Principles of Macroeconomics: Government Debt

Class 20

Alex Houtz

November 17, 2025

University of Notre Dame

Overview

- Announcements:
  - LC 13/15, GH 13/15 due 11/21 at 11:59pm
- Topics:
  - Government Debt
  - Long-term sustainability
- Readings:
  - Chapters 13.3-13.4; 15.1-15.2
  - Skim chapter 14 if you want some details on the banking system

Practice Problem

Recall the equation for AD:

$$GDP = \frac{1}{1 - MPC}\left[A + MPC(TR - T) + I(r) + G\right]$$

(1) Suppose that taxes are now a linear function of income: $T = T_0 + \tau GDP$, where τ is the tax rate. Solve for GDP

(2) What is the multiplier on lump-sum taxes now? What is the multiplier on distortionary taxes?

(3) At what point will an increase in the tax rate result in a larger change in GDP than an increase in G?

(1) We plug T into the AD equation:

$$GDP = \frac{1}{1 - MPC}\left[A + MPC(TR - T_0 - \tau GDP) + I(r) + G\right]$$

Solve for GDP:

$$GDP\left(1 + \frac{\tau MPC}{1 - MPC}\right) = \frac{1}{1 - MPC}\left[A + MPC\left(TR - T_0\right) + I(r) + G\right]$$

$$GDP\left(\frac{1 - MPC + \tau MPC}{1 - MPC}\right) = \frac{1}{1 - MPC}\left[A + MPC\left(TR - T_0\right) + I(r) + G\right]$$

$$GDP = \frac{1}{1 - MPC + \tau MPC}\left[A + MPC(TR - T_0) + I(r) + G\right]$$

(2) The multiplier on T_0 is now $\frac{-MPC}{1-MPC+\tau MPC}$. The multiplier on τ is more complicated (without calculus). Subtract the new GDP from the old GDP:

$$\begin{aligned}
\Delta GDP &= \left(\frac{1}{1-MPC+(\tau+\Delta\tau)MPC} - \frac{1}{1-MPC+\tau MPC}\right)[A+MPC(TR-T_0)+I(r)+G] \\
&= \left(\frac{-\Delta\tau MPC}{(1-MPC+\tau MPC)(1-MPC+(\tau+\Delta\tau)MPC}\right)[A+MPC(TR-T_0)+I(r)+G] \\
&= \frac{-\Delta\tau MPC}{1-MPC+(\tau+\Delta\tau)MPC}\, GDP_{old}
\end{aligned}$$

We can turn this into a gross ratio by dividing by GDP_{old}:

$$\begin{aligned}
\frac{GDP^{new}}{GDP_{old}} &= \frac{-\tau MPC}{1-MPC+(\tau+\Delta\tau)MPC} + \frac{1-MPC+\tau MPC+\Delta\tau MPC}{1-MPC+(\tau+\Delta\tau)MPC} \\
\frac{GDP^{new}}{GDP^{old}} &= \frac{1-MPC+\tau MPC}{1-MPC+(\tau+\Delta\tau)MPC}
\end{aligned}$$

(3) Start from $\Delta GDP_\tau = \frac{-\Delta\tau MPC}{1-MPC+(\tau+\Delta\tau)MPC} GDP_{old}$ We know that $\Delta GDP_G = \frac{\Delta G}{1-MPC+\tau MPC}$ Set these equal and solve for $\Delta\tau$:

$$\frac{\Delta G}{1-MPC+\tau MPC} = \frac{-\Delta\tau MPC}{1-MPC+(\tau+\Delta\tau)MPC} GDP_{old}$$

$$\Delta\tau = -\frac{\Delta G(1-MPC+\tau MPC)}{MPC(GDP(1-MPC+\tau MPC)-\Delta G)}$$

What does this mean?

- The larger GDP, the less a tax cut needs to be to match an increase in G.
- Why? τ works on the whole income number, G is an absolute number

Thinking about Government Debt

Recall back to savings/investment and the government budget constraint:

$$S_{gov} = T - G - TR$$

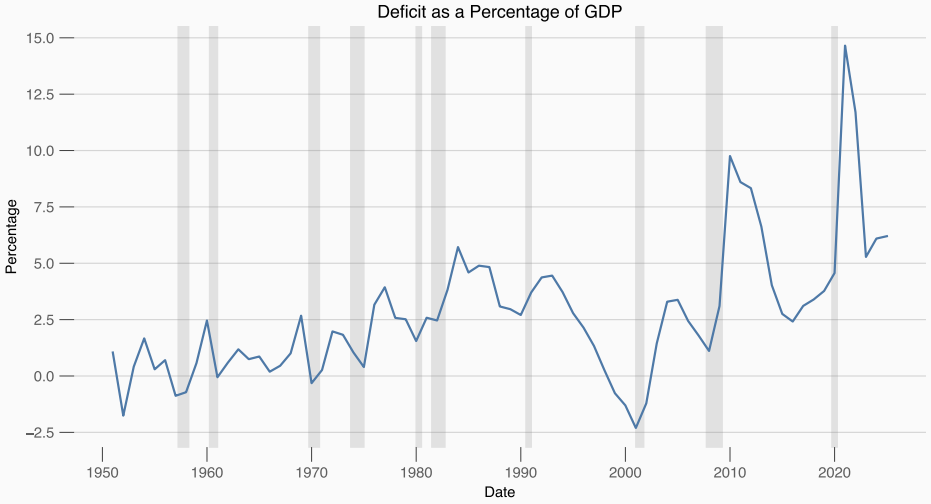
We will think of S_{gov} as the residual of this equation – if the government spends more than it brings in, it borrows

- If fiscal policy is expansionary, S_{gov} will be negative
- If fiscal policy is contractionary, S_{gov} will be positive

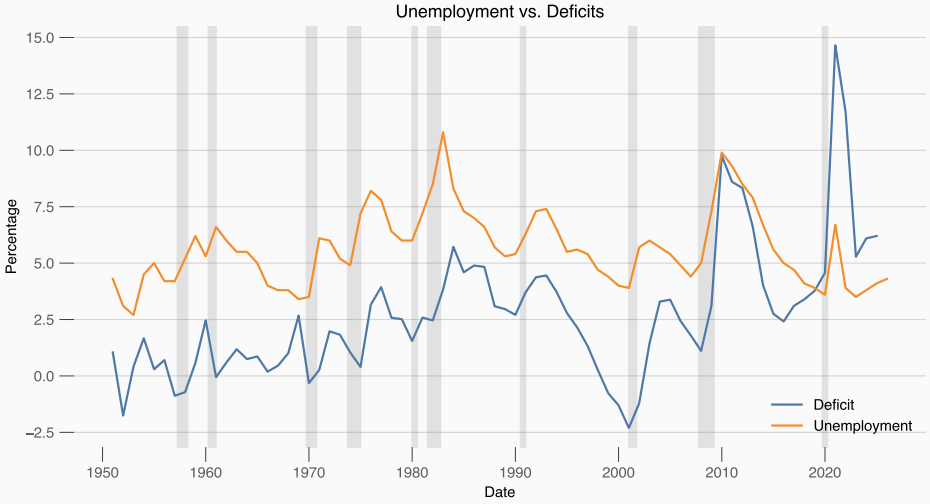
Two caveats:

(1) As we've seen a lot over the last two weeks, ΔGDP changes depending on which policy lever the government pulls
(2) Maybe the budget is changing because of the economy, not independently of it

Data First – What Happens in Recessions?



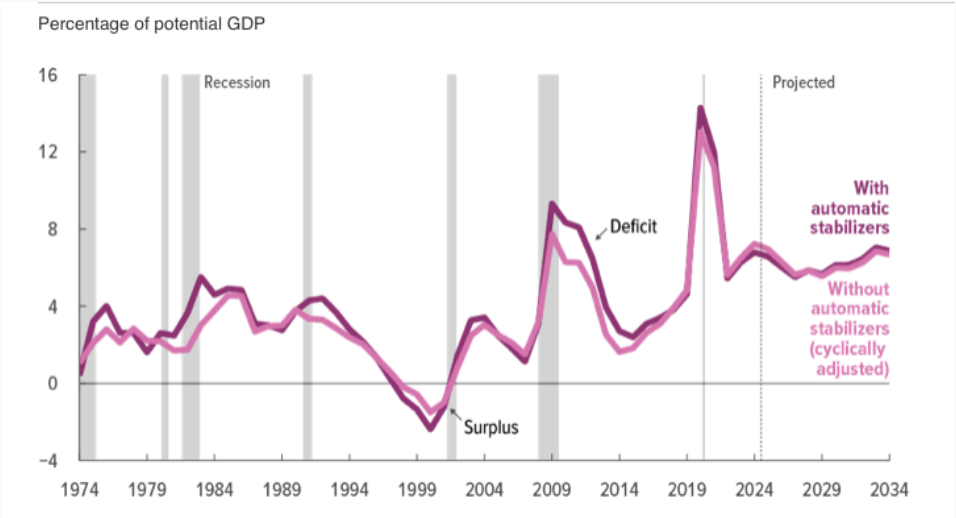
Unemployment Leads Deficits



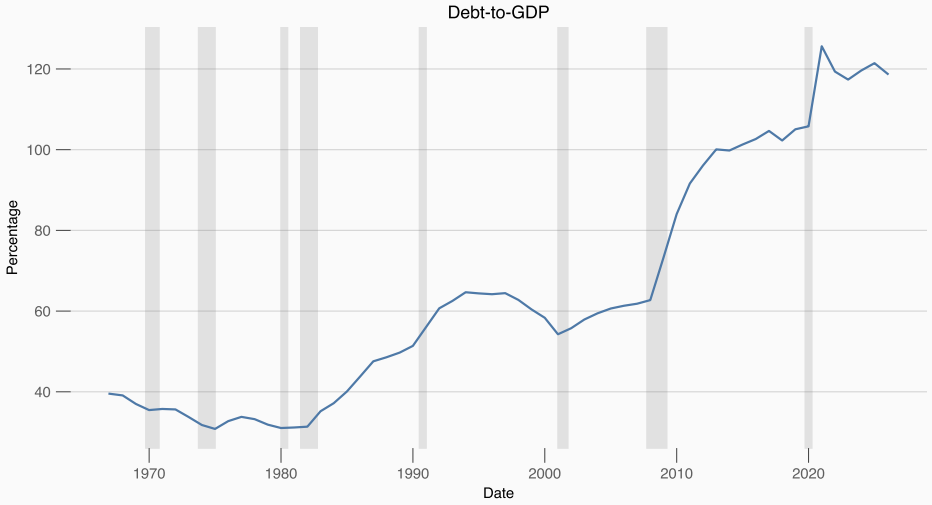
So it looks like fiscal policy is actively moving to stabilize the economy.

- But maybe this is the work of automatic stabilizers?
  - Built-in parts of the law that help bring AD back to potential
    - Think tax brackets, unemployment benefits, etc.
- Introduce a cyclically adjusted deficit – CBO produces an estimate of what the deficit would look like absent any automatic stabilization

Adjusted Deficit (CBO 2024)



Problem with Debt...



Debt Background

So debt is growing a lot, but what exactly is government debt?

- Amount of money that the government has borrowed
- US Treasury issues bonds (20-30 yr), notes (2-10 yrs), bills (<1 yr)
- Debt is held by:
  - The public – individuals, banks, etc (either foreign or domestic)
  - The government – the Fed, other government agencies (like Social Security)
  - Almost all of the debt is held by the public (80%)
- Debt is built up by deficits, repaid by surpluses
- Usually we compare debt to GDP to get an idea of how well the government could repay its debt

Let B_t be debt. Then the government budget constraint is:

$$B_t = (1 + r)B_{t-1} + G_t + TR_t - T_t$$

Recall the pie chart of government outlays from Tuesday:

- rB_{t-1} denotes interest payments on debt
- G_t denotes government consumption and investment
- TR_t denotes transfer payments

To shrink B_t, the government must shrink G_t or TR_t, or increase T_t

Debt-to-GDP is:

$$\frac{B_t}{GDP_t} = \frac{(1+r)B_{t-1} + G_t + TR_t - T_t}{GDP_t}$$

Evaluate the percent change in debt-to-GDP ($g_{B/Y} \approx g_B - g_{GDP}$):

$$g_B = r + \frac{G_t + TR_t - T_t}{B_{t-1}}$$

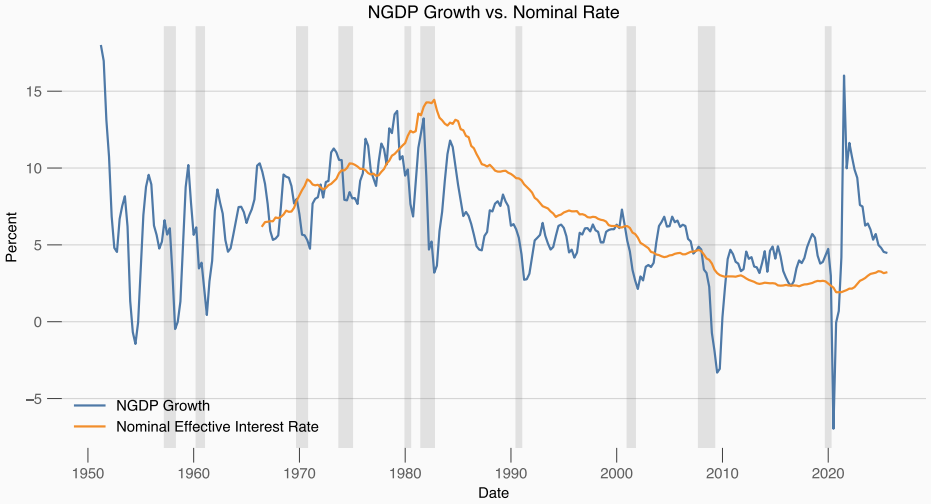
$$g_{B/GDP} = (r - g_{GDP}) + \frac{G_t + TR_t - T_t}{B_{t-1}}$$

What does this mean?

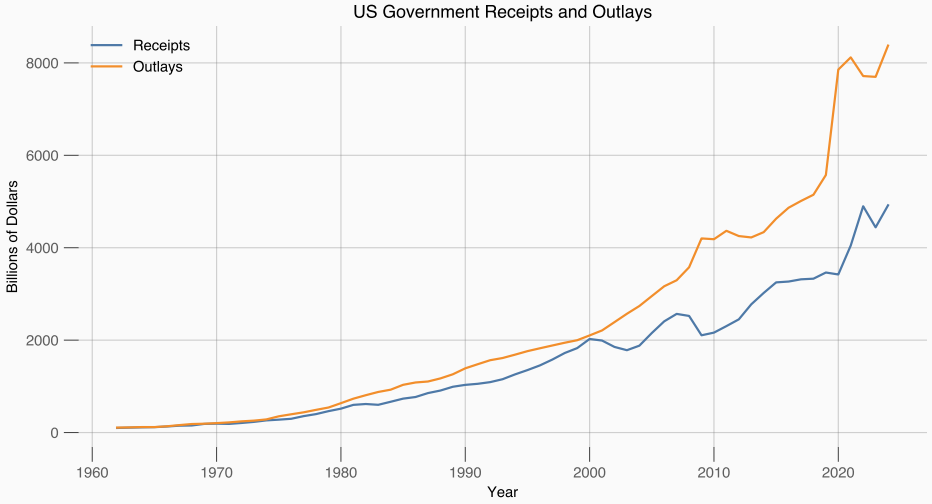
- If GDP growth is high, we shrink debt-to-GDP
- If the interest rate is high, debt-to-GDP increases
- If the primary deficit ($G_t + TR_t - T_t$) increases, debt-to-GDP increases

Why is US Debt so Out of Control?

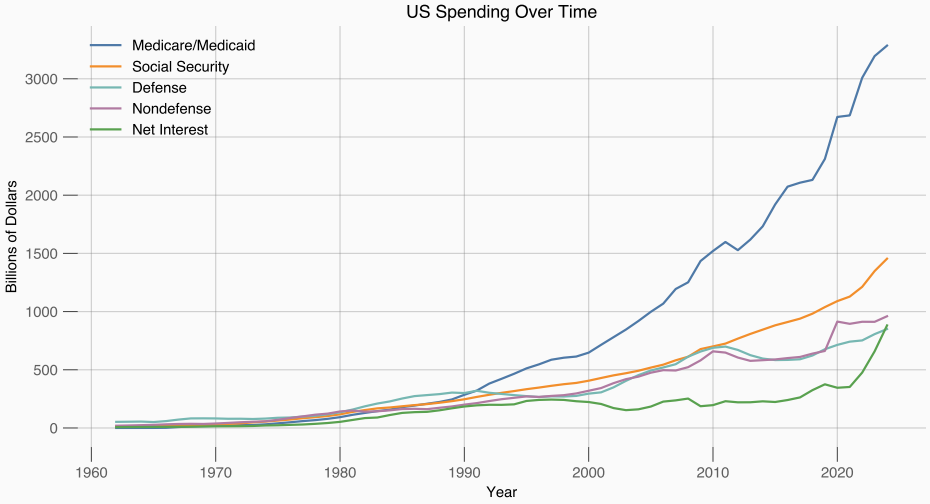
First, are we growing GDP faster than the interest rate?



So we Must be Spending...



On What?


US Spending Over Time
Medicare/Medicaid
Social Security
Defense
Nondefense
Net Interest
Billions of Dollars
3000
2500
2000
1500
1000
500
0
1960
1970
1980
1990
2000
2010
2020
Year

So What Do We Do?

(1) Cut health care costs
    - How? Voters never support cuts to Medicare/Medicaid
    - Can we be more efficient somehow?

(2) Raise more revenue
    - More taxes! Very, very popular... (no, not popular)

(3) Default
    - We could just not pay the debt
    - But this usually leads to very deep recessions that last a long time

Summary

- Government debt
- Problem is healthcare spending
- Read chapters 15.1-15.2, chapter 14 if you need more background on banking