Federal Budget Projections

Aggregate Methods and Fiscal Accounting

Penn Wharton Budget Model

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Abstract

This account describes how annual projections of federal receipts, program outlays, interest, and debt are assembled from policy-model estimates and externally supplied budget categories. The framework preserves supplied estimates over their available horizons, extends most categories at constant shares of nominal gross domestic product, and uses explicit spending-share targets for discretionary outlays. Residual calibrations reconcile tax-credit estimates with broader spending categories. A tariff adjustment allocates an externally estimated income and payroll tax offset across revenue accounts. Debt evolves from the primary balance and interest on inherited public debt. The resulting paths support conventional policy comparisons and provide fiscal inputs to an overlapping-generations model.

1 Economic role and closure

The research question is how a set of policy-specific revenue and spending estimates translates into a complete annual federal budget and a path of debt held by the public. Penn Wharton Budget Model (PWBM) combines household and business tax estimates, Social Security benefits, tariff receipts, and supplied budget categories into this account. The same framework supplies the overlapping-generations (OLG) model with fiscal quantities for categories that lack a dedicated conventional policy model.

The unit of analysis is a national annual budget category. The framework receives aggregate dollar amounts; it neither selects individual beneficiaries nor applies survey weights. Household eligibility, tax liability, participation, and behavioral responses enter through the upstream estimates. A scenario supplies its nominal gross domestic product (GDP) path, policy-model aggregates, off-model budget paths, interest rates, and discretionary spending assumptions. Receipts and noninterest outlays determine the primary balance. Interest and debt then follow recursively. GDP and interest rates do not respond internally to this debt path; macroeconomic responses must already be embodied in the supplied scenario inputs. There is no terminal debt target or balancing tax.

For a baseline–reform comparison, each scenario is evaluated using its selected inputs. Categories without a policy change retain their supplied baseline paths. The baseline household credit series is reused in the residual spending calibrations described below; it is not re-estimated from the reform's credits. The calculation is deterministic conditional on these inputs. A changed projected primary balance persists through inherited debt and subsequent interest, even after the direct policy effect ends; supplied historical debt is preserved.

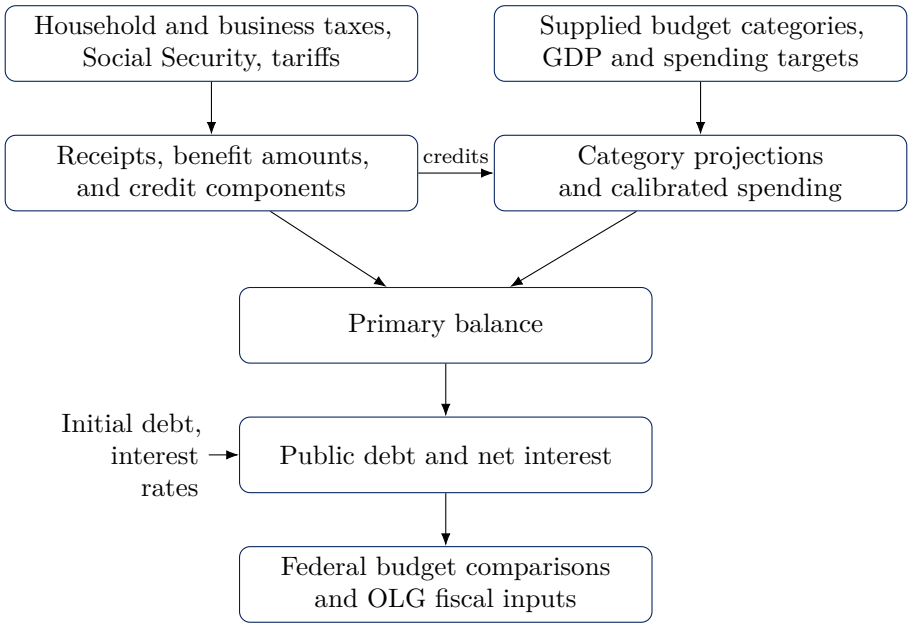


Figure 1: Economic dependencies. GDP scales extensions of both receipts and spending. The downstream budget contains the component amounts as well as balances and debt.

1.1 Time, units, and the input domain

Let t denote fiscal year, s a scenario, and 0 its designated baseline. Amounts are annual nominal billions of dollars, except that debt is a stock at the end of the year. All inputs must use a common monetary scale and annual-year convention. The assembly matches year labels directly; it performs no calendar-to-fiscal conversion, inflation adjustment, or currency conversion. Nominal fiscal-year GDP Y_t^s is the denominator for spending shares and debt ratios. Rates and shares are fractions, so a rate of 0.03 means 3 percent.

The first output year a is the latest first year among the household-tax, business-tax, economic, Social Security, and tariff interfaces. The last year T is supplied for the analysis. GDP must span the entire output horizon. The off-model paths and the baseline credit anchor must also cover every year needed by the category rules. Annual input indices must be ordered and unique. Within a supplied dollar category's usable interval, every year has a nonmissing value. Zero is an observed amount, not a missing-value code. Leading or trailing blanks delimit availability; internal gaps have no interpolation rule. Interest rates are an exception: later missing rates use the most recent available rate. Supplied values are not backcast before their first valid year. An extension needs its last supplied amount and GDP at that anchor year. Ratios require positive GDP; the tariff allocation additionally requires nonzero tax denominators.

Notation	Meaning
a, T	First and last output years, inclusive.
Y_t^s	Nominal fiscal-year GDP in scenario s.
$L(x)$	Last year with a nonmissing value in supplied series x.
$\mathcal{E}_t^s(x; L)$	Supplied series x through year L, extended thereafter using scenario GDP.
R_t^s, M_t^s, V_t^s	Total receipts, mandatory outlays, and discretionary outlays.
S_t^s, B_t^s	Primary balance and total balance, both positive for a surplus.
D_t^s, I_t^s, r_t^s	End-year public debt, net interest outlays, and effective annual interest rate.

2 Supplied paths and long-horizon projections

2.1 Data and common extension rule

PWBM's economic projections provide nominal fiscal-year GDP. Its household tax model supplies individual income, payroll, estate-related, wealth, and value-added tax receipts, total premium tax credits, refundable premium credits, and the broader refundable-credit aggregate. The business tax model supplies corporate receipts. The Social Security interface supplies separate Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) outlays. The tariff model supplies gross customs receipts and customs receipts after an income and payroll tax offset. These are aggregate inputs, not predictors estimated inside this framework.

The supplied off-model budget series draw on Congressional Budget Office (CBO) historical data, the January 2025 ten-year outlook, and the March 2025 long-term outlook [1, 2]. Their preparation combines CBO shares with PWBM nominal GDP and selected policy adjustments. Accordingly, a supplied dollar path is an empirical input in its own right, rather than an unmodified CBO forecast. The selected inputs include policy adjustments to Medicaid, income security, and other mandatory

programs. The gift-to-estate shares are attributed to CBO's estate and gift tax publication [3]. That attribution identifies the data source; the constant-share projection below is PWBM's rule.

For a supplied category x whose last retained observation is L, define

$$\mathcal{E}_t^s(x; L) = \begin{cases} x_t, & a \le t \le L, \\ x_L \dfrac{Y_t^s}{Y_L^s}, & L < t \le T. \end{cases} \tag{1}$$

The default endpoint is $L = L(x)$; write $\mathcal{E}_t^s(x)$ in this case. Equivalently, an extended amount grows each year at $Y_t^s / Y_{t-1}^s - 1$. The final supplied ratio to GDP is held fixed. Supplied history and outside projections are treated alike until their endpoint. A zero anchor remains zero; a negative offsetting-receipts anchor remains negative. No nonnegativity cap is imposed.

This rule separately extends Medicare, Medicaid, the Children's Health Insurance Program (CHIP), federal retirement, veterans programs, other mandatory programs, offsetting receipts, excise taxes, miscellaneous receipts, and the memorandum measure of net major health-program outlays. OASI and DI each preserve their own supplied annual benefit amounts and then use the same extension. Their sum is total Social Security outlays. The framework does not project beneficiary counts or average benefits separately. Credit and tariff components also use this operator, with the constructions specified in subsequent sections.

Selected dated assumption or input endpoint	Value
Last requested output year	2175
First discretionary target-path year	2026
Last supplied discretionary year	2035
Defense / nondefense target shares	0.03179 / 0.03108
Last supplied off-model mandatory and net-health memo year	2055
Last supplied excise and miscellaneous receipts year	2035
Supplied gift-to-estate share window	2020–2031
Last supplied debt and net-interest year	2024
Last supplied effective-rate year	2055

These values describe the selected dated input specification, not statutory requirements. Upstream tax, benefit, and tariff endpoints are properties of their bound input series and need not equal the off-model endpoints.

2.2 Discretionary spending targets

Defense and nondefense discretionary spending are projected separately. Let $j \in \{d, n\}$ identify defense and nondefense, $v_{j,t}$ be the supplied nominal category, p the first target-path year, and q_j the desired terminal GDP share. Let b_j be the last nonmissing supplied year for category j within $[a, T]$. The endpoint is determined by available category data within the analysis horizon. In the selected specification $p = 2026$ and $b_j = 2035$.

For $b_j \geq p$, define the inherited share $h_j = v_{j,p-1}/Y^s_{p-1}$. Discretionary outlays are

$$V^s_{j,t} = \begin{cases} v_{j,t}, & t < p, \\ Y^s_t \left[h_j + \dfrac{t-(p-1)}{b_j-(p-1)}(q_j - h_j) \right], & p \leq t \leq b_j, \\ q_j Y^s_t, & t > b_j. \end{cases} \tag{2}$$

Thus the share moves linearly from its last pre-projection value to its target, then remains constant. Nominal spending during the transition follows that share times contemporaneous GDP. Supplied dollar values during p through b_j establish availability but do not override the target path. Total discretionary spending is $V^s_t = V^s_{d,t} + V^s_{n,t}$. The inputs require the year $p-1$ and a target endpoint at or after p.

For a policy specified as an external nominal spending path, either category may instead use $\mathcal{E}^s_t(v_j)$. That alternative preserves every supplied annual amount, including a spending cut, and extends the final amount with GDP. Its GDP-share target does not enter the calculation. Defense and nondefense can choose this treatment independently.

3 Tax credits and mandatory spending

3.1 Income-security calibration

Refundable credits and other income-security programs are reconciled using a baseline anchor. Let Q^s_t be the household model's supplied refundable income-security-credit aggregate, including its refundable premium tax credit amount F^s_t. The net income-security credit input is $c^s_t = Q^s_t - F^s_t$. Subtraction takes place on common supplied years, before extension. Let U^s_t be the supplied off-model total for income security and c^0_t the corresponding credit input from the designated baseline household run. Define

$$C^s_t = \mathcal{E}^s_t(c^s), \tag{3}$$

$$N^s_t = \mathcal{E}^s_t(U^s - c^0), \tag{4}$$

$$H^s_t = C^s_t + N^s_t. \tag{5}$$

Here C^s_t is income-security credit outlay, N^s_t is the calibrated noncredit residual, and H^s_t is total income-security outlay. The residual input exists only where both U^s and c^0 are observed; its last common valid year determines its extension anchor. It is not constructed by first extending the baseline credits. The credit component and residual can consequently have different endpoints.

Within their common supplied window, $H^s_t = U^s_t + c^s_t - c^0_t$. When the off-model total is fixed across scenarios, a one-dollar increase in net refundable credits raises total income-security outlays by one dollar. In the baseline, the sum reproduces the supplied total within that window. The baseline anchor remains the same in a policy comparison, although the off-model total can itself change under a policy. Different scenario GDP paths can also change the extended residual. Beyond its own endpoint, each component follows equation (1); the within-window identity must not be extrapolated across unequal endpoints.

3.2 Premium credits and other health subsidies

Let p_t^s denote the supplied total premium tax credit (PTC), including refundable payments and reductions in income-tax liability. Let A_t^s denote the supplied broad Affordable Care Act (ACA) subsidy total. The premium-credit line uses the full cost measure rather than only its refundable part:

$$P_t^s = \mathcal{E}_t^s(p^s), \tag{6}$$

$$P_t^{0|s} = \mathcal{E}_t^s(p^0), \tag{7}$$

$$Z_t^s = \mathcal{E}_t^s(A^s - P^{0|s}), \tag{8}$$

$$J_t^s = P_t^s + Z_t^s. \tag{9}$$

$P_t^{0|s}$ is the baseline premium-credit path extended using the scenario's GDP; Z_t^s is the other-subsidy residual and J_t^s is total ACA subsidy outlay. Unlike the income-security residual, this construction uses the extended premium-credit path before subtracting it from the supplied subsidy total. The baseline household run anchors this residual as well. Where A_t^s is supplied, $J_t^s = A_t^s + P_t^s - P_t^{0|s}$. A policy change in premium credits therefore changes total subsidies when the off-model total is held fixed. After the residual's last valid year, Z_t^s grows with scenario GDP, while P_t^s continues to follow its own supplied path and endpoint.

The premium-credit line is a budget presentation of the supplied full-cost measure. The refundable premium amount is removed from income-security credits to separate the two program categories. The individual-income-tax receipt input is retained as supplied, subject to the tariff adjustment below; this assembly makes no additional premium-credit adjustment to receipts. The accounting basis of those upstream receipt and credit inputs is therefore part of the scenario specification.

3.3 Mandatory total and memorandum quantities

Mandatory outlays are the sum of Social Security, Medicare, Medicaid, ACA subsidies J_t^s, CHIP, income security H_t^s, federal retirement, veterans programs, other mandatory programs, and offsetting receipts. Medicare is entered gross of its offsetting receipts. Offsetting receipts enter with their supplied sign, generally negative, and reduce total outlays. There is no residual balancing item that forces mandatory outlays to match an external grand total.

The separately supplied measure of major health-program outlays net of offsetting receipts is extended using equation (1) and reported as a memorandum quantity. It is not added to mandatory outlays. Likewise, total Social Security, total ACA subsidies, and total income security summarize their components; adding those subtotals again to the component accounts would double-count outlays.

4 Receipts and tariff offsets

4.1 Tax projections and common endpoints

Household and business tax receipts preserve their supplied policy-model estimates over a shared usable horizon. Let k_t^s be supplied corporate receipts. For each household receipt category x^s, the

retained endpoint is

$$L_x = \min\{L(x^s), L(k^s)\}, \qquad X_t^s = \mathcal{E}_t^s(x^s; L_x). \tag{10}$$

The rule applies separately to individual income tax, total payroll tax, Social Security payroll tax, estate-related receipts, wealth tax, and value-added tax. Corporate receipts use the endpoint $\min\{L(k^s), L(i^s)\}$, where i^s is the supplied individual-income-tax series. Later observations beyond the selected endpoint are not retained. Each household category is capped at the corporate input endpoint; the corporate projection is capped at the individual-income input endpoint. Household categories with different availability can therefore have different retained endpoints.

Estate-related receipts use the upstream combined measure of estate tax and capital-gains taxation at death. Denote its extended value by E_t^s. Gift receipts are linked to this entire measure. For the set $\mathcal{W}$ of all years with a nonmissing supplied gift-to-estate share u_τ, define

$$\bar{u} = \frac{1}{|\mathcal{W}|} \sum_{\tau \in \mathcal{W}} u_\tau, \qquad G_t^s = \bar{u} E_t^s. \tag{11}$$

$|\mathcal{W}|$ is the number of valid annual shares. The mean is unweighted, uses all supplied valid years rather than only output years, and applies to every output year, including supplied history. In the selected inputs $\mathcal{W}$ covers 2020–2031. This is an aggregate allocation assumption, not a separate gift-tax liability calculation; changes to the estate-related base carry through proportionally to gifts.

4.2 Gross customs receipts and offset allocation

Let K_t^s and $N_t^{K,s}$ be the separately extended tariff-model series for gross customs receipts and receipts net of the income and payroll offset. The model receives this offset's magnitude from the tariff calculation; it does not estimate an elasticity of taxable income here. Let $I_t^{\text{tax},s}$, W_t^s, and $W_t^{\text{SS},s}$ denote individual income tax, total payroll tax, and Social Security payroll tax before reallocation. The effective reallocation year is $e = 2026$. Define

$$O_t^s = \begin{cases} 0, & t < e, \\ K_t^s - N_t^{K,s}, & t \geq e, \end{cases} \qquad Z_t^{\text{tax},s} = I_t^{\text{tax},s} + W_t^s. \tag{12}$$

O_t^s is the offset and $Z_t^{\text{tax},s}$ its allocation denominator. Reported customs, individual income, and payroll receipts are

$$K_t^{*,s} = N_t^{K,s} + O_t^s, \tag{13}$$

$$I_t^{*,s} = I_t^{\text{tax},s} - O_t^s \frac{I_t^{\text{tax},s}}{Z_t^{\text{tax},s}}, \tag{14}$$

$$W_t^{*,s} = W_t^s - O_t^s \frac{W_t^s}{Z_t^{\text{tax},s}}, \tag{15}$$

$$W_t^{\text{SS}*,s} = W_t^{\text{SS},s} - \left(O_t^s \frac{W_t^s}{Z_t^{\text{tax},s}} \right) \frac{W_t^{\text{SS},s}}{W_t^s}. \tag{16}$$

Non-Social-Security payroll receipts are $W_t^{*,s} - W_t^{\text{SS}*,s}$. The allocation uses pre-adjustment shares throughout. It requires $Z_t^{\text{tax},s} \neq 0$ and $W_t^s \neq 0$ and imposes no sign or size cap on the supplied offset. Before 2026, customs receipts are reported net and the other tax categories are unchanged. From 2026, customs receipts are gross and the income/payroll offset reduces those respective taxes. The effective year is separate from the discretionary projection start.

The identity

$$K_t^{*,s} + I_t^{*,s} + W_t^{*,s} = N_t^{K,s} + I_t^{\text{tax},s} + W_t^s \tag{17}$$

shows that this adjustment changes the classification of revenue, not its combined total. The shares also preserve the decomposition of total payroll receipts into Social Security and other payroll receipts.

Total receipts R_t^s add adjusted individual income tax, adjusted total payroll tax, corporate income tax, reported customs, excise taxes, miscellaneous receipts, estate-related receipts, wealth tax, value-added tax, and gifts. The two payroll subcategories replace total payroll when constructing the sum from detailed categories; they are not additional sources of revenue.

5 Balances, interest, and debt

Define the primary balance as

$$S_t^s = R_t^s - M_t^s - V_t^s. \tag{18}$$

A positive value is a surplus; a negative value is a deficit. All outlay components retain their nominal annual amounts and signs. The primary balance excludes net interest.

Let $d = L(D^{\text{input}})$ be the last supplied end-year debt observation. The input domain requires $d \geq a - 1$, so the first calculated year has an inherited debt stock without an unmodeled gap. Supplied debt and net interest are retained through d, rather than being reconciled retroactively to the constructed primary balance. For each output year after d, the recursion is

$$I_t^s = r_t^s D_{t-1}^s, \tag{19}$$

$$D_t^s = D_{t-1}^s - S_t^s + I_t^s = (1 + r_t^s) D_{t-1}^s - S_t^s. \tag{20}$$

The effective annual interest rate is supplied externally. Missing later rates take the most recent supplied value, including after the final rate observation; the initial forecast rate must be available. Interest is charged on the inherited end-year stock, so borrowing associated with the current year's primary deficit begins affecting interest in the next year. The projected debt identity has no additional stock–flow adjustment. It is an aggregate effective-rate calculation rather than a security-by-security maturity model. Supplied historical interest is retained because it need not equal the annual effective rate times prior end-year debt.

Total outlays and the total balance are

$$\text{Outlays}_t^s = M_t^s + V_t^s + I_t^s, \qquad B_t^s = R_t^s - \text{Outlays}_t^s = S_t^s - I_t^s. \tag{21}$$

For projected years $D_t^s - D_{t-1}^s = -B_t^s$. The reported debt-to-GDP ratio is D_t^s / Y_t^s, a fraction using end-year public debt and the same year's nominal fiscal GDP. It is neither gross federal debt nor debt per person. Beginning-year debt is the preceding output year's end-year debt; it is unreported for the first output year. A prior-year debt observation can still initialize the forecast recursion.

At fixed interest rates and common initial debt, a scenario change satisfies

$$\Delta D_t = (1 + r_t) \Delta D_{t-1} - \Delta S_t, \tag{22}$$

where Δ means reform minus baseline and r_t is the common rate. A reduction in the primary surplus raises debt, which raises future interest at positive rates. If the scenarios also change rates,

equation (20) is applied separately to each scenario. No discounting is applied to annual dollar outputs. A cumulative budget comparison over specified years is the sum of those annual differences; its horizon and whether it includes interest must be stated separately. The model's reported outputs themselves are annual levels, balances, and ratios.

A Implementation components

Assembly, inputs and aggregate outputs

Model boundary and selected settings. The assembly connects upstream policy aggregates with supplied budget categories and economic projections. It selects the horizon, discretionary treatment, and baseline household credit anchor.

Budget input preparation. Budget schedules provide nominal categories, historical debt and interest, effective rates, and gift-to-estate shares. Their preparation combines CBO data, PWBM GDP, and selected policy adjustments. These amounts are inputs to the continuation rules.

Program spending and receipts

Category continuation. The projection component preserves supplied annual estimates and extends them with GDP. Discretionary spending uses targets or external policy paths. Companion tax horizons determine when receipt extensions begin.

Credit reconciliation and revenue allocation. The credit component reconciles household credits with broader spending totals. The tariff component reallocates the income and payroll offset while preserving combined receipts. Gift receipts follow their calibrated estate-related share.

Fiscal accounting and model connections

Balances and financing. Receipts and program outlays determine the primary balance. Inherited debt and effective rates determine subsequent interest and debt. Supplied debt history is preserved.

Aggregate fiscal interface. Additive categories, subtotals, balances, and memorandum measures support federal budget comparisons and OLG fiscal inputs. Subtotals and memorandum health outlays remain separate from the additive account.

References

[1] Congressional Budget Office. 2025. *The Budget and Economic Outlook: 2025 to 2035*. January 17. https://www.cbo.gov/publication/60870.

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[3] Congressional Budget Office. 2021. *Understanding Federal Estate and Gift Taxes*. June 9. https://www.cbo.gov/publication/57129.