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

Agustin Diaz*, Jagadeesh Gokhale*, and Kent A. Smetters*

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Abstract

The Penn Wharton Budget Model's microsimulation projects U.S. demographics consistent with historical information for future decades. Here, we use this microsimulation 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 $93.8 trillion, which is 7.0 percent of the present value of projected GDP (PVGDP) over that time horizon. Calculated in perpetuity, FI equals $202.9 trillion, which is 8.2 percent of PVGDP, also calculated in perpetuity. The FI/PVGDP ratio in perpetuity would be 9.4 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 29.8 percent. As a share of the present value of federal revenues, it equals 38.6 percent. These figures are 32.6 percent and 46.1 percent, respectively, when calculated in perpetuity. When estimated in perpetuity, total federal debt outstanding ($27.5 trillion) accounts for 1.1 percentage points, Social Security plus Medicare Part A ($83.1 trillion) for 3.3 percentage points, and public purchases ($135.0 trillion) for 5.4 percentage points of FI as a share of PVGDP (8.2 percent). Other federal transfer programs net of all non-payroll-tax receipts ($42.7 trillion) contribute a surplus of 1.7 percentage points 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 $44.7 trillion. The imbalance on account of future-born generations equals $38.4 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.

* Penn Wharton Budget Model.

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 $202.9 trillion, which is 8.2 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 components. 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 these elements is described in a number of Appendices. Federal budget projections and FI measures are compared to GDP projections, which are benchmarked to the Congressional Budget Office's projections through the year 2030, are also based on PWBM's microsimulation as described in Appendix A6.

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]

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[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.

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, 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

[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.

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]

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

[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.
[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.

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 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 Appendix A6.[11]

	Assets(+)/ Debt(-) (A)	75-year Projections			Assets(+)/ Debt(-) (A)	Infinite Horizon Projections		
		Receipts (R)	Expenditures (E)	FI (E-R-A)		Receipts (R)	Expenditures (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**	83.6	116.9	30.2	3.0**	150.6	236.8	83.1
non-OASDHI	3.1**	157.3	121.6	-38.8	3.1**	286.1	246.5	-42.7
Public Purchases		1.8	76.7	74.9		3.2	138.2	135.0
Net Value	-21.4	242.7	315.1	93.8	-21.4	440.0	621.5	202.9
Memo: OASDI	2.9	60.8	81.7	17.9	2.9	109.8	161.8	49.0
	As a percent of PVGDP*							
U.S. Treasury	-2.1**			2.1	-1.1***			1.1
OASDHI	0.2**	6.2	8.7	2.3	0.1**	6.1	9.5	3.3
non-OASDHI	0.2**	11.8	9.1	-2.9	0.1**	11.5	9.9	-1.7
Public Purchases		0.1	5.7	5.6		0.1	5.6	5.4
Net Value/PVGDP	-1.6	18.1	23.5	7.0	-0.9	17.7	25.0	8.2
Memo: OASDI	0.2	4.5	6.1	1.3	0.1**	4.4	6.5	2.0
Memo: PVGDP	1,338.2				2,481.1			

Table 1: 75-year and infinite horizon FI measures under current fiscal laws and purchases policies.

[10] Per capita purchases growth is maintained at labor productivity growth only for non-Covid-19 related expenditures.
[11] See the Appendix, section A5, for details on projecting U.S. GDP.

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.

FI Measured over the next 75 Years

According to our estimates, the federal government faces a financial shortfall equal to $93.8 trillion through the next 75 years (2021-95), or 7.0 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 – $74.9 trillion in present value through 2095 or 5.6 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 ($30.2 trillion or 2.3 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 ($38.8 trillion, or 2.9 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 $93.8 trillion or 7.0 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 ($315.1 trillion or 23.5 percent of PVGDP) amounts to $336.5 trillion (25.1 percent of PVGDP) whereas all tax and non-tax revenues generate only $242.7 trillion (18.1 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 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 similar in size to that reported in this study ($93.8 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 $17.9 trillion (or 1.3 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 $12.3 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 $202.9 trillion or 8.2 percent of PVGDP. Over the longer horizon, the non-OASDHI surplus of 42.7 trillion is considerably smaller than the sum of shortfalls in OASDHI ($83.1 trillion), public purchases at current rates ($135.0

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

trillion) and outstanding federal debt ($27.5 trillion). The reasons for the larger total shortfall over the longer time horizon become clear when we consider trajectories of accruing annual budget shortfalls even just though the year 2095.

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

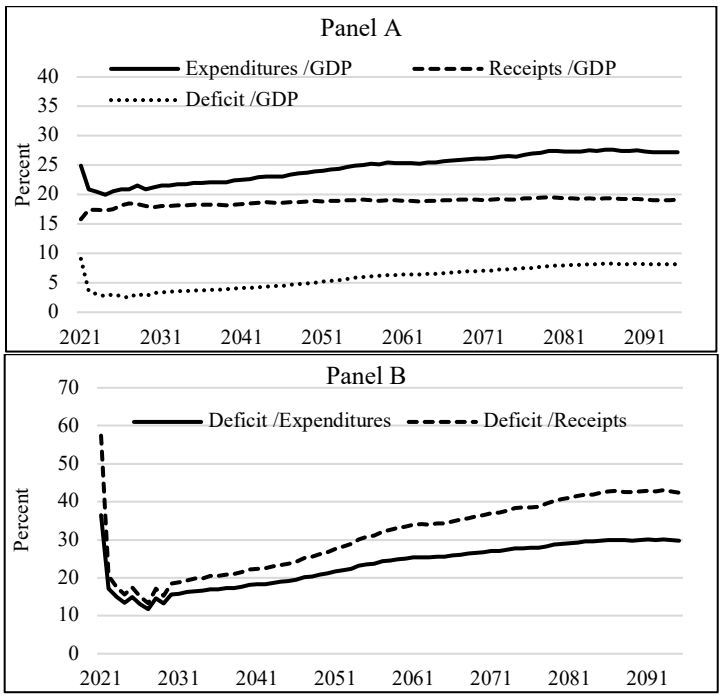

Figure 1: Projected federal deficits as shares of GDP, federal receipts, and noninterest expenditures under current fiscal laws and purchases policy.
Source: Authors' calculations.

The relatively high GDP shares of non-interest expenditures and the deficit and the low GDP share of revenues during 2021 emerged 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 29.8 percent by 2095. And the deficit-revenue share increases from 13.3 percent in 2027 to 42.5 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 225 percent by 2050 and 731 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 many years after 2095, causing the infinite horizon FI measure to exceed the 75-year measure.

Because projection uncertainty increases over time, the FI estimates are more uncertain over longer than over shorter time horizons. However, because they are anchored to the continuation of current laws and policies, they inform us about the long term direction of the federal government's financial conditions from making no fiscal adjustments in the short term. Longer-term FI estimates also provide

[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.

useful information about the sustainability of policy adjustments that target achieving budget balance over a limited time horizon.[17]

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***			-76.5
OASDHI	3.0**	83.7	116.9	30.2	3.0**	150.7	236.8	-34.0
non-OASDHI	3.1**	141.1	121.6	-22.6	3.1**	256.1	246.5	12.6
Public Purchases		1.8	76.7	74.9		3.2	138.2	135.0
Net Value	-21.4	226.5	315.1	110.0	-21.4	410.0	621.5	232.9
Memo: OASDI	2.9	63.2	87.9	21.8	2.9	109.9	161.8	49.0
	As a percent of PVGDP*							
U.S. Treasury	–2.1***			2.1	–1.2***			-3.1
OASDHI	0.2**	6.3	8.7	2.3	0.1**	6.1	9.5	-1.4
non-OASDHI	0.2**	10.5	9.1	-1.7	0.1**	10.3	9.9	0.5
Public Purchases		0.1	5.7	5.6		0.1	5.6	5.4
Net Value/PVGDP	–1.7	16.9	23.5	8.2	–0.9	16.5	25.0	9.4
Memo: OASDI	0.2**	4.5	6.1	1.3	0.1**	4.4	6.5	2.0
Memo: PVGDP	1338.3				2481.1			

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

[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.
[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.

TCJA tax provisions would reduce federal revenues relative to those under current fiscal laws.[19] Under the "no-sunset" case, FI through 2095 equals $110.0 trillion or 8.2 percent of PVGDP. Under the infinite horizon projection the FI is estimated to be 232.9 trillion, which equals 9.4 percent of the PVGDP.

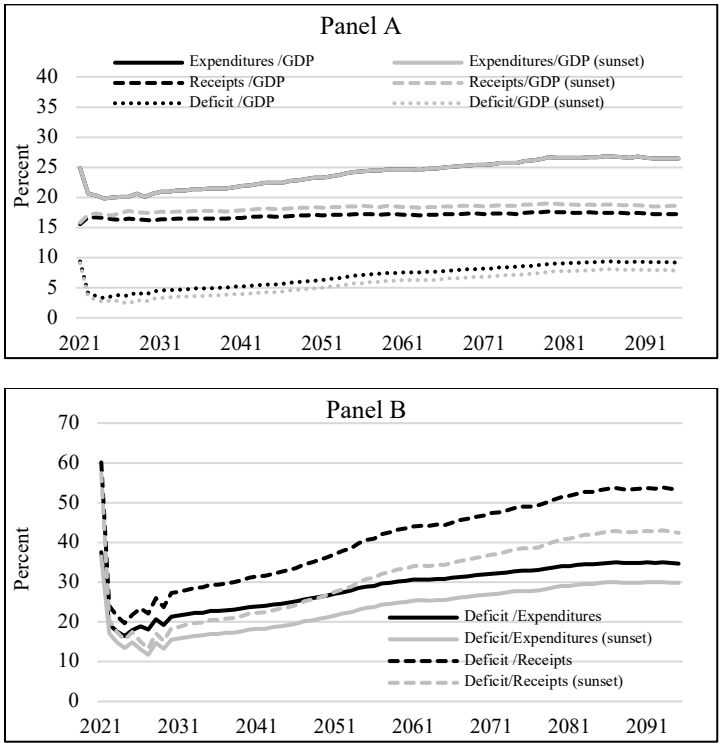

Figure 2: Projected federal deficits as shares of GDP, federal receipts, and non-interest expenditures under continuation of fiscal laws applicable in 2021 ("no-sunset" of expiring provisions).
Source: Authors' calculations.

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.

[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.

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 34.7 percent of GDP by 2095 (compared to 29.8 percent under current-laws-and-purchases policy). And the deficit-receipts share reaches 53.2 percent by 2095 (compared to 42.5 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 261 percent of GDP by 2050 (instead of 225 percent under the current law and purchases policy), and to 859 percent by 2095 (compared to 731 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 under 5 percent of GDP during the late-2020s to 2.9 percent in 2050 and to 1.6 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 2.1 percent by 2050 and to 3.9 percent by 2095. Finally, public goods and services purchases in GDP (also identical under the two cases) decline from recent highs of 7-plus percent to 5.6

[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).

percent of GDP by 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 2.4 percent (projected for 2027) to 7.9 percent by 2095.

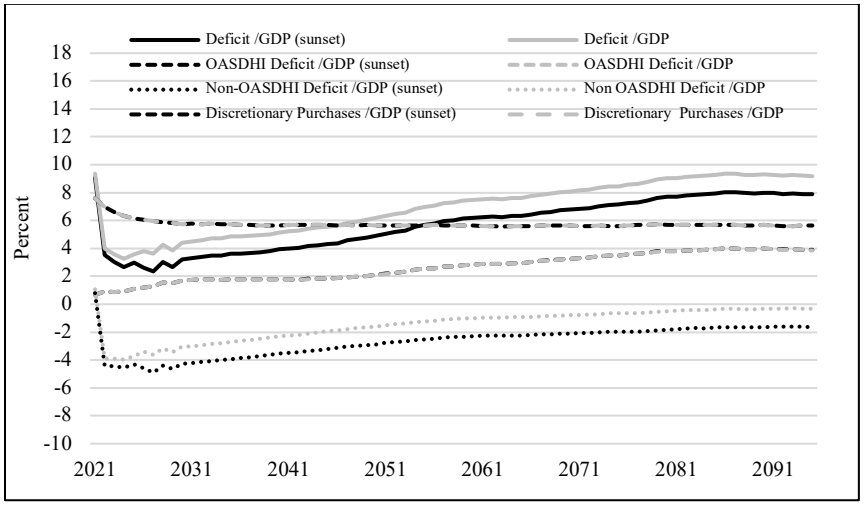

Figure 3: Deficit components as shares of GDP: OASDHI, non-OASDHI, and public purchases under current laws including scheduled expirations ("sunset") and under continuation of fiscal laws applicable in 2021 ("no sunset" of expiring provisions).
Source: Authors' calculations.

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, today's non-OASDHI surplus declines from 1.1 percent to only 0.3 percent 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 9.2 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

[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.

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.

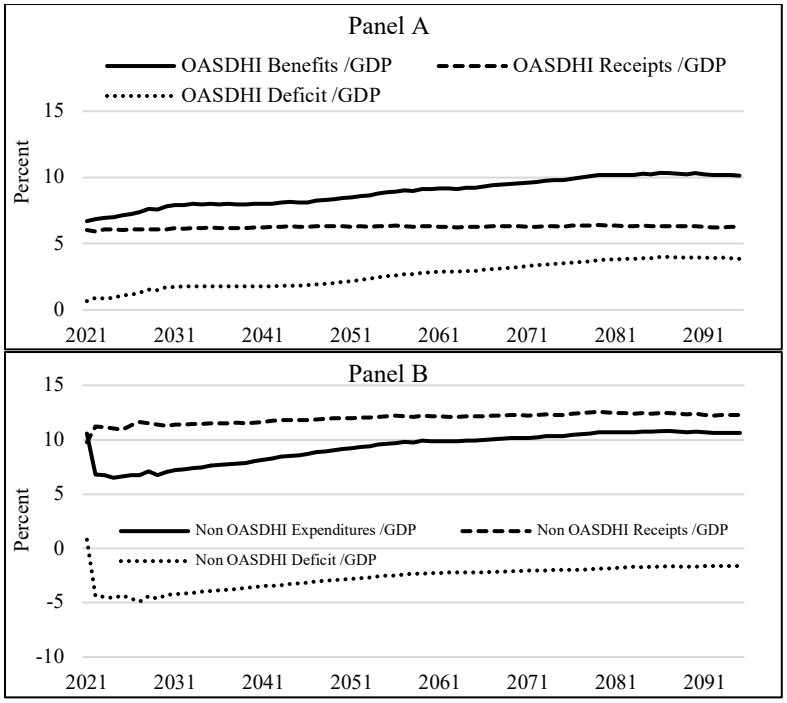

Figure 4: Federal receipts, expenditures, and deficits in OASDHI and non-OASDHI programs as shares of GDP under current laws.
Source: Authors' calculations.

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	Expendi-tures	Imbalance	Trust Fund	Receipts	Expendi-tures	Imbalance
		Panel-A: Through the Infinite Horizon							
Social Security (OASDI)	FI	2.9	109.8	161.8	49.0	0.1	4.4	6.5	2.0
	GI	2.9	73.5	101.0	27.5	0.1	3.0	4.1	1.1
	FI-GI	0.0	36.4	60.7	21.5	0.0	1.5	2.4	0.9
Medicare Part A (HI)	FI	0.1	40.8	75.0	34.1	0.0	1.6	3.0	1.4
	GI	0.1	27.5	44.6	17.2	0.0	1.1	1.8	0.7
	FI-GI	0.0	13.3	30.4	16.9	0.0	0.5	1.2	0.7
Social Security and Medicare Part A (OASDHI)	FI	3.0	150.6	236.8	83.1	0.1	6.1	9.5	3.3
	GI	3.0	100.9	145.7	44.7	0.1	4.1	5.9	1.8
	FI-GI	0.0	49.7	91.1	38.4	0.0	2.0	3.7	1.5
		Panel-B: Through 2095							
Social Security (OASDI)	FI	2.9	60.8	81.7	17.9	0.2	4.5	6.1	1.3
	GI	2.9	22.7	53.8	31.1	0.2	1.7	4.0	2.3
	FI-GI	0.0	38.1	27.9	-13.2	0.0	2.8	2.1	-1.0
Medicare Part A (HI)	FI	0.1	22.8	35.2	12.3	0.0	1.7	2.6	0.9
	GI	0.1	7.9	23.0	15.2	0.0	0.6	1.7	1.1
	FI-GI	0.0	14.9	12.2	-2.9	0.0	1.1	0.9	-0.2
Social Security and Medicare Part A (OASDHI)	FI	3.0	83.6	116.9	30.2	0.2	6.2	8.7	2.3
	GI	3.0	30.6	76.8	46.2	0.2	2.3	5.7	3.5
	FI-GI	0.0	53.0	40.0	-16.0	0.0	4.0	3.0	-1.2

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 $83.1 trillion over the infinite horizon – the sum of $49.0 trillion on account of Social Security and $34.1 trillion on account of Medicare Part A. Past and current generations contribute $27.5 trillion on account of Social Security and $17.2 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 $21.5 trillion on account of Social Security and $16.9 trillion on account of Medicare Part A.

OASDHI's net benefits to past, current, and future generations under current laws amount to 3.3 percent of PVGDP through the infinite horizon – 2.0 percent on account of Social Security and 1.4 percent on account of Medicare Part A. Of the total OASDHI imbalance of 3.3 percent of PVGDP, 1.8 percent arises on account of past and current generations and 1.5 percent on account of future ones. Panel-B of Table 3 shows that more than one-third of the total OASDHI imbalance ($30.2 trillion out of $83.1 trillion), accrues during the next 75 years. Of this amount, about 40 percent ($12.3 trillion) accrues on account of Medicare Part A.

4. Cost of Delaying Fiscal Adjustments to Restore Fiscal Balance

Panel A of Figure 1 indicates that current federal tax and spending policies embody a large and growing fiscal imbalance. Besides choosing which tax and spending policies to change, policymakers must also decide on when to begin fiscal adjustments to reduce or eliminate the federal fiscal imbalance.

Year of First Fiscal Adjustment	75-Year Fiscal Imbalance Ratio					Infinite Horizon Fiscal Imbalance Ratio				
	Gross Federal Debt	OASDHI	Non-OASDHI	Federal Purchases	Fiscal Imbalance	Gross Federal Debt	OASDHI	Non-OASDHI	Federal Purchases	Fiscal Imbalance
2021	2.07	2.24	-2.92	5.60	7.00	1.11	3.35	-1.72	5.44	8.18
2022	2.11	2.28	-2.96	5.69	7.12	1.12	3.38	-1.74	5.49	8.25
2023	1.89	2.53	-2.72	5.55	7.24	1.13	3.41	-1.75	5.54	8.33
2024	1.97	2.56	-2.69	5.53	7.37	1.14	3.44	-1.77	5.59	8.40
2025	2.05	2.59	-2.66	5.52	7.50	1.15	3.47	-1.78	5.64	8.48
2026	2.15	2.61	-2.63	5.51	7.64	1.16	3.51	-1.80	5.69	8.56
2027	2.23	2.64	-2.60	5.51	7.78	1.17	3.54	-1.82	5.75	8.64
2028	2.32	2.66	-2.56	5.50	7.92	1.18	3.57	-1.84	5.80	8.72
2029	2.42	2.69	-2.53	5.50	8.07	1.19	3.61	-1.85	5.86	8.80
2030	2.52	2.71	-2.49	5.49	8.23	1.20	3.64	-1.87	5.91	8.89

Table 4: The Cost of Delaying Fiscal Adjustment to Reduce or Eliminate Fiscal Imbalance.
Source: Authors' calculations.

It's worth noting that, over time, federal debt will grow according to interest accruals on existing debt plus primary federal deficits (federal non-interest expenditures minus receipts) whereas GDP will grow at the rate of population plus productivity growth. Since during normal economic times, the (long-term) interest rate exceeds the GDP growth rate, the ratio of the fiscal imbalance to GDP will grow larger each

year that fiscal adjustments are postponed. Table 4 shows how components of and total federal fiscal would change over time if current fiscal policies are maintained through each of the years shown (up to year 2030).

Not engaging in fiscal adjustments through the year 2028, for example, would increase the 75-year U.S. federal fiscal imbalance to 7.92 percent (from its current value of 7.0 percent). The infinite horizon fiscal imbalance would increase to 8.72 percent (from its current value of 8.18 percent. A higher fiscal imbalance means that tax increases, spending cuts, or both in combination to reduce the imbalance to a given target ratio to the present value of GDP (or to eliminate it) would have to be larger.

5. 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.

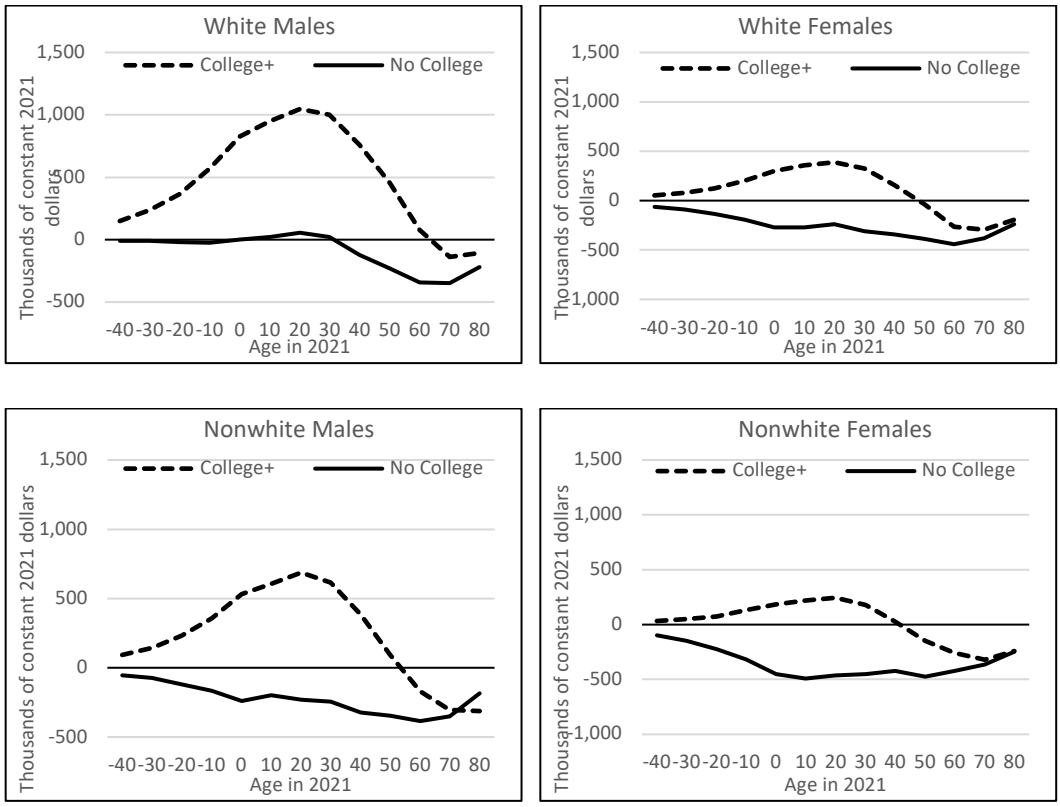

Figure 5: Generational accounts: Present values of prospective net taxes per capita for current and future generations by birth year, gender, race, and lifetime educational attainment.
Source: Author's calculations.
Negative ages on the X-axis indicate future birth years. For projected future-born cohorts, 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 Appendix A1.

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 5 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 A9 (forthcoming). In general, Figure 5 and Table 5 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 nonwhite males

Among the college educated, white and nonwhite 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 $1,000,000 (in constant 2021 dollars) over their lifetimes in net taxes. The bottom left Panel of Figure 5 shows that similarly aged nonwhite 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 A9 [forthcoming]). 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 nonwhite counterparts.

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

Younger white males with less than college education receive lifetime transfers in the $0- $200 range whereas those aged 40 and older receive substantially more in 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 negative unlike those of their college-educated white counterparts.

C. Nonwhite college and non-college educated males

Younger non-college educated nonwhite males receive considerable transfer benefits on net, whereas their college-educated counterparts pay substantial amounts in net taxes. The contrast is highlighted among newborns in 2021: College educated nonwhite males would expect to pay more than $500,000 in net taxes whereas non-college-educated males would receive between $200,000 and $400,000 in net transfers during their lifetimes.

D. College educated white and nonwhite females

White college educated females pay slightly 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 work for more hours per year, earn more and, therefore, pay more taxes than non-college educated women.[26]

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 2021: College education begets a lifetime net tax burden of almost

[26] For example, compare 20-year-old white college educated females in Table A9.2 with 20-year-old nonwhite college educated females in Table A9.6.

$400,000 whereas non college status confers net transfers of almost $250,000. Most of the difference emerges from the earnings premium accruing to those with a college degree.

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 nonwhite 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 will pay almost $250,000 in lifetime net taxes, on average, their non-college-educated counterparts, will receive more than $450,000 in lifetime 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	151,737	53,852	-9,839	-63,027	94,002	31,965	-54,550	-97,616
2051	-30	237,342	80,982	-10,591	-87,092	143,342	49,775	-71,785	-145,805
2041	-20	365,921	123,676	-17,591	-132,955	229,701	71,900	-119,835	-223,640
2031	-10	570,085	201,848	-26,573	-193,929	354,120	129,863	-166,217	-315,412
2021	0	826,727	300,240	-316	-272,455	531,864	185,296	-240,232	-451,504
2011	10	950,522	359,941	20,078	-269,261	604,568	216,670	-200,560	-491,451
2001	20	1,046,725	388,151	55,425	-238,103	687,157	244,605	-230,614	-460,953
1991	30	1,001,961	323,742	20,176	-310,482	612,518	176,322	-242,656	-450,959
1981	40	760,077	157,915	-121,496	-342,167	385,907	26,757	-325,337	-424,188
1971	50	458,630	-35,112	-228,318	-386,342	92,705	-148,470	-347,856	-476,225
1961	60	77,897	-267,079	-340,699	-441,687	-170,196	-257,585	-384,944	-424,820
1951	70	-138,414	-294,290	-348,356	-383,518	-304,402	-319,816	-352,595	-363,364
1941	80	-99734	-181990	-205470	-220753	-288044	-254248	-167784	-225726

Table 5: 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.[27] 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.[28] 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.[29] 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) $\text{PVTL}_t^c = \sum_{j_t=0}^{D} \sum_x \left(GA_{j_t,t}^{c,x} p_{j_t,t}^x \right)$,

[27] In this study population cohorts are distinguished by birth year, gender, race, and lifetime educational attainment.
[28] 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.
[29] 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, nonwhite)], 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.[30] 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

[30] 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.[31] 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.[32]

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) $\text{FI}_t^c = -(\text{NWTF}_t + \text{PVTL}_t^c + \text{PVTF}_t^c)$.

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.[33]

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 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

[31] Government purchases of program-administrative services are not included in these accounts.
[32] Evaluating social insurance provision as a separate benefit is not within the scope of Generational Accounting.
[33] The term 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 nonwhite) 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, F)	Education (N, C)	Race (W, N)
MCW	Male	College degree or more	White
FCW	Female	College degree or more	White
MNW	Male	No college degree	White
FNW	Female	No college degree	White
MCN	Male	College degree or more	Nonwhite
FCN	Female	College degree or more	Nonwhite
MNN	Male	No college degree	Nonwhite
FNN	Female	No college degree	Nonwhite

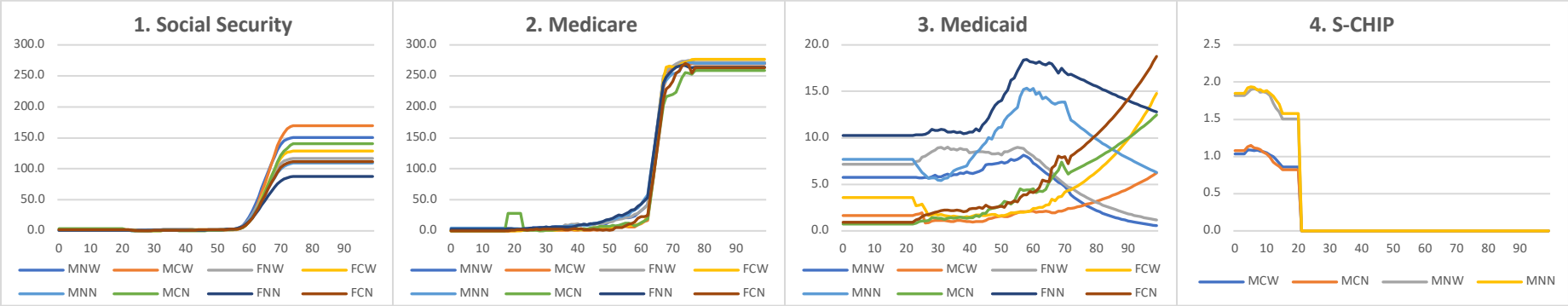
Table A4.1. *Person-Type Characteristics Distinguished for Calculating Labor Efficiency*

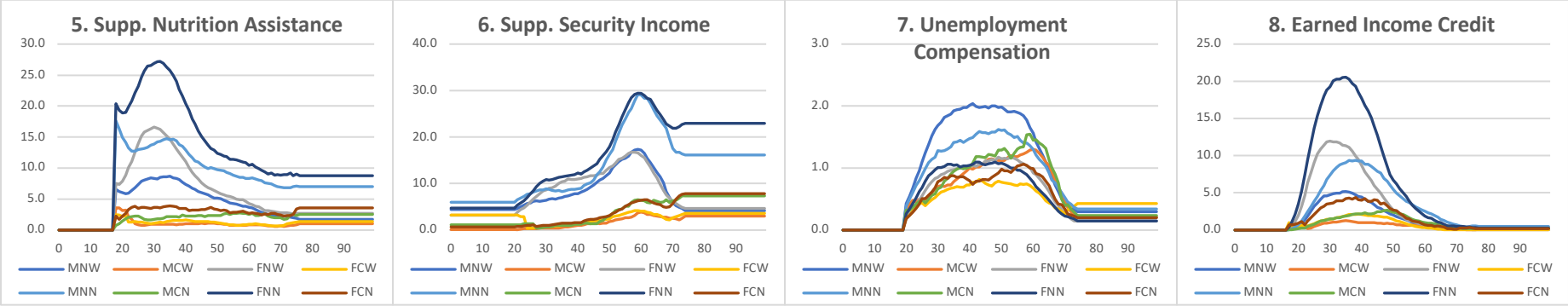
Because mortality, fertility, and immigration rates (and their evolution through many interactive socio-economic processes such as ages and frequencies of marriage, childbearing, and divorce, patterns of assortative mating, and processes of family formation and dissolution etc.) differ significantly 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.

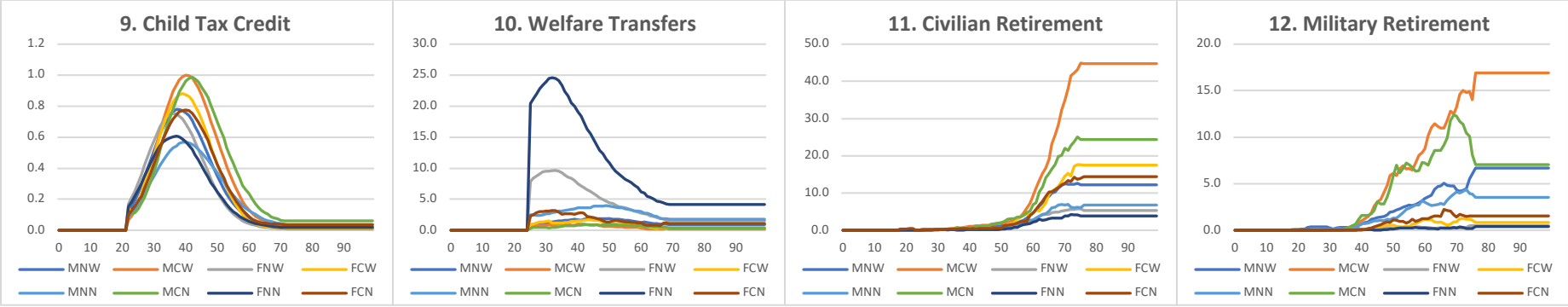
Differential base-period tax and transfer distributions by race and education in addition to age and gender, interact with differential sub-population growth and mortality rates. Table A.1 shows the classification of sub-populations by gender, race, and education (maximum attainment over the lifetime). 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.

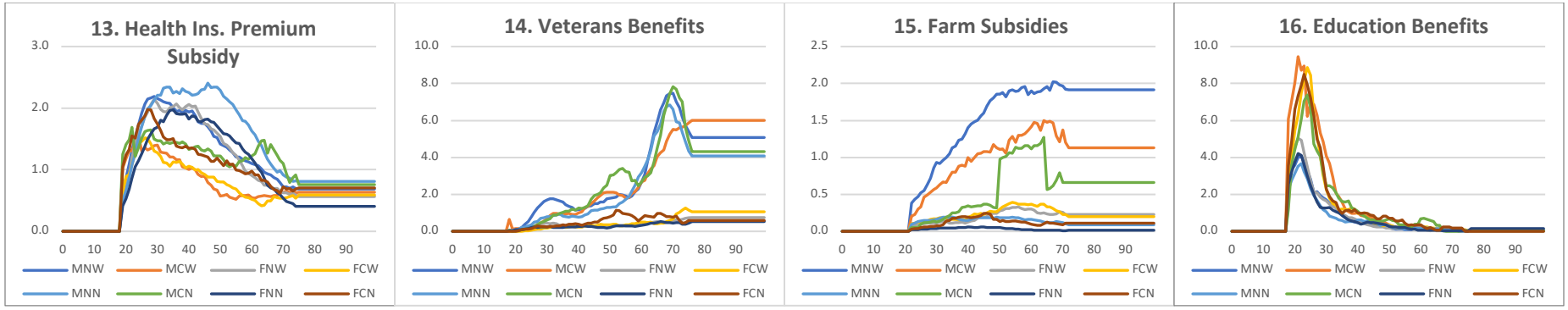
Figure A4.2 shows relative tax and benefit profiles by age estimated from micro-data surveys and used to allocate federal taxes and benefits for 37 tax and benefit programs in the federal budget items.[34] Several age-benefits profile charts in the figure, especially those related to means tested benefits 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.

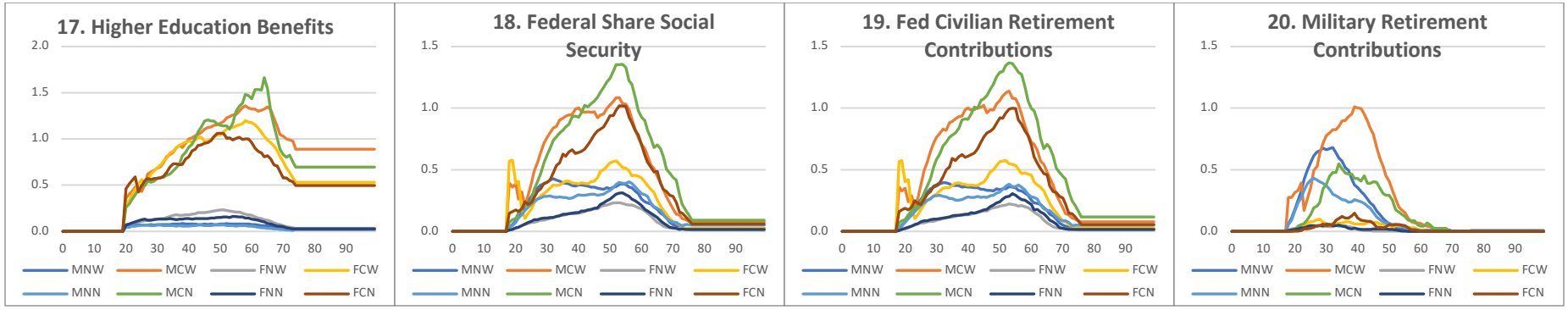
[34] The tax and benefit aggregates and 10 year projections that are allocated by the relative age-profiles are taken from the Congressional Budget Office's Budget and Economic Outlook, February, 2021.

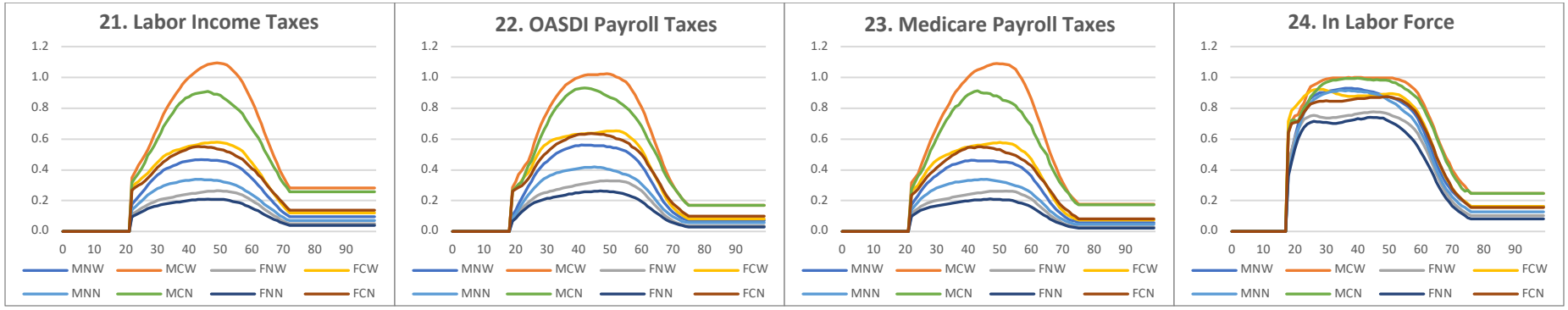

1. Social Security
2. Medicare
3. Medicaid
4. S-CHIP
MNW MCW FNW FCW
MNN MCN FNN FCN
MCW MCN MNW MNN

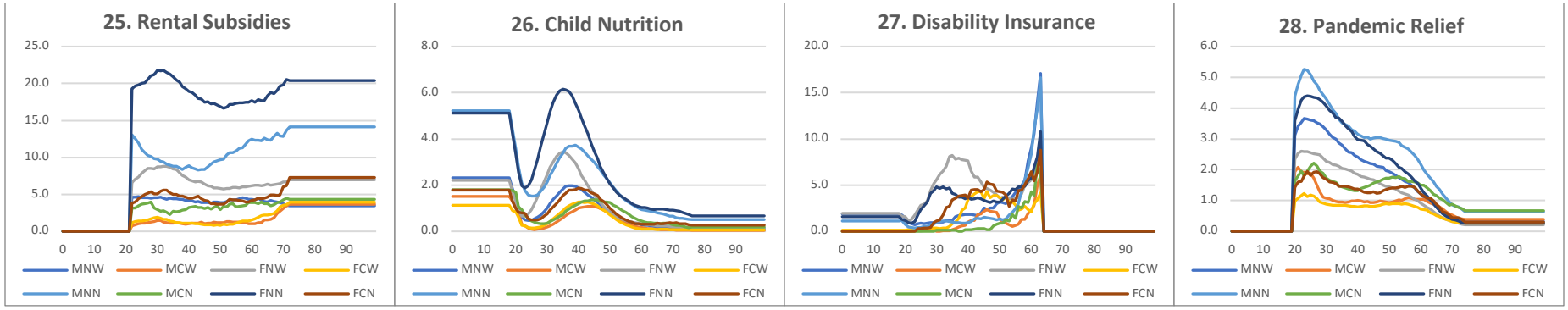

5. Supp. Nutrition Assistance
6. Supp. Security Income
7. Unemployment Compensation
8. Earned Income Credit
MNW MCW FNW FCW
MNN MCN FNN FCN

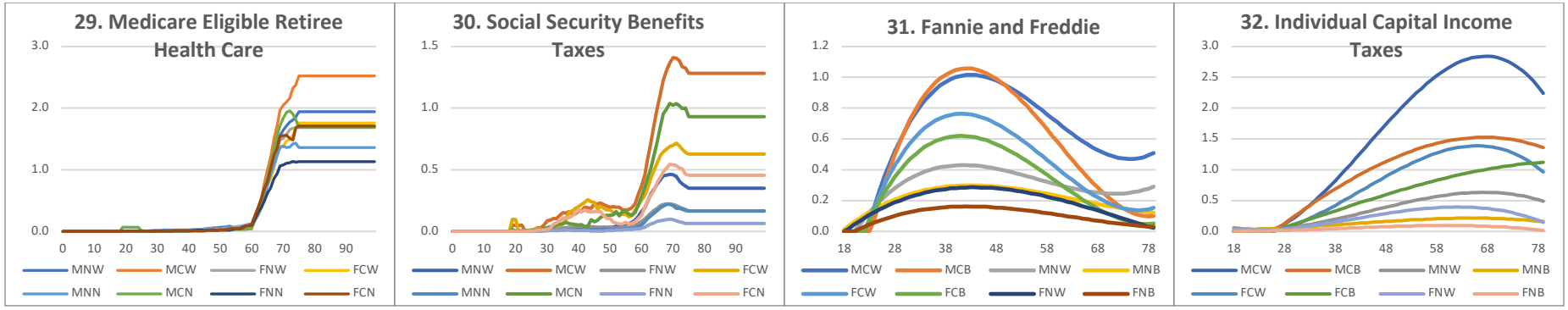

9. Child Tax Credit
10. Welfare Transfers
11. Civilian Retirement
12. Military Retirement
MNW MCW FNW FCW
MNN MCN FNN FCN

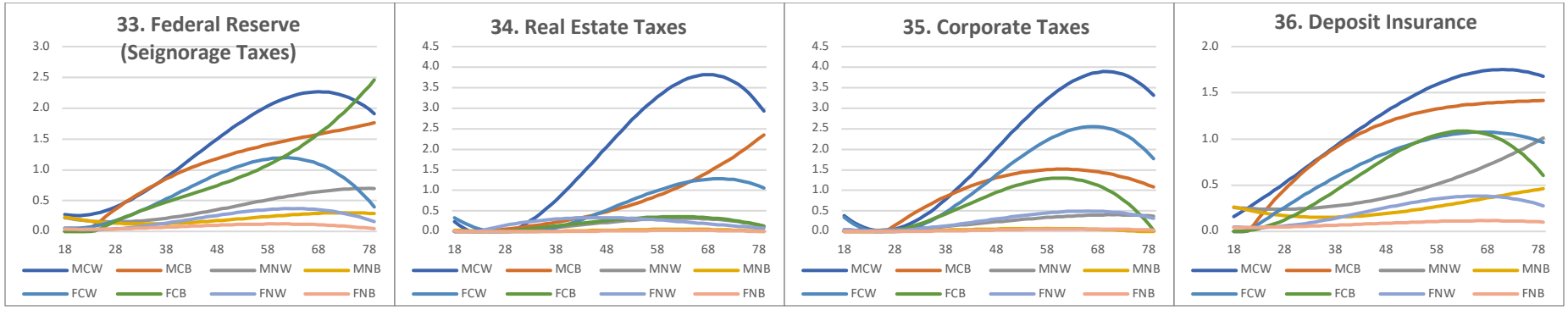

13. Health Ins. Premium Subsidy
14. Veterans Benefits
15. Farm Subsidies
16. Education Benefits
MNW MCW FNW FCW
MNN MCN FNN FCN


17. Higher Education Benefits
18. Federal Share Social Security
19. Fed Civilian Retirement Contributions
20. Military Retirement Contributions
MNW MCW FNW FCW
MNN MCN FNN FCN


21. Labor Income Taxes
22. OASDI Payroll Taxes
23. Medicare Payroll Taxes
24. In Labor Force
MNW MCW FNW FCW
MNN MCN FNN FCN


25. Rental Subsidies
26. Child Nutrition
27. Disability Insurance
28. Pandemic Relief
MNW MCW FNW FCW
MNN MCN FNN FCN


29. Medicare Eligible Retiree Health Care
30. Social Security Benefits Taxes
31. Fannie and Freddie
32. Individual Capital Income Taxes
MNW MCW FNW FCW
MNN MCN FNN FCN
MCW MCB MNW MNB
FCW FCB FNW FNB


33. Federal Reserve (Seignorage Taxes)
34. Real Estate Taxes
35. Corporate Taxes
36. Deposit Insurance
MCW MCB MNW MNB
FCW FCB FNW FNB

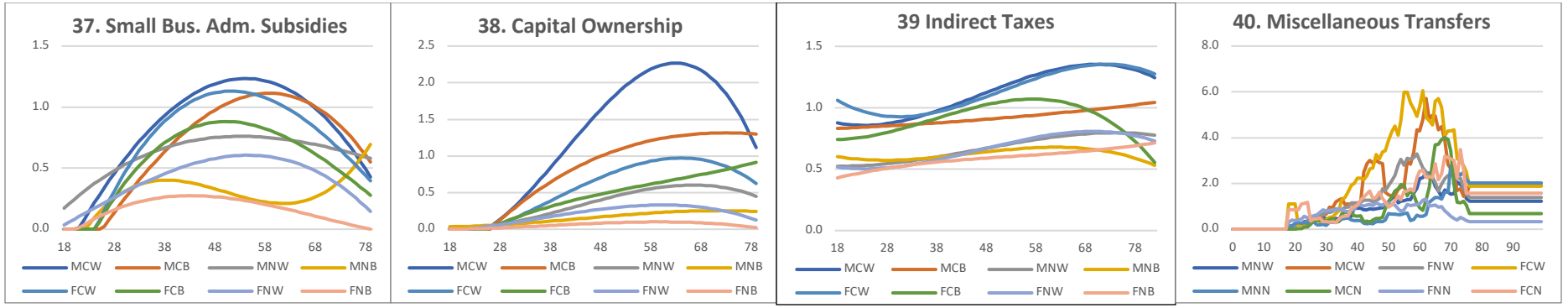


Figure A4.2: Relative tax and transfer profiles by single year of age.

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, N=Nonwhite.

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.[35] 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.

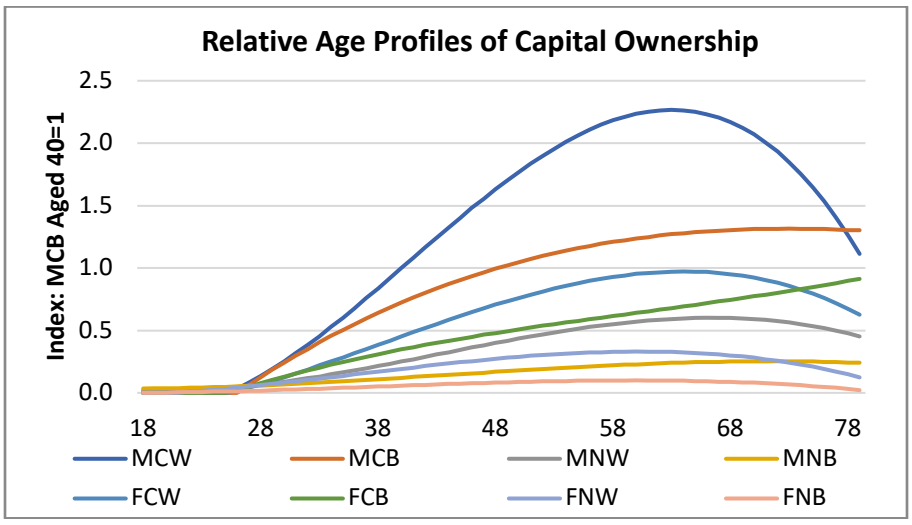


Figure A5.1: Relative Age Profiles of Fixed Capital Ownership by Person Type.
Source: Authors' calculations from the Federal Reserve's Survey of Consumer Finances.

[35] 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

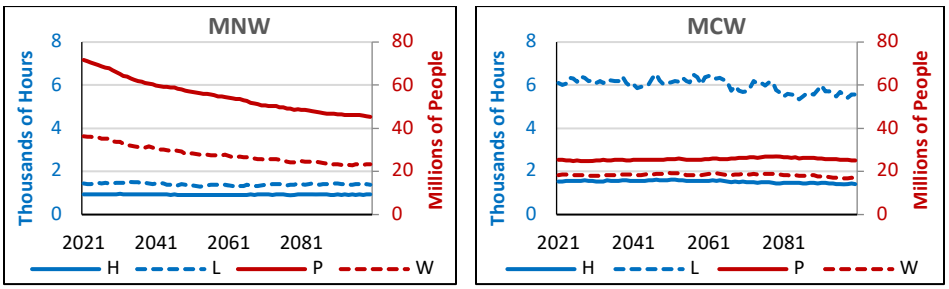
Projection of the productive capital stock for future years assumes that relative holding patterns of claims on that stock will remain constant and changes in population's size and in the relative proportions of person-types in the population will drive the evolution of the stock. Projecting aggregate 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 nonwhite female with less than high-school education (FC1N).

Person Type	MCW	FCW	MNW	FNW	MCN	FCN	MNN	FNN
Average Wage: $ Per Hour	58.70	36.71	24.01	17.73	45.56	31.53	18.72	15.28
Relative Labor Efficiency Index FC1N=1	3.84	2.40	1.57	1.16	2.98	2.06	1.22	1.00

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: N=Less than College, C=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).



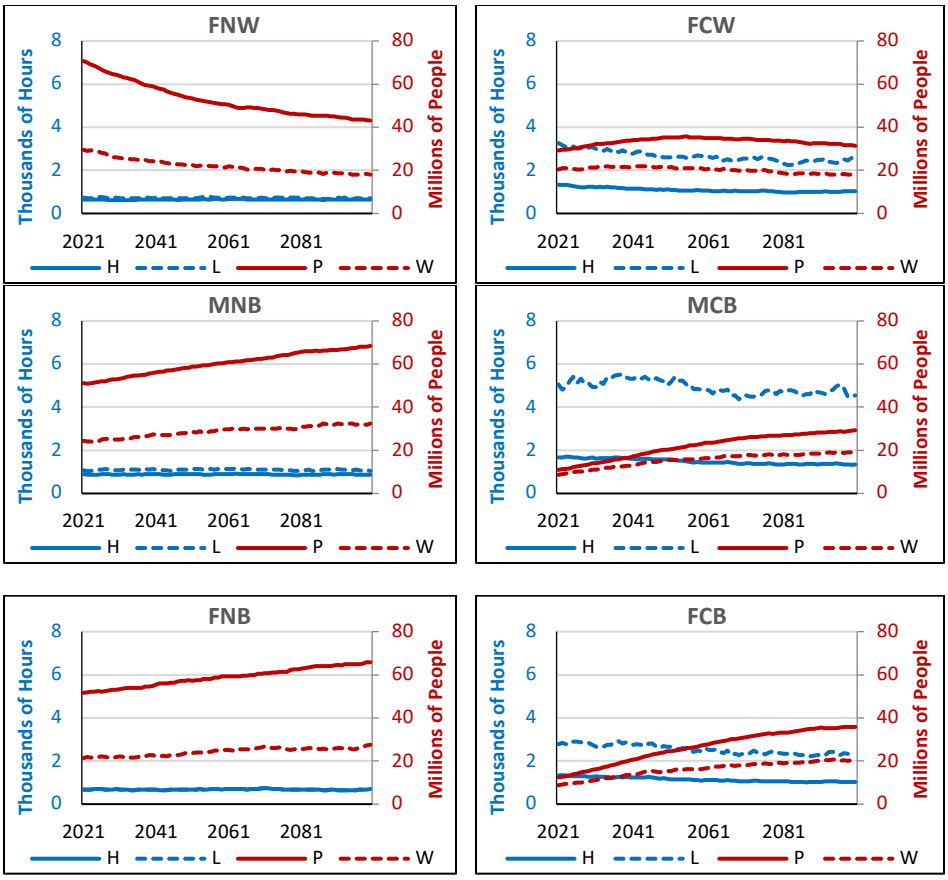


Figure A5.2: Projected total population (P), worker population (W), average hours per worker (H), and average efficiency-adjusted hours per worker (L) by person type through 2095.
Source: Author's calculations from the PWBM Microsim.
Title legend: Person types: Gender: M=Male F=Female; Education: N=Less than College, C=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 nonwhites, each gender-education group has lower hours and efficiency-adjusted hours relative to their white counterparts.[36]

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.[37] 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

[36] 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.

[37] 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.[38] Next a power regression is estimated on the historical ratio of the government capital stock to total government employee compensation.[39] 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.[40]

In order to ensure that our GDP estimates are consistent with those of the Congressional Budget Offices' (CBO) projections (since the budget aggregates through the year 2030 are those

[38] 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 $\hat{b} = -0.0654$.

[39] 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 $\hat{b} = 0.003$.

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

of the CBO), we benchmark our GDP projections to those of the CBO in 2030. Nominal GDP projections after 2030 are based on PWBM's calculations described above.

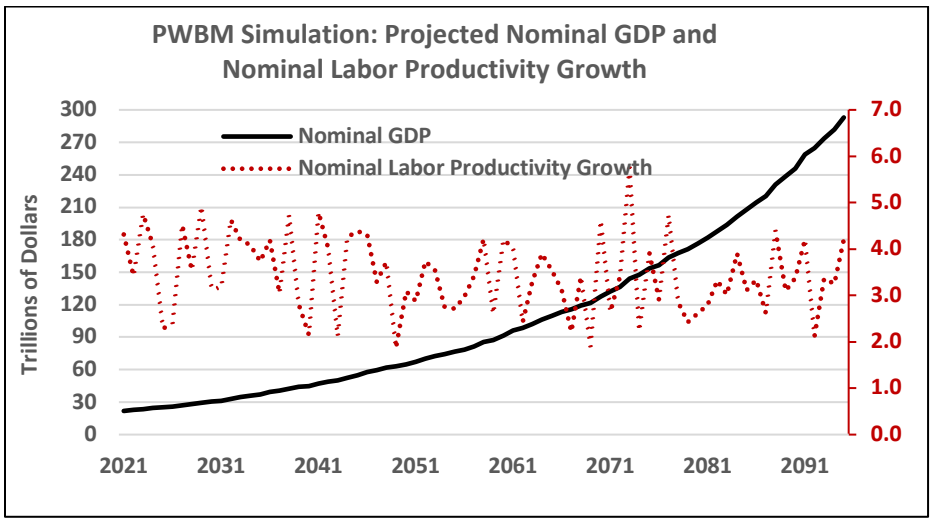


Figure A6.1: Projected nominal GDP and nominal labor productivity growth.
Source: Author's Calculations from the PWBM microsimulation.

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
	1,338.3	2,481.1

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.[41] 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. [42]

[41] See the Appendix in Auerbach, Gokhale, and Kotlikoff (1991) for the derivation of the formulae for Q and Δ.
[42] 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 5.

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	151737	152263	77479	2616	3869	12270	248497	38829	32488	6513	4369	14562	96761
2051	-30	237342	237322	120694	4063	6027	19083	387189	60127	50334	10014	6780	22592	149847
2041	-20	365921	364614	185499	6236	9251	29296	594896	91944	77017	15070	10407	34538	228975
2031	-10	570085	553492	282619	9453	13961	44408	903933	133947	111861	21746	15829	50465	333848
2021	0	826727	816452	414530	13927	20770	65259	1330938	203334	171330	29341	23038	77168	504212
2011	10	950522	951624	480116	16212	24380	74925	1547257	241593	207664	28038	25885	93555	596735
2001	20	1046725	1008313	507060	16746	25665	78213	1635997	237788	207045	23126	26138	95175	589272
1991	30	1001961	1026855	480999	15251	27591	77222	1627918	253304	220611	20134	23448	108459	625957
1981	40	760077	932449	380832	13072	27264	70054	1423670	271686	230611	17639	18835	124822	663594
1971	50	458630	801936	277522	11262	25253	61680	1177654	306958	239075	15747	14676	142567	719024
1961	60	77897	577549	161511	8621	18853	48580	815115	338451	229104	12070	10248	147346	737218
1951	70	-138414	381997	82322	6144	11913	33629	516006	315782	190703	9483	6069	132382	654419
1941	80	-99734	234438	44228	3845	6284	21581	310377	200308	110367	6851	3773	88811	410111

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	53852	89446	51143	2841	1327	9714	154470	37524	40747	12095	4263	5989	100618
2051	-30	80982	140754	79959	4462	2109	15247	242530	60499	65921	18827	6643	9659	161548
2041	-20	123676	220689	124540	6971	3338	23843	379381	96163	105201	28641	10303	15397	255705
2031	-10	201848	330238	187963	10430	4914	35709	569255	138424	150611	40623	15540	22210	367408
2021	0	300240	478211	272723	15106	7090	51510	824640	199105	217224	53711	22296	32064	524400
2011	10	359941	553420	314072	17430	8213	58382	951517	228032	252299	49506	24370	37369	591576
2001	20	388151	608263	339506	18667	8950	62644	1038030	253912	284425	43692	24937	42913	649879
1991	30	323742	619081	316319	17132	9768	61864	1024164	277438	310953	39370	22379	50282	700422
1981	40	157915	576885	253892	15356	10436	58113	914682	305749	337315	37717	17997	57989	756767
1971	50	-35112	477571	177142	13006	9798	50052	727570	321678	333324	33849	12469	61363	762682
1961	60	-267079	349822	103017	10559	8042	38883	510322	350405	325797	31270	8220	61709	777401
1951	70	-294290	205103	45466	7008	4839	23088	285505	276924	228293	22543	5095	46940	579795
1941	80	-181990	113069	22885	4178	2495	11946	154571	164299	124794	15781	3444	28243	336562

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	-9839	45529	35630	1432	299	5709	88600	31555	29935	20378	8536	8035	98439
2051	-30	-10591	69052	54323	2166	448	8634	134622	45898	43478	31075	13034	11728	145213
2041	-20	-17591	105187	82547	3301	688	13155	204878	71021	67246	46251	19781	18169	222469
2031	-10	-26573	162893	127294	5101	1081	20309	316678	111315	105357	67528	30336	28715	343251
2021	0	-316	225607	178139	7039	1455	27859	440100	141198	132954	87110	42285	36869	440416
2011	10	20078	269344	211735	8401	1756	32135	523371	166482	160312	83311	48089	45099	503293
2001	20	55425	300613	234837	9117	1999	34530	581096	177102	173015	72431	51994	51129	525671
1991	30	20176	288817	216980	8135	2128	32023	548082	185498	178732	58579	48770	56327	527906
1981	40	-121496	256026	174773	7388	2232	29788	470208	227382	209586	47208	38753	68775	591703
1971	50	-228318	187480	113889	5848	1800	24131	333148	238542	195666	31615	25925	69718	561467
1961	60	-340699	117829	57473	4333	1158	18638	199431	256240	182972	17098	15070	68749	540130
1951	70	-348356	71735	23388	3166	588	13986	112864	234929	154600	7359	7757	56576	461219
1941	80	-205470	42327	11307	1952	225	8924	64736	142113	87218	2471	4609	33795	270206

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	-63027	30668	22159	1599	492	5346	60264	39328	42677	27075	10505	3705	123291
2051	-30	-87092	45203	32862	2340	727	7835	88967	55498	59378	40259	15657	5267	176059
2041	-20	-132955	71716	52150	3692	1155	12359	141073	86494	92298	62202	24778	8256	274027
2031	-10	-193929	105452	76686	5447	1698	18231	207513	128074	136571	88140	36466	12191	401443
2021	0	-272455	155893	113383	8041	2509	26702	306528	187688	200987	118728	53538	18041	578983
2011	10	-269261	182618	132776	9353	2946	29918	357611	206809	224831	113699	60809	20724	626873
2001	20	-238103	198724	143759	9873	3217	30953	386527	209282	229416	97708	66030	22194	624630
1991	30	-310482	202264	136182	9557	3227	31274	382504	245057	278528	82270	60893	26238	692986
1981	40	-342167	176754	108098	8461	2556	28481	324350	249063	289089	60992	40040	27333	666518
1971	50	-386342	135262	72996	7041	1680	24489	241469	256351	278945	41111	23386	28018	627811
1961	60	-441687	85852	37219	5437	913	18852	148273	268826	258721	23449	12717	26247	589960
1951	70	-383518	44637	13998	3715	398	12414	75162	224661	197111	10726	6114	20069	458680
1941	80	-220753	20718	6535	2152	162	6842	36410	131294	106475	4257	3503	11634	257163

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	94002	120462	71351	2419	1820	11071	207123	41364	42270	10210	5755	13522	113121
2051	-30	143342	182771	108461	3677	2755	16809	314473	62572	63964	15502	8748	20346	171132
2041	-20	229701	276171	164829	5536	3993	25286	475814	89339	91350	22720	13261	29443	246113
2031	-10	354120	434328	258010	8676	6383	39707	747104	143273	146325	35312	20709	47365	392983
2021	0	531864	622788	371496	12418	8922	56584	1072208	196377	200293	48461	29551	65662	540344
2011	10	604568	721929	428415	14407	10627	64582	1239959	231892	239412	52167	33011	78909	635391
2001	20	687157	779903	459868	15087	11244	68181	1334283	236319	242934	50224	34205	83444	647126
1991	30	612518	800612	444026	13831	12655	69383	1340507	271237	273309	52031	32978	98434	727989
1981	40	385907	736469	371227	12302	13641	65123	1198762	310794	302015	51526	29755	118766	812855
1971	50	92705	556528	254088	9759	12660	53090	886125	320815	282572	44361	22915	122756	793420
1961	60	-170196	366438	146655	7211	10852	39899	571054	325132	251288	34897	15153	114780	741250
1951	70	-304402	258259	85247	5843	9901	32340	391591	325726	228000	30743	9306	102217	695992
1941	80	-288044	217060	67498	5223	9380	28019	327180	294046	199598	31309	7692	82578	615223

Table A9.5: The Composition of Generational Accounts for Nonwhite 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	31965	76092	48961	2369	446	9771	137640	38405	43599	12908	6167	4596	105675
2051	-30	49775	114668	74003	3578	671	14720	207640	57354	64976	19360	9333	6843	157865
2041	-20	71900	179626	115261	5580	1054	23113	324635	91947	104701	30532	14520	11035	252735
2031	-10	129863	267263	173293	8350	1565	34065	484535	129079	145137	43412	21767	15277	354672
2021	0	185296	400413	257886	12449	2363	50837	723948	196763	222975	63245	32079	23589	538652
2011	10	216670	460082	296024	14291	2709	57320	830426	225385	257858	67378	35874	27262	613756
2001	20	244605	500314	317912	15211	2990	60893	897320	241673	277453	66305	37643	29641	652715
1991	30	176322	504696	298693	14049	3231	60851	881520	264904	304110	66941	35030	34214	705199
1981	40	26757	449897	237187	12066	3098	56653	758900	279832	319698	64166	27516	40932	732143
1971	50	-148470	353904	161187	9520	2514	48920	576046	288562	313698	57132	19260	45864	724516
1961	60	-257585	229586	85931	6254	1535	37432	360738	263906	256113	42587	11744	43973	618323
1951	70	-319816	158625	43391	4052	803	32444	239316	248358	224899	37915	8138	39822	559132
1941	80	-254248	121991	28964	2502	428	27340	181225	195121	166865	36025	6556	30906	435473

Table A9.6: The Composition of Generational Accounts for Nonwhite 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	-54550	30478	27435	1482	49	5084	64529	28290	39279	32027	12398	7083	119078
2051	-30	-71785	45088	40734	2176	72	7449	95519	38487	53396	47267	18390	9764	167304
2041	-20	-119835	70513	63547	3422	114	11724	149320	63577	88031	72799	28700	16047	269155
2031	-10	-166217	106215	95803	5130	171	17533	224852	92441	127234	104801	43109	23484	391069
2021	0	-240232	159260	143528	7692	257	26093	336829	140259	192275	145053	63704	35771	577061
2011	10	-200560	180115	162813	8625	284	28081	379917	141882	195611	136847	68563	37573	580477
2001	20	-230614	199908	179023	9400	305	30242	418878	169082	233407	128094	73166	45743	649492
1991	30	-242656	184715	161710	8084	307	26663	381480	167676	228632	111101	67890	48836	624136
1981	40	-325337	147813	124390	6827	319	22859	302207	183507	238493	96884	54091	54570	627544
1971	50	-347856	99559	79624	5196	265	17788	202431	180438	207077	72615	36806	53351	550287
1961	60	-384944	53465	37752	3588	156	13138	108099	188826	185100	45956	21297	51864	493043
1951	70	-352595	28426	15075	2444	54	10298	56297	171624	156672	26897	11754	41945	408892
1941	80	-167784	13874	5979	1132	2	5282	26269	84816	71988	10818	6023	20408	194053

Table A9.7: The Composition of Generational Accounts for Nonwhite 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	-97616	17636	16939	1416	20	4261	40272	29732	43592	44852	17564	2148	137888
2051	-30	-145805	27701	26594	2187	31	6594	63107	44488	64830	68994	27358	3242	208912
2041	-20	-223640	42477	40795	3363	48	10139	96823	68724	100112	104584	42047	4996	320463
2031	-10	-315412	64221	61726	5011	73	15149	146179	98461	141773	150831	63299	7227	461591
2021	0	-451504	95135	91287	7423	109	22188	216142	146144	211489	206720	92479	10814	667645
2011	10	-491451	111600	106898	8733	128	24913	252272	168895	249232	207637	105082	12877	743723
2001	20	-460953	116818	111421	8969	126	24810	262144	168239	250367	180894	110288	13310	723097
1991	30	-450959	108964	100864	8043	134	22649	240654	167543	251981	156991	101431	13667	691613
1981	40	-424188	84281	75531	6582	138	18622	185154	160530	241504	126521	67547	13240	609342
1971	50	-476225	59459	50852	5656	133	15689	131789	184713	258380	107794	42583	14544	608013
1961	60	-424820	29859	23117	4021	80	10926	68004	173377	212822	69168	23998	13458	492824
1951	70	-363364	13148	8317	3018	27	7531	32040	153320	172616	43895	14606	10968	395404
1941	80	-225726	6089	4127	2052	1	4717	16987	98279	102845	25027	9490	7071	242712

Table A9.8: The Composition of Generational Accounts for Nonwhite 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										
			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	4369	317	621	359	117	306	1044	255	715	250	385	0
2051	-30	6780	495	968	552	183	476	1618	396	1114	386	592	0
2041	-20	10407	761	1485	844	282	732	2483	608	1712	592	908	0
2031	-10	15829	1156	2251	1292	429	1118	3773	917	2620	901	1373	0
2021	0	23038	1698	3326	1874	628	1630	5531	1356	3835	1316	1844	0
2011	10	25885	1975	3882	2073	726	1887	6353	1566	4423	1533	1467	0
2001	20	26138	2109	4159	1610	787	2080	6340	1623	4929	1561	936	5
1991	30	23448	2054	4335	577	762	2091	4874	1693	5116	1117	810	19
1981	40	18835	1575	3955	179	514	1491	3276	1666	4641	916	604	17
1971	50	14676	1094	3488	71	289	894	2332	1607	3925	712	246	18
1961	60	10248	655	2735	30	139	391	1714	1242	2743	516	66	19
1951	70	6069	408	1852	10	85	124	1254	846	1015	405	26	44
1941	80	3773	247	1223	4	55	76	791	556	421	330	14	56

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										
			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	4263	222	159	285	207	490	1049	667	549	292	342	0
2051	-30	6643	347	251	440	324	762	1637	1038	860	457	528	0
2041	-20	10303	539	393	674	503	1179	2540	1611	1341	710	812	0
2031	-10	15540	816	588	1030	761	1795	3832	2407	2018	1068	1226	0
2021	0	22296	1184	852	1497	1106	2609	5568	3336	2928	1548	1669	0
2011	10	24370	1366	984	1664	1273	3011	6362	3120	3372	1786	1432	0
2001	20	24937	1503	1102	1352	1417	3387	6640	2656	3850	1936	1084	7
1991	30	22379	1437	1133	479	1378	3391	5344	2520	4054	1643	975	25
1981	40	17997	1063	1062	175	1056	2531	3905	2515	3628	1372	673	17
1971	50	12469	630	934	71	634	1155	2693	2267	2829	1006	237	14
1961	60	8220	320	687	35	334	257	1928	1772	1974	810	79	26
1951	70	5095	147	374	12	192	52	1298	1146	1153	629	42	50
1941	80	3444	80	224	5	117	24	787	718	918	487	23	60

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										
			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	8536	136	835	153	243	1047	1528	1636	1196	1133	629	0
2051	-30	13034	207	1255	236	369	1612	2337	2488	1827	1735	968	0
2041	-20	19781	314	1919	356	561	2438	3544	3785	2774	2629	1461	0
2031	-10	30336	485	2985	539	868	3713	5433	5824	4273	4020	2197	0
2021	0	42285	674	4069	776	1205	5306	7656	7952	6004	5694	2950	0
2011	10	48089	804	4887	877	1440	6256	9032	8460	7125	6744	2463	0
2001	20	51994	895	5552	705	1634	7403	9699	8428	8312	7600	1740	26
1991	30	48770	836	5766	279	1652	7515	8039	7828	8900	6436	1451	69
1981	40	38753	674	5716	103	1411	4651	5764	7351	7671	4462	887	64
1971	50	25925	442	4717	42	953	1875	3532	5808	5500	2662	332	62
1961	60	15070	269	3519	19	543	645	2038	3273	3086	1485	127	66
1951	70	7757	182	2639	6	333	187	1195	1224	1042	830	61	57
1941	80	4609	109	1764	2	206	86	699	618	547	495	31	52

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										
			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	10505	93	128	173	1062	2338	1562	1829	698	1855	768	0
2051	-30	15657	138	187	259	1581	3510	2321	2707	1037	2764	1153	0
2041	-20	24778	220	296	406	2509	5562	3677	4280	1648	4370	1811	0
2031	-10	36466	323	435	603	3684	8175	5411	6303	2421	6436	2675	0
2021	0	53538	477	644	886	5459	12108	8002	9155	3581	9516	3711	0
2011	10	60809	560	750	993	6380	14129	9314	10007	4200	11110	3366	0
2001	20	66030	607	826	761	7106	16710	9871	10167	4780	12424	2737	41
1991	30	60893	573	890	285	6632	15735	8603	10036	5231	10505	2271	131
1981	40	40040	436	851	100	4091	8023	6022	8524	4495	6266	1121	111
1971	50	23386	275	766	40	2266	2347	3632	6469	3437	3666	398	91
1961	60	12717	137	554	12	1227	548	2059	3707	1989	2210	180	94
1951	70	6114	44	368	2	675	118	1194	1550	641	1331	90	102
1941	80	3503	11	235	0	403	57	672	817	300	856	46	106

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										
			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	5755	295	372	275	127	621	1525	682	824	499	535	0
2051	-30	8748	449	561	420	193	945	2321	1032	1251	759	816	0
2041	-20	13261	688	840	644	292	1447	3524	1529	1907	1142	1247	0
2031	-10	20709	1075	1329	990	458	2259	5500	2411	2989	1792	1906	0
2021	0	29551	1555	1894	1437	659	3270	7915	3363	4310	2566	2581	0
2011	10	33011	1787	2212	1606	762	3754	9081	3691	4959	2978	2181	0
2001	20	34205	1956	2406	1361	835	4215	9346	3668	5569	3262	1567	19
1991	30	32978	1918	2657	607	867	4530	8050	3884	5967	3103	1345	48
1981	40	29755	1456	2813	273	773	3953	6552	4183	5743	2844	1119	47
1971	50	22915	813	2651	138	541	2554	4760	3939	4568	2292	607	51
1961	60	15153	332	1892	57	316	1042	3233	3128	3171	1668	259	56
1951	70	9306	128	1237	9	202	394	2040	2581	1184	1320	148	62
1941	80	7692	88	1096	7	173	306	1620	2312	663	1244	117	66

Table A10.5: The Composition of Generational Accounts Welfare Programs for Nonwhite 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										
			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	6167	178	90	316	402	1059	1462	685	653	748	574	0
2051	-30	9333	269	136	482	607	1605	2215	1028	987	1130	874	0
2041	-20	14520	419	213	739	946	2487	3442	1625	1537	1766	1347	0
2031	-10	21767	633	316	1129	1417	3770	5171	2361	2317	2626	2026	0
2021	0	32079	940	472	1648	2107	5565	7666	3530	3449	3908	2794	0
2011	10	35874	1082	545	1831	2427	6423	8756	3910	3954	4499	2447	0
2001	20	37642	1182	600	1469	2670	7244	9040	4101	4459	4959	1896	24
1991	30	35030	1124	638	582	2519	7366	7395	4310	4811	4540	1665	80
1981	40	27516	808	565	274	1731	5313	5449	4333	4102	3713	1155	71
1971	50	19260	444	387	125	1116	2498	3818	4093	3283	2897	537	61
1961	60	11744	173	243	42	684	746	2314	3073	2135	1997	272	65
1951	70	8138	62	194	12	544	321	1623	2559	842	1700	191	92
1941	80	6556	37	158	0	429	254	1269	2081	506	1575	135	112

Table A10.6: The Composition of Generational Accounts Welfare Programs for Nonwhite 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										
			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	12398	105	98	134	555	2105	1885	2690	1006	2359	1462	0
2051	-30	18390	155	145	202	816	3143	2792	3947	1493	3492	2206	0
2041	-20	28700	242	227	312	1281	4876	4361	6213	2330	5457	3401	0
2031	-10	43109	365	341	469	1927	7361	6565	9293	3515	8197	5077	0
2021	0	63704	547	512	698	2893	11023	9839	13646	5265	12265	7018	0
2011	10	68563	618	577	772	3262	12647	11126	13869	5966	13919	5806	0
2001	20	73166	679	660	615	3705	14527	12097	14317	6918	15470	4111	68
1991	30	67890	612	632	267	3639	15331	10659	13384	7201	12728	3287	150
1981	40	54091	477	512	139	3012	11269	8046	12739	6220	9356	2190	131
1971	50	36806	312	375	63	2062	5546	5141	11095	4664	6355	1043	150
1961	60	21297	171	224	30	1125	2079	2621	7476	2735	4175	476	184
1951	70	11754	94	132	14	673	668	1424	4216	1152	2915	261	204
1941	80	6023	37	69	7	344	330	682	1968	586	1669	116	215

Table A10.7: The Composition of Generational Accounts Welfare Programs for Nonwhite 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										
			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	17564	50	22	148	2614	4272	1424	3033	687	3617	1699	0
2051	-30	27358	78	34	228	4088	6698	2231	4679	1079	5617	2627	0
2041	-20	42047	120	52	351	6276	10290	3425	7193	1655	8638	4047	0
2031	-10	63299	181	78	532	9463	15589	5173	10695	2505	13001	6081	0
2021	0	92479	268	116	773	13960	22883	7641	15659	3704	19117	8359	0
2011	10	105082	314	136	870	16361	26755	8936	17396	4334	22442	7538	0
2001	20	110288	330	147	673	17641	30398	9227	17060	4789	24082	5831	111
1991	30	101431	307	145	282	16091	29753	8196	16493	5048	20043	4749	324
1981	40	67547	224	111	123	9477	17454	5772	14632	4015	12834	2612	292
1971	50	42583	145	67	55	5325	6188	3711	13874	2967	8747	1239	263
1961	60	23998	70	31	23	2752	1624	1774	9546	1584	5678	645	270
1951	70	14606	30	18	20	1723	479	831	6254	553	4008	388	302
1941	80	9490	13	13	18	1126	241	479	3991	300	2777	219	313

Table A10.8: The Composition of Generational Accounts Welfare Programs for Nonwhite 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.[43] 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%	113.0	129.5	150.2	392.5	1022.1	4033.2
r=4.39%	83.9	93.8	105.9	136.6	202.9	374.8
r+1.0%	66.0	72.0	79.4	81.5	99.1	129.9
FI/PVGDP						
r–1.0%	7.2%	6.8%	6.5%	8.9%	9.1%	9.0%
r=4.39%	7.4%	7.0%	6.7%	8.2%	8.2%	8.5%
r+1.0%	7.8%	7.4%	7.0%	8.1%	7.9%	7.8%

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

[43] 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.[44]

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.

[44] 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.

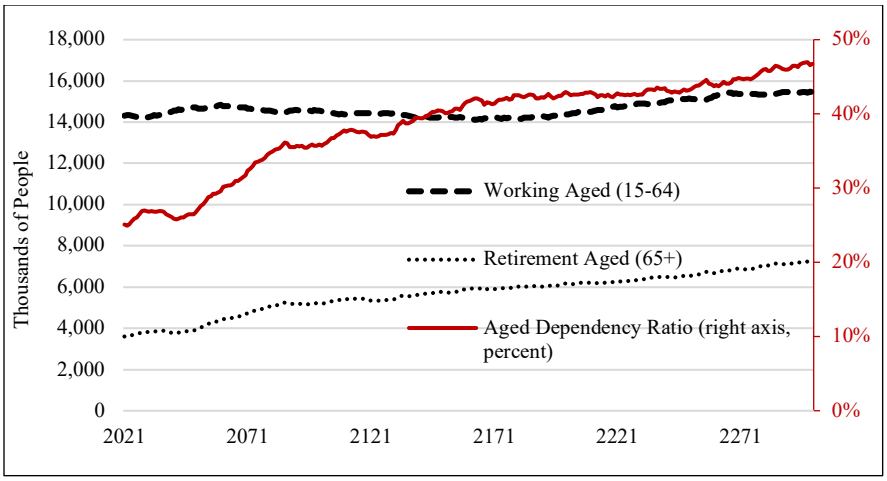


Figure 6*: *Projected populations of the working aged (15-64), retirement aged (65+) and the aged dependency ratio (right axis, percent).
Source: Authors' calculations from the PWBM microsimulation.

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%	**8.9**	**9.1**	**9.0**	5.4	4.9	4.5
r=4.39%	**8.2**	**8.2**	**8.5**	6.1	5.6	5.1
r+1.0%	**8.1**	**7.9**	**7.8**	6.9	6.3	5.8

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

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

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

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

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 $(E_0 - R_0)(1+g+n)^s$

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

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

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

Letting $n \to \infty$, write

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

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

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

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.

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

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.