	54,578	843,744	224,011	238,201	66,314	27,127	32,181	587,834
2021	0	289,357	565,761	333,631	19,433	7,958	65,121	991,904	273,300	284,684	72,396	31,114	41,053	702,547
2011	10	286,015	628,065	368,987	21,438	9,051	69,782	1,097,323	316,680	351,633	63,863	32,737	46,394	811,307
2001	20	377,594	680,473	405,068	23,219	9,352	74,554	1,192,665	320,881	357,686	53,945	34,010	48,550	815,072
1991	30	253,534	733,176	392,878	22,124	11,082	76,927	1,236,187	393,234	442,872	51,561	31,626	63,360	982,653
1981	40	103,922	636,498	300,025	18,355	10,720	67,600	1,033,197	377,756	415,977	45,625	24,563	65,355	929,276
1971	50	-177,068	583,270	228,358	17,289	11,586	64,488	904,991	458,279	481,986	44,601	18,400	78,793	1,082,059
1961	60	-454,880	420,494	131,888	13,851	9,434	49,844	625,510	489,524	458,622	42,056	12,000	78,188	1,080,390
1951	70	-499,277	257,647	59,339	9,721	6,029	31,777	364,512	418,599	342,597	31,079	7,504	64,011	863,789
1941	80	-313,136	142,474	31,367	6,035	3,165	16,876	199,918	254,161	191,762	22,318	5,348	39,464	513,054

Table A9.2: The Composition of Generational Accounts for White College-Educated Females by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.
* Net of Supplementary Medical Insurance premiums.

Year of Birth	Age in 2021	Generational Account	Present Values of Remaining Lifetime Taxes						Present Values of Remaining Lifetime Transfers					
			Income	Payroll	Indirect	Estate	Other Taxes	All Taxes	Social Security	Medicare*	Medicaid	Welfare	Other	All Transfers
2061	-40	-115,093	190,171	151,793	6,426	1,188	24,897	374,474	163,820	155,618	89,904	41,601	38,624	489,567
2051	-30	-95,171	217,604	174,905	7,247	1,338	28,031	429,126	171,255	162,493	101,774	47,638	41,137	524,297
2041	-20	-60,287	222,679	179,734	7,314	1,364	28,324	439,415	159,089	149,146	103,484	48,786	39,197	499,703
2031	-10	-68,330	232,154	188,933	7,752	1,367	30,039	460,246	169,249	159,234	107,848	52,078	40,167	528,577
2021	0	-47,857	266,444	218,006	8,877	1,567	34,273	529,168	184,614	172,239	115,434	59,945	44,793	577,025
2011	10	8,021	295,273	241,237	9,709	1,753	36,154	584,126	185,723	176,887	101,789	63,401	48,305	576,105
2001	20	-57,933	369,313	294,896	12,247	2,356	44,632	723,445	271,306	266,551	96,658	74,527	72,336	781,378
1991	30	17,107	316,233	249,122	9,377	2,071	35,758	612,561	204,411	197,318	68,627	65,367	59,731	595,454
1981	40	-312,663	301,629	211,211	9,504	2,471	37,314	562,129	344,052	324,129	59,377	54,614	92,620	874,792
1971	50	-402,570	240,368	151,542	8,050	2,206	32,248	434,414	356,605	300,434	43,830	39,382	96,734	836,984
1961	60	-423,416	136,736	71,375	5,268	1,288	22,344	237,011	316,357	218,942	22,009	21,521	81,598	660,427
1951	70	-528,312	87,838	29,656	4,242	718	18,227	140,682	344,704	225,497	10,169	11,446	77,177	668,994
1941	80	-312,778	51,305	14,871	2,632	269	11,633	80,710	208,729	128,727	3,358	6,950	45,724	393,488

Table A9.3: The Composition of Generational Accounts for White Non-College-Educated Males by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.
* Net of Supplementary Medical Insurance premiums.

Year of Birth	Age in 2021	Generational Account	Present Values of Remaining Lifetime Taxes						Present Values of Remaining Lifetime Transfers					
			Income	Payroll	Indirect	Estate	Other Taxes	All Taxes	Social Security	Medicare*	Medicaid	Welfare	Other	All Transfers
2061	-40	-306,322	123,578	93,002	6,875	1,881	22,543	247,879	178,331	191,227	117,974	51,023	15,646	554,201
2051	-30	-309,613	129,875	97,372	7,174	1,971	23,558	259,951	181,971	194,309	124,067	53,036	16,181	569,564
2041	-20	-315,316	146,208	109,957	7,933	2,235	26,185	292,518	191,537	200,348	138,847	59,809	17,293	607,834
2031	-10	-376,674	157,068	118,601	8,762	2,389	28,740	315,561	224,044	237,402	145,516	65,635	19,638	692,235
2021	0	-431,198	172,353	128,684	9,819	2,603	32,528	345,987	263,169	273,515	146,555	70,693	23,254	777,185
2011	10	-345,547	204,856	154,749	11,009	3,139	34,811	408,564	246,263	261,143	141,288	81,952	23,465	754,111
2001	20	-444,567	238,670	178,947	13,140	3,647	39,895	474,298	315,462	351,960	127,762	93,681	30,000	918,866
1991	30	-480,063	232,724	163,385	11,858	3,550	37,991	449,508	331,538	375,330	103,488	86,580	32,635	929,571
1981	40	-368,391	202,604	131,235	9,954	2,840	33,040	379,673	274,137	311,693	75,870	56,582	29,781	748,064
1971	50	-433,947	150,674	86,080	8,073	1,796	27,800	274,423	285,867	310,977	49,579	31,339	30,609	708,371
1961	60	-612,142	103,580	47,795	6,983	1,065	24,126	183,548	363,832	348,975	30,996	18,470	33,416	795,689
1951	70	-472,427	49,398	15,194	4,324	414	14,827	84,156	275,857	236,434	12,884	7,819	23,588	556,583
1941	80	-307,053	23,103	7,936	2,740	179	8,673	42,630	179,136	145,473	5,455	4,928	14,692	349,684

Table A9.4: The Composition of Generational Accounts for White Non-College-Educated Females by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.
* Net of Supplementary Medical Insurance premiums.

Year of Birth	Age in 2021	Generational Account	Present Values of Remaining Lifetime Taxes						Present Values of Remaining Lifetime Transfers					
			Income	Payroll	Indirect	Estate	Other Taxes	All Taxes	Social Security	Medicare*	Medicaid	Welfare	Other	All Transfers
2061	-40	341,885	474,944	291,974	10,208	6,576	44,912	828,614	179,823	183,471	41,765	26,567	55,102	486,729
2051	-30	385,430	533,038	328,257	11,464	7,414	50,386	930,559	201,361	205,887	47,189	29,801	60,890	545,129
2041	-20	402,703	609,333	372,421	13,127	8,885	57,800	1,061,567	245,867	251,071	55,116	33,822	72,988	658,864
2031	-10	494,565	664,118	408,744	14,200	9,091	62,501	1,158,653	245,064	250,178	56,851	37,011	74,984	664,088
2021	0	447,887	798,482	479,216	17,401	12,517	77,743	1,385,359	358,965	353,704	73,925	43,870	107,008	937,472
2011	10	639,524	844,788	517,236	17,900	11,660	77,711	1,469,295	306,821	315,600	64,859	45,297	97,194	829,771
2001	20	704,605	909,930	557,853	19,412	12,619	82,438	1,582,253	324,751	335,361	64,441	47,436	105,658	877,648
1991	30	720,079	954,603	553,939	17,517	13,416	84,200	1,623,675	337,014	338,986	63,621	46,375	117,600	903,596
1981	40	374,077	890,178	468,027	15,912	15,424	80,713	1,470,254	422,685	414,383	66,807	42,532	149,769	1,096,176
1971	50	-54,787	664,633	314,720	12,660	14,834	65,883	1,072,730	459,688	415,332	59,967	32,646	159,885	1,127,518
1961	60	-323,224	463,879	195,455	9,861	13,177	51,648	734,020	468,057	367,183	48,250	23,297	150,457	1,057,244
1951	70	-373,589	263,663	88,060	6,348	8,795	35,181	402,047	372,446	246,988	29,248	11,157	115,796	775,635
1941	80	-273,758	180,630	53,951	4,547	6,917	23,889	269,934	266,890	174,534	24,445	7,579	70,244	543,692

Table A9.5: The Composition of Generational Accounts for Non-White College-Educated Males by Selected Years of Birth.
(Present values in constant 2021 dollars)
Source: Authors' calculations.
* Net of Supplementary Medical Insurance premiums.

Year of Birth	Age in 2021	Generational Account	Present Values of Remaining Lifetime Taxes						Present Values of Remaining Lifetime Transfers					
			Income	Payroll	Indirect	Estate	Other Taxes	All Taxes	Social Security	Medicare*	Medicaid	Welfare	Other	All Transfers
2061	-40	72,198	312,518	206,850	10,378	1,742	41,570	573,057	184,360	209,665	56,891	29,500	20,444	500,860
2051	-30	80,482	339,151	225,791	11,320	1,871	45,226	623,359	199,716	227,182	61,650	32,351	21,978	542,877
2041	-20	95,097	395,025	260,799	13,069	2,212	52,423	723,528	232,846	260,223	72,356	37,045	25,961	628,430
2031	-10	83,550	422,051	279,100	14,025	2,323	56,681	774,180	258,005	286,107	77,825	40,103	28,589	690,630
2021	0	89,258	501,917	327,016	16,612	2,819	69,212	917,576	310,023	345,537	90,143	46,689	35,926	828,318
2011	10	168,274	515,105	344,617	17,159	2,846	66,498	946,225	288,189	328,885	81,221	47,856	31,801	777,951
2001	20	313,991	539,053	369,936	18,150	2,963	66,692	996,795	253,978	281,986	69,702	49,666	27,473	682,804
1991	30	135,516	593,976	368,204	17,816	3,597	73,469	1,057,062	349,203	398,881	83,267	49,359	40,836	921,546
1981	40	-54,361	531,639	294,457	15,322	3,470	68,833	913,722	372,469	426,179	80,946	38,969	49,519	968,083
1971	50	-291,563	448,811	214,508	13,080	3,112	63,323	742,834	414,506	454,568	76,679	28,829	59,815	1,034,397
1961	60	-551,101	330,293	129,946	9,852	2,190	56,443	528,725	464,150	455,963	70,965	20,046	68,701	1,079,826
1951	70	-440,018	171,114	48,208	4,792	850	36,124	261,088	308,635	288,446	48,359	10,217	45,448	701,106
1941	80	-123,898	76,089	13,993	1,450	180	15,863	107,575	108,083	86,413	15,544	4,374	17,058	231,473

Table A9.6: The Composition of Generational Accounts for Non-White College-Educated Females by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.
* Net of Supplementary Medical Insurance premiums.

Year of Birth	Age in 2021	Generational Account	Present Values of Remaining Lifetime Taxes						Present Values of Remaining Lifetime Transfers					
			Income	Payroll	Indirect	Estate	Other Taxes	All Taxes	Social Security	Medicare*	Medicaid	Welfare	Other	All Transfers
2061	-40	-257,371	125,807	115,905	6,419	187	21,446	269,763	125,240	173,878	138,828	59,070	30,118	527,135
2051	-30	-255,939	128,889	118,997	6,591	192	22,006	276,676	124,999	173,306	143,347	60,799	30,164	532,614
2041	-20	-249,730	148,891	137,953	7,479	214	24,914	319,450	128,420	178,506	160,907	70,098	31,250	569,180
2031	-10	-337,624	176,504	162,330	8,937	270	29,743	377,783	171,147	235,680	184,367	82,050	42,163	715,408
2021	0	-398,648	187,610	171,981	9,753	277	33,376	402,997	206,616	271,708	185,424	88,143	49,754	801,645
2011	10	-348,618	216,803	199,647	10,966	324	35,069	462,809	204,041	281,162	178,769	96,134	51,322	811,427
2001	20	-315,764	237,719	219,226	12,027	339	37,270	506,580	211,291	291,932	161,672	102,027	55,421	822,344
1991	30	-470,458	236,469	210,964	11,072	376	35,809	494,688	267,832	366,487	156,372	101,461	72,996	965,147
1981	40	-338,836	172,296	149,982	8,068	334	26,128	356,809	195,671	254,841	112,991	73,553	58,588	695,645
1971	50	-563,276	129,963	106,528	7,196	325	24,278	268,290	274,174	323,229	102,639	55,687	75,838	831,567
1961	60	-430,450	63,655	47,824	4,329	184	15,085	131,077	215,983	200,703	55,631	29,576	59,634	561,527
1951	70	-693,929	43,298	24,268	4,140	74	17,442	89,222	330,850	310,447	47,064	21,177	73,612	783,150
1941	80	-162,917	12,856	5,189	1,153	0	5,576	24,775	82,712	66,760	10,669	6,840	20,711	187,692

Table A9.7: The Composition of Generational Accounts for Non-White Non-College-Educated Males by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.
* Net of Supplementary Medical Insurance premiums.

Year of Birth	Age in 2021	Generational Account	Present Values of Remaining Lifetime Taxes						Present Values of Remaining Lifetime Transfers					
			Income	Payroll	Indirect	Estate	Other Taxes	All Taxes	Social Security	Medicare*	Medicaid	Welfare	Other	All Transfers
2061	-40	-443,991	71,637	70,079	5,988	77	17,770	165,550	132,648	193,447	191,242	83,024	9,181	609,542
2051	-30	-465,550	84,187	82,573	6,812	87	20,292	193,951	138,130	197,614	217,170	96,849	9,739	659,502
2041	-20	-564,616	90,007	88,163	7,593	93	22,484	208,340	170,132	247,676	238,534	104,919	11,695	772,957
2031	-10	-537,297	103,020	100,920	8,238	110	24,609	236,897	162,314	229,098	253,869	117,322	11,591	774,194
2021	0	-600,551	110,252	107,936	9,175	114	27,188	254,664	191,442	262,938	259,732	127,454	13,648	855,215
2011	10	-657,898	130,288	127,302	10,628	140	30,064	298,422	217,636	318,848	259,308	144,716	15,811	956,320
2001	20	-637,677	134,421	132,195	11,209	133	30,179	308,136	222,793	331,362	224,332	150,609	16,718	945,813
1991	30	-564,994	132,236	125,250	9,930	149	27,691	295,256	203,300	298,907	195,817	145,921	16,305	860,250
1981	40	-561,102	103,741	95,283	8,321	154	23,318	230,817	206,453	310,230	160,756	97,944	16,536	791,920
1971	50	-631,038	74,134	65,231	7,181	154	19,820	166,519	240,423	340,563	138,126	60,514	17,930	797,557
1961	60	-674,387	39,268	31,436	5,705	101	15,346	91,855	270,271	338,820	100,882	36,952	19,317	766,242
1951	70	-328,248	12,134	7,390	2,685	29	6,856	29,094	141,286	152,941	38,604	14,723	9,789	357,342
1941	80	-265,301	6,128	4,379	2,315	0	5,302	18,124	116,276	119,375	28,101	11,780	7,892	283,425

Table A9.8: The Composition of Generational Accounts for Non-White Non-College-Educated Females by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.
* Net of Supplementary Medical Insurance premiums.

A10. Detailed Decomposition of Welfare Transfers (Welfare column reported in Tables A9.1-9.8)

Year of Birth	Age in 2021	Welfare Programs	Present Values of Remaining Lifetime Taxes										
			Medicare-eligible Retiree HC Fund (MERHCF)	Agriculture	Higher education	Family support and foster care	Earned income, child, and other tax credits	Health Insurance Premium tax credits	Supplemental Security Income	Unemployment compensation	Supplemental Nutrition Assistance Program	Child nutrition	Emergency rental assistance
2061	-40	19,410	1,219	2,983	1,530	541	1,460	4,690	1,058	3,236	1,183	1,509	0
2051	-30	22,965	1,470	3,545	1,757	655	1,758	5,525	1,248	3,898	1,382	1,726	0
2041	-20	26,904	1,742	4,343	1,955	755	2,000	6,447	1,578	4,521	1,624	1,938	0
2031	-10	29,587	1,910	4,789	2,158	825	2,184	7,095	1,757	4,955	1,792	2,122	0
2021	0	32,179	2,069	5,105	2,408	912	2,426	7,757	1,819	5,417	1,972	2,290	0
2011	10	35,668	2,377	5,845	2,644	1,040	2,770	8,689	2,045	6,327	2,158	1,774	0
2001	20	37,990	2,611	6,428	2,323	1,141	3,213	9,362	2,216	6,921	2,651	1,123	0
1991	30	31,270	2,376	6,081	752	1,074	3,040	6,556	2,015	6,886	1,548	917	26
1981	40	28,030	2,054	6,331	249	794	2,287	4,848	2,341	6,920	1,410	777	19
1971	50	20,452	1,337	5,181	90	418	1,346	3,197	2,111	5,389	1,062	297	24
1961	60	16,545	928	4,720	45	227	627	2,773	1,966	4,282	872	84	20
1951	70	8,324	474	2,697	14	118	172	1,698	1,066	1,457	543	30	55
1941	80	5,421	307	1,871	5	80	114	1,114	754	592	492	16	74

Table A10.1: The Composition of Generational Accounts Welfare Programs for White College-Educated Males by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.

Year of Birth	Age in 2021	Welfare Programs	Present Values of Remaining Lifetime Taxes										
			Medicare-eligible Retiree HC Fund (MERHCF)	Agriculture	Higher education	Family support and foster care	Earned income, child, and other tax credits	Health Insurance Premium tax credits	Supplemental Security Income	Unemployment compensation	Supplemental Nutrition Assistance Program	Child nutrition	Emergency rental assistance
2061	-40	20,398	930	866	1,243	1,034	2,464	5,103	3,160	2,718	1,513	1,367	0
2051	-30	23,407	1,077	1,002	1,405	1,194	2,839	5,862	3,596	3,146	1,741	1,546	0
2041	-20	25,568	1,181	1,082	1,553	1,308	3,146	6,387	3,897	3,415	1,884	1,716	0
2031	-10	27,127	1,249	1,102	1,715	1,388	3,417	6,782	4,062	3,560	1,979	1,873	0
2021	0	31,114	1,438	1,317	1,916	1,598	3,837	7,785	4,667	4,179	2,333	2,039	0
2011	10	32,737	1,590	1,449	2,095	1,766	4,251	8,623	4,169	4,592	2,531	1,672	0
2001	20	34,010	1,761	1,582	1,893	1,956	4,870	9,277	3,437	5,030	2,960	1,245	0
1991	30	31,626	1,785	1,747	600	2,028	5,054	7,622	3,407	5,752	2,438	1,157	37
1981	40	24,563	1,278	1,512	231	1,510	3,836	5,283	3,142	4,956	1,968	824	23
1971	50	18,400	815	1,470	97	955	1,859	3,963	3,182	4,194	1,556	291	18
1961	60	12,000	406	1,082	46	488	381	2,772	2,486	2,977	1,242	92	28
1951	70	7,504	193	606	15	298	79	1,973	1,658	1,603	958	53	67
1941	80	5,348	114	378	7	190	39	1,242	1,089	1,381	800	30	80

Table A10.2: The Composition of Generational Accounts Welfare Programs for White College-Educated Females by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.

Year of Birth	Age in 2021	Welfare Programs	Present Values of Remaining Lifetime Taxes										
			Medicare-eligible Retiree HC Fund (MERHCF)	Agriculture	Higher education	Family support and foster care	Earned income, child, and other tax credits	Health Insurance Premium tax credits	Supplemental Security Income	Unemployment compensation	Supplemental Nutrition Assistance Program	Child nutrition	Emergency rental assistance
2061	-40	41,601	581	4,526	677	1,224	5,358	7,425	7,636	5,845	5,780	2,550	0
2051	-30	47,638	664	5,100	772	1,405	6,227	8,527	8,660	6,763	6,640	2,881	0
2041	-20	48,786	675	5,147	785	1,438	6,377	8,693	8,937	6,977	6,784	2,973	0
2031	-10	52,078	712	5,348	880	1,506	6,896	9,310	9,431	7,339	7,325	3,329	0
2021	0	59,945	813	6,069	1,037	1,720	8,046	10,796	10,765	8,472	8,510	3,717	0
2011	10	63,401	897	6,703	1,109	1,909	8,790	11,812	10,624	9,390	9,285	2,882	0
2001	20	74,527	1,116	8,740	1,017	2,379	10,585	13,993	11,665	11,365	11,636	2,030	0
1991	30	65,367	946	7,924	360	2,203	10,996	10,670	9,454	11,947	9,120	1,654	93
1981	40	54,614	831	8,768	130	2,018	6,947	8,092	9,544	10,609	6,538	1,053	84
1971	50	39,382	591	7,758	58	1,490	2,922	5,341	8,400	8,146	4,182	414	80
1961	60	21,521	312	5,095	26	759	983	2,782	4,568	4,572	2,191	145	88
1951	70	11,446	234	4,184	9	497	274	1,742	1,651	1,429	1,272	76	79
1941	80	6,950	145	2,792	4	312	126	1,039	885	786	753	39	69

Table A10.3: The Composition of Generational Accounts Welfare Programs for White Non-College-Educated Males by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.

Year of Birth	Age in 2021	Welfare Programs	Present Values of Remaining Lifetime Taxes										
			Medicare-eligible Retiree HC Fund (MERHCF)	Agriculture	Higher education	Family support and foster care	Earned income, child, and other tax credits	Health Insurance Premium tax credits	Supplemental Security Income	Unemployment compensation	Supplemental Nutrition Assistance Program	Child nutrition	Emergency rental assistance
2061	-40	51,023	386	662	766	5,310	12,107	7,513	8,347	3,378	9,436	3,119	0
2051	-30	53,036	406	691	803	5,486	12,499	7,805	8,772	3,538	9,789	3,248	0
2041	-20	59,809	460	765	887	6,200	14,117	8,772	9,907	4,011	10,967	3,722	0
2031	-10	65,635	494	835	1,009	6,799	15,658	9,624	10,673	4,303	12,175	4,064	0
2021	0	70,693	534	943	1,063	7,341	16,614	10,438	11,634	4,673	13,159	4,289	0
2011	10	81,952	649	1,064	1,241	8,773	20,050	12,351	12,799	5,657	15,459	3,910	0
2001	20	93,681	745	1,281	1,115	10,148	24,054	14,160	13,726	6,505	18,739	3,209	0
1991	30	86,580	682	1,318	374	9,601	23,800	11,933	13,075	7,237	15,666	2,722	172
1981	40	56,582	533	1,190	133	5,872	12,530	8,339	11,056	6,282	9,144	1,356	148
1971	50	31,339	324	1,070	50	3,078	3,439	4,784	8,185	4,776	5,076	437	119
1961	60	18,470	174	856	17	1,799	837	2,917	5,225	2,994	3,313	214	123
1951	70	7,819	53	525	3	862	157	1,501	1,847	858	1,786	96	132
1941	80	4,928	13	356	0	577	83	938	1,094	420	1,255	53	140

Table A10.4: The Composition of Generational Accounts Welfare Programs for White Non-College-Educated Females by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.

Year of Birth	Age in 2021	Welfare Programs	Present Values of Remaining Lifetime Taxes										
			Medicare-eligible Retiree HC Fund (MERHCF)	Agriculture	Higher education	Family support and foster care	Earned income, child, and other tax credits	Health Insurance Premium tax credits	Supplemental Security Income	Unemployment compensation	Supplemental Nutrition Assistance Program	Child nutrition	Emergency rental assistance
2061	-40	26,567	1,204	1,874	1,193	609	3,085	7,133	3,004	3,905	2,437	2,122	0
2051	-30	29,801	1,358	2,089	1,341	686	3,481	8,009	3,349	4,380	2,739	2,371	0
2041	-20	33,822	1,532	2,413	1,488	781	3,931	9,049	3,899	4,932	3,137	2,658	0
2031	-10	37,011	1,697	2,609	1,650	855	4,345	9,927	4,138	5,467	3,396	2,926	0
2021	0	43,870	1,942	3,282	1,849	1,020	4,986	11,672	5,325	6,343	4,225	3,222	0
2011	10	45,297	2,148	3,345	2,029	1,086	5,491	12,480	4,891	6,935	4,291	2,600	0
2001	20	47,436	2,311	3,628	1,879	1,172	6,002	13,366	4,924	7,503	4,826	1,825	0
1991	30	46,375	2,413	4,038	796	1,255	6,783	11,395	5,046	8,491	4,505	1,590	64
1981	40	42,532	1,848	4,337	363	1,144	5,944	9,390	5,639	8,177	4,264	1,368	59
1971	50	32,646	1,002	3,978	179	793	3,924	6,705	5,400	6,460	3,406	731	69
1961	60	23,297	450	3,156	87	494	1,620	4,911	4,531	5,013	2,634	322	78
1951	70	11,157	137	1,698	6	242	470	2,452	2,893	1,405	1,626	149	80
1941	80	7,579	70	1,197	6	170	337	1,520	2,080	726	1,296	91	86

Table A10.5: The Composition of Generational Accounts Welfare Programs for Non-White College-Educated Males by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.

Year of Birth	Age in 2021	Welfare Programs	Present Values of Remaining Lifetime Taxes										
			Medicare-eligible Retiree HC Fund (MERHCF)	Agriculture	Higher education	Family support and foster care	Earned income, child, and other tax credits	Health Insurance Premium tax credits	Supplemental Security Income	Unemployment compensation	Supplemental Nutrition Assistance Program	Child nutrition	Emergency rental assistance
2061	-40	29,500	745	476	1,377	1,999	5,381	7,028	3,203	3,183	3,801	2,306	0
2051	-30	32,351	815	519	1,536	2,194	5,933	7,720	3,461	3,463	4,162	2,548	0
2041	-20	37,045	939	601	1,712	2,509	6,746	8,819	4,046	4,022	4,780	2,872	0
2031	-10	40,103	1,003	646	1,884	2,722	7,295	9,565	4,385	4,278	5,197	3,129	0
2021	0	46,689	1,171	764	2,121	3,171	8,374	11,103	5,264	5,055	6,195	3,466	0
2011	10	47,856	1,254	790	2,305	3,347	9,116	11,701	4,926	5,292	6,274	2,851	0
2001	20	49,666	1,369	836	2,051	3,558	10,333	12,274	4,627	5,697	6,794	2,128	0
1991	30	49,359	1,390	956	740	3,695	11,060	10,392	5,640	6,784	6,632	1,967	103
1981	40	38,969	1,012	870	368	2,554	8,017	7,693	5,709	5,792	5,449	1,411	94
1971	50	28,829	597	616	181	1,708	3,947	5,757	5,837	4,917	4,522	670	75
1961	60	20,046	259	445	67	1,219	1,227	4,052	5,248	3,447	3,608	394	80
1951	70	10,217	68	263	19	713	374	2,049	3,061	1,170	2,192	207	101
1941	80	4,374	16	123	0	272	207	758	1,175	455	1,157	65	146

Table A10.6: The Composition of Generational Accounts Welfare Programs for Non-White College-Educated Females by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.

Year of Birth	Age in 2021	Welfare Programs	Present Values of Remaining Lifetime Taxes										
			Medicare-eligible Retiree HC Fund (MERHCF)	Agriculture	Higher education	Family support and foster care	Earned income, child, and other tax credits	Health Insurance Premium tax credits	Supplemental Security Income	Unemployment compensation	Supplemental Nutrition Assistance Program	Child nutrition	Emergency rental assistance
2061	-40	59,070	437	514	594	2,739	10,790	9,038	12,251	4,887	11,908	5,912	0
2051	-30	60,799	448	527	624	2,797	11,077	9,283	12,581	5,015	12,280	6,167	0
2041	-20	70,098	516	605	717	3,223	13,101	10,731	14,095	5,808	14,098	7,204	0
2031	-10	82,050	612	719	807	3,845	15,016	12,610	17,100	6,857	16,449	8,035	0
2021	0	88,143	654	773	878	4,135	15,954	13,500	18,420	7,279	18,073	8,466	0
2011	10	96,134	752	884	998	4,718	18,627	15,533	18,920	8,421	20,289	6,991	0
2001	20	102,027	820	978	882	5,183	20,937	16,856	18,703	9,241	23,626	4,802	0
1991	30	101,461	798	1,026	355	5,551	23,525	15,858	19,566	10,620	19,901	4,060	200
1981	40	73,553	559	736	180	4,171	16,987	10,892	15,537	8,545	13,184	2,585	175
1971	50	55,687	417	617	89	3,234	8,662	7,857	16,183	7,011	10,100	1,321	194
1961	60	29,576	202	337	39	1,573	3,240	3,581	9,901	4,055	5,865	534	249
1951	70	21,177	159	261	25	1,286	1,134	2,691	7,547	1,901	5,499	411	262
1941	80	6,840	30	87	6	386	418	734	1,959	744	2,092	99	286

Table A10.7: The Composition of Generational Accounts Welfare Programs for Non-White Non-College-Educated Males by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.

Year of Birth	Age in 2021	Welfare Programs	Present Values of Remaining Lifetime Taxes										
			Medicare-eligible Retiree HC Fund (MERHCF)	Agriculture	Higher education	Family support and foster care	Earned income, child, and other tax credits	Health Insurance Premium tax credits	Supplemental Security Income	Unemployment compensation	Supplemental Nutrition Assistance Program	Child nutrition	Emergency rental assistance
2061	-40	83,024	203	111	631	12,703	21,340	6,684	13,570	3,269	17,822	6,692	0
2051	-30	96,849	239	131	740	14,905	25,357	7,862	15,277	3,860	20,714	7,763	0
2041	-20	104,919	256	140	801	16,039	27,001	8,430	17,106	4,115	22,537	8,494	0
2031	-10	117,322	292	159	889	18,025	30,569	9,569	18,641	4,714	25,025	9,439	0
2021	0	127,454	313	172	962	19,578	32,987	10,302	20,484	5,053	27,519	10,068	0
2011	10	144,716	371	202	1,109	23,014	38,787	12,118	22,426	5,944	31,858	8,888	0
2001	20	150,609	383	211	957	24,003	42,409	12,481	21,921	6,162	35,513	6,568	0
1991	30	145,921	378	221	367	23,675	45,165	11,579	21,378	7,223	29,774	5,731	430
1981	40	97,944	281	175	161	14,041	27,231	8,262	19,342	5,727	19,154	3,180	390
1971	50	60,514	184	108	72	7,826	9,341	5,364	18,538	4,323	12,944	1,469	345
1961	60	36,952	94	52	33	4,356	2,471	2,751	14,411	2,432	9,162	835	354
1951	70	14,723	27	20	13	1,738	601	837	5,707	650	4,403	328	398
1941	80	11,780	14	17	20	1,423	318	590	4,679	394	3,689	222	413

Table A10.8: The Composition of Generational Accounts Welfare Programs for Non-White Non-College-Educated Females by Selected Years of Birth. (Present values in constant 2021 dollars)
Source: Authors' calculations.

A11. Sensitivity of FI and GI to Productivity Growth and Discount Rate Assumptions

The FI measures reported above are based on discounting projections of nominal future dollar flows of federal taxes and expenditures. Nominal future dollar flows are projected by (1) distributing CBO budget aggregates for various programs through the year 2030 across population subgroups distinguished by age, gender, race and education, (2) growing per-capita values annually for years after 2030 by applying a labor productivity growth rate, and applying an actuarial discount rate based on population survival rates to find present values as of 2021.[42] Labor productivity growth rates are projected based on the PWBM microsimulation. These year-specific growth rates are derived by estimating national output based on the microsimulation's annual projections of the efficiency-adjusted labor input and capital services, and dividing by the unadjusted labor input (total work hours). The resulting time series of (nominal) labor productivity growth is 3.51 percent per year.

	2021-95			Infinite Horizon		
	g–0.5%	**g=3.51%**	**g+0.5%**	**g–0.5%**	**g=3.51%**	**g+0.5%**
PVGDP						
r–1.0%	1527.1	1828.6	2212.1	4163.3	10406.3	40718.5
r=4.39%	1109.6	1300.3	1539.4	1635.3	2410.0	4316.7
r+1.0%	841.4	966.4	1120.5	1001.6	1254.8	1671.7
FI						
r–1.0%	127.2	147.3	172.5	488.3	1305.8	5233.8
r=4.39%	92.4	104.3	119.1	160.1	244.8	466.6
r+1.0%	71.2	78.4	87.3	91.0	113.1	152.1
FI/PVGDP						
r–1.0%	8.33	8.05	7.80	11.73	12.55	12.85
r=4.39%	8.33	8.02	7.73	9.79	10.16	10.81
r+1.0%	8.46	8.11	7.79	9.09	9.02	9.10

Table 5: Sensitivity of FI to alternative discount rate and productivity growth rate assumptions.
Source: Author's calculations.

[42] The nominal discount rate used (excluding mortality discount) is 4.4 percent the product of a real discount rate of 2.3 percent per year and a 2.1 percent annual GDP inflation rate.

To account for future uncertainty on productivity and interest discount rates, we report FI measures under alternative values for these parameters. Table 5 shows FI measured under a +/- 0.5 percent variation in the productivity growth rates (in each future year) and a +/- 1.0 percent variation in the interest discount factor. The FI measure is shown in present value dollars and as a share of PVGDP estimated under the same parametric variations of productivity and interest rates. The Table shows that FI estimates in present value (in constant 2021 dollars) are quite variable across alternative labor productivity growth and discount rates. But ratio FI/PVGDP is quite stable because variations in the two parameters change the numerator and denominator in the same direction and approximately in the same proportion.

A12. Faster Labor Productivity Growth and the Ratio of FI to the Present Value of GDP

Over the 2021-95 time window, FI/PVGDP ratios shown in Table 5 decline when assumed labor productivity growth, g, is increased. This result challenges conventional wisdom that a higher growth rate would ease the federal government's financial condition. The conventional view, however, appears to be based on finite horizon estimates of the federal financial condition. A fuller picture, under infinite horizon estimates suggests that higher labor productivity growth rate would worsen the federal government's financial condition. That's because the largest government transfer programs (Medicare and Social Security) provide benefits to older populations financed by taxes levied on younger populations in each period. When the population is not aging rapidly, productivity growth effects on the numerator and denominator of the FI/PVGDP ratio cancel out. However, when the population is aging rapidly, the numerator (the difference between federal outlays and receipts) increases more than proportionally than the increase in the denominator. Stated briefly, when labor productivity (output per worker) is higher, annual increases in GDP follow the growth rate $(1 + g)(1 + n^w)$,

where n^w is the growth rate of workers. However, the growth rate of FI is determined by $(1+g)(n^w - n^b)$, where n^b is growth in the population transfer recipients. Over time, an increase in g spurs both tax payments and transfer receipts. However, because of population aging, the transfer-recipient population (predominantly retirees) increases faster compared to the population that provides labor input and pays taxes – mainly working-aged- individuals.[43]

Figure 6 shows projected aged dependency ratios calculated from the PWBM microsimulation as the population of retirement aged (65+) individuals divided by the working-aged (15-64) individuals. This ratio is projected to increase during future decades, and to continue increasing well beyond the year 2095 – suggesting a near-stationary worker population and a growing retiree population. Hence, when g is increased, the positive interaction between higher g and the larger future population of (retiree) beneficiaries is stronger than that between higher g and the number of workers who produce GDP. Hence, a higher value of g increases future deficits by more than in proportion to the increase in GDP, causing the FI/PVGDP ratio to increase. From Table 5, the differential interaction effect of g with worker and beneficiary populations is not explicitly visible over the shorter 75-year time window because it takes a long time for the positive interaction of g with net beneficiary recipients to grow significantly larger than the interaction of higher g with net tax payers. Over the infinite horizon, however, the dominance of the positive interaction of g with net transfer recipients is clearly visible – and it is stronger at low values of r, which confers larger weights on deficits accruing in the more distant future.

[43] See Appendix section A12 for a detailed description of the effect of population aging on the fiscal imbalance under faster labor productivity and wage growth.

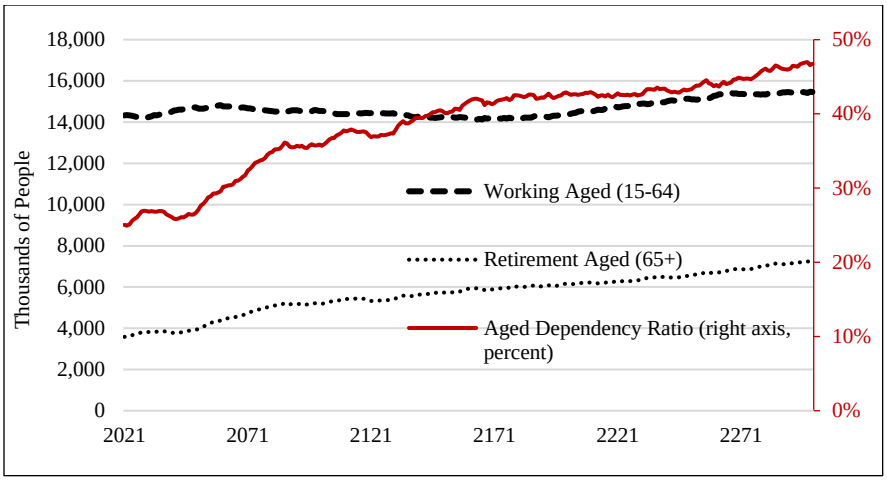


Figure 6*: *Projected populations of the working aged (15-64), retirement aged (65+) and the aged dependency ratio (right axis, percent).
Source: Authors' calculations from the PWBM microsimulation.

To verify that it is indeed the interaction of higher productivity growth with population aging, we recalculate the FI/PVGDP ratios of Table 4 by allowing the (microsimulation) population's to grow as projected but hold its age distribution constant after the year 2021.

	FI/PVGDP (Infinite Horizon; Base Case of Table 4)			FI/PVGDP (Infinite Horizon; Fixed age distribution after 2021)		
	g–0.5%	**g=3.51%**	**g+0.5%**	**g–0.5%**	**g=3.51%**	**g+0.5%**
r–1.0%	11.73	12.55	12.85	-5.73	-5.29	-4.95
r=4.39%	9.79	10.16	10.81	-6.24	-5.73	-5.25
r+1.0%	9.09	9.02	9.10	-6.85	-6.32	-5.80

Table 6*: *FI-to-PVGDP ratios under alternative population aging scenarios.
Source: Authors' calculations from the PWBM microsimulation.

In Table 6, the first panel repeats the infinite horizon FI/PVGDP ratios of Table 5 – the "base case." The 2nd panel shows the same calculations under the case of constant population age distribution after 2021. Under the latter case, all FI/PVGDP ratios are considerably smaller than under the base case. The reason is simply that with no population aging, the relative size of older net transfer recipients does not grow as fast as under the base case relative to the size of the population of workers who are predominantly taxpayers. Moreover, for each value of the

discount rate (each row of Table 5), the FI/PVGDP ratio declines at higher values of labor productivity growth. This is because the deficit-increasing effect of faster labor productivity growth is not boosted by interaction with population aging. This interaction effect is formally described below.

Labor Productivity Growth, Population Aging, and the Share of FI in the Present Value of GDP

Let Y denote Output (GDP); W the number of workers/hours; n^w the worker population/hours growth rate; Y/W labor productivity; g labor productivity growth rate $\frac{1}{Y/W}\frac{d(Y/W)}{dt}$. This yields the expression for total output: $Y = \left(\frac{Y}{W}\right) * W$, and output growth $\frac{1}{Y}\frac{dY}{dt} = \frac{1}{Y/W}\frac{d(Y/W)}{dt} + \frac{1}{W}\frac{dW}{dt} = g + n^w$.

Then, the present value of all future output is given by

$$PV\_Y = Y_0 \sum_{s=0}^{\infty}(1 + g + n^w)\,(1 + r)^{-s} \qquad \text{(A.11.1)}$$

Similarly, let τ^w represent taxes per worker, which are assumed to grow at rate g, and which makes revenue $\tau^w W$ and revenue growth equals $g + n^w$.

Let b^r represent benefits per retiree, also assumed to grow at rate g. Let R be the number of retirees and n^r the retiree population growth rate. Thus, benefit outlays are $b^r R$ and the benefit growth rate equals $g + n^r$.

Debt, D, accumulates from period to period - accruing service charges on prior debt plus the current deficit:

$$D_1 = D_0(1 + r) + (E_0 - R_0) \qquad \text{(A.11.2)}$$

Where E_t denotes non-interest expenditures and R_t denotes revenues.

Successive period's debts can be expressed by manipulating the debt transition equation (A.11.2) as follows:

$D_2 = D_1(1+r) + (E_1 - R_1) = D_0(1+r)^2 + (E_0 - R_0)(1+r) + (E_1 - R_1)$, and

$D_n = D_0(1+r)^n + \sum_{s=0}^{n-1}(E_s - R_s)(1+r)^{n-1-s}$. (A.11.3)

Since $E_s = E_0(1+g+n^r)^s$ and $R_s = R_0(1+g+n^w)^s,\ s = 0 \ldots n-1$, we can write

$D_n = D_0(1+r)^n + \sum_{s=0}^{n-1}[E_0(1+g+n^r)^s - R_0(1+g+n^w)^s](1+r)^{n-1-s}$. (A.11.4)

With the population's age structure in a steady state, that is, with $n^r = n^w = n$, the term inside the square brackets collapses to $(E_0 - R_0)(1+g+n)^s$

$D_n = D_0(1+r)^n + (E_0 - R_0)\sum_{s=1}^{n}(1+g+n)^s(1+r)^{n-s}$. (A11.5)

Dividing both sides by $(1+r)^n$

$D_n(1+r)^{-n} = D_0 + (E_0 - R_0)\sum_{s=1}^{n}(1+g+n)^s(1+r)^{-s}$ (A.11.6)

Letting $n \to \infty$, write

$FI = D_0 + (E_0 - R_0)\sum_{s=1}^{\infty}(1+g+n)^s(1+r)^{-s}$. (A.11.7)

Starting from a position of zero outstanding debt, $D_0 = 0$, we have

$\frac{FI}{PV\_Y} = \frac{(E_0 - R_0)\sum_{s=1}^{\infty}(1+g+n)^s(1+r)^{-s}}{Y_0\sum_{s=1}^{\infty}(1+g+n)^s(1+r)^{-s}} = \frac{(E_0 - R_0)}{Y_0}$, (A.11.8)

which is invariant to changes in the labor productivity growth rate g.

However, when $n^r > n^w$, that is, when the population is aging, the invariance result does not obtain as the numerator grows faster than the denominator.

$\frac{FI}{PV\_Y} = \frac{\sum_{s=1}^{n}[E_0(1+g+n^r)^s - R_0(1+g+n^w)^s](1+r)^{n-s}}{Y_0\sum_{s=1}^{\infty}(1+g+n^w)^s(1+r)^{-s}}$. (A.11.9)

With non-zero initial debt, if it is small relative to the future component of FI, then the response of FI to changes in g would be in the same ball park. If initial debt is huge, then the response would be closer to the invariance type.