Valuation using Textbook Finance

- Government securitizes claim to surpluses

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>$PV_{2021}({T})$</td>
<td>$PV_{2021}({G})$</td>
</tr>
<tr>
<td>Debt</td>
<td></td>
</tr>
</tbody>
</table>

- Debt is fully backed by PDV of surpluses; Fiscal Capacity:

$$PV_{2021}(\{T - G\}_{2022}^{2052}) + PV_{2021}(D_{2052}) = PV_{2021}(\{T - G\}_\infty^{2022})$$

- Suppose U.S. government collects tax revenue $T/Y$, spends $G/Y$ and runs surplus $S/Y$ that are constant as % of GDP.

$$PV_{2021}(\{T - G\}) = \frac{S}{Y} \sum_{j=1}^{\infty} \frac{Y_{2021+j}}{(1 + r^{S,y}j)^j} = pd^y \times \frac{S}{Y} \times Y_{2021}.$$ 

- Only GDP is risky in this calculation

- Measure of extra fiscal capacity per % of surplus (as fraction of GDP): Total Wealth/GDP Ratio

$$pd^y = \frac{1}{r_{f} - g} = \frac{1}{r_{f} + r_{p} - g} = \frac{1}{r_{f} - g + r_{p}}$$
Valuation using Textbook Finance

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- Measure of extra fiscal capacity per % of surplus (as fraction of GDP): Total Wealth/GDP Ratio

\[ pd^y = \frac{1}{r^{S,Y} - g} = \frac{1}{r^f + \text{term} + rp^y - g} \]

- \( r^f - g \) is not sufficient statistic; depends on risk-free rate \( r^f \) and growth rate \( g \), but also on term premium and GDP risk premium \( rp^y \) (unlevered equity premium).
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U.S. Steady-State Fiscal Capacity

- Total wealth/GDP ratio is given by
  \[ pd_y = \frac{1}{(r^f + \text{term}) + rp_y - g} = \frac{1}{2.07\% + 2.60\% - 3.50\%} = \frac{1}{1.17\%} = 85.8 \]

- Total wealth is \( 85 \times GDP \)

- What is steady-state surplus \( S/Y \) needed to get to \( PV_{2021}(\{T - G\}) = 0.99 \times Y_{2021} \)?

<table>
<thead>
<tr>
<th>Assets/GDP</th>
<th>Liabilities/GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>( PV_{2021}({T})/Y_{2021} )</td>
<td>19.7 = 23.06% \times 85.8</td>
</tr>
<tr>
<td>( D/Y_{2021} )</td>
<td>0.99 = 1.16% \times 85.8</td>
</tr>
</tbody>
</table>

- Need a steady-state primary surplus of 1.16\% of GDP to get to \( D/Y = 0.99 \)
- CBO projects deficits of 3.19\% until 2052.
Upper Bound on U.S. Steady-State Fiscal Capacity

- But tax revenue $T/Y$ is pro-cyclical (risky) and spending $G/Y$ is counter-cyclical (safer)
  - Higher risk premium on $T$ claim $rp_T > rp_Y$; lower risk premium on $G$ claim $rp_G < rp_Y$
  - Lower multiple on $T$ claim $pd_T < pd_Y$; higher multiple on $G$ claim $pd_G > pd_Y$

<table>
<thead>
<tr>
<th>Assets/GDP</th>
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<tbody>
<tr>
<td>$PV_{2021}({T})/Y_{2021} \leq 19.7 = 23.0% \times 85.8$</td>
<td>$PV_{2021}({G})/Y_{2021} \geq 18.7 = 21.9% \times 85.8$</td>
</tr>
<tr>
<td></td>
<td>$D/Y_{2021} \leq 0.99 = 1.16% \times 85.8$</td>
</tr>
</tbody>
</table>

- 0.99 is really an upper bound on fiscal capacity

$$PV_{2021}(\{T - G\}) \leq pd_y \times \frac{S}{Y} \times Y_{2021} = 0.99 \times Y_{2021}.$$
Boost Treasury’s Fiscal Capacity

- Unless you think Treasury will start to run large surpluses during pandemics and financial crises
- Suppose tax revenue $T/Y$ is counter-cyclical (safe) and spending $G/Y$ is pro-cyclical (in PDV) (risky)

\[
P V_{2021}(\{T - G\}) = pdT \times \frac{T}{Y} \times Y_{2021} - pdG \times \frac{G}{Y} \times Y_{2021}.
\]

- We can have steady-state deficits $\frac{T}{Y} << \frac{G}{Y}$ and positive fiscal capacity iff $pdT > pdY > pdG$

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<th>Assets/GDP</th>
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<tr>
<td>$PV_{2021}({T})/Y_{2021} \geq \frac{T}{Y} \times 85.8$</td>
<td>$PV_{2021}({G})/Y_{2021} \leq \frac{G}{Y} \times 85.8$</td>
</tr>
<tr>
<td>$FC \geq$</td>
<td>$\frac{S}{Y} \times 85.8$</td>
</tr>
</tbody>
</table>

- Taxpayers provide insurance and U.S. Treasury collects insurance premium
- Not what Treasury does (see Pandemic, GFC, etc.) or will do anytime soon!
Textbook Finance vs. Bubbly Finance

1. **Deterministic Economies Approach** \((rpy = 0)\): Debt is not fully backed by PDV of surpluses; \(PV_{2021}(D_{2221}) \not\to 0\) because we’re discounting at \(r^f - g < 0\)
   - We can keep rolling over the debt; There’s a lot more wealth than you think! \(pd^y \to \infty\)

<table>
<thead>
<tr>
<th></th>
<th>Assets</th>
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<tbody>
<tr>
<td>Until 2221</td>
<td>(PV_{2021}({T}_{2021}^{2221}))</td>
<td>(PV_{2021}({G}_{2021}^{2221}))</td>
</tr>
<tr>
<td>After 2221</td>
<td>(PV_{2021}(D_{2221}))</td>
<td>(D)</td>
</tr>
</tbody>
</table>

2. **Our Textbook Finance Approach** \((rpy > 0)\): Debt is fully backed by PDV of surpluses; \(PV_{2021}(D_{2221}) \to 0\) because we’re discounting at \(r^f + term + rpy - g > 0\)

3. **Bubbly Finance Approach**. \((rpy \approx 0)\): Debt is not fully backed by future surpluses and PDV of future debt \(PV_{2021}(D_{2221}) \not\to 0\) because we’re discounting at \(DR < 0\)
   - Bubble in some long-lived assets, typically in models without long-lived investors; Total wealth/GDP ratio \(pd^y \to \infty\) (missing investors, missing wealth hypothesis)
Textbook Finance vs. Bubbly Finance

1. **Deterministic Economies Approach** \((rp^y = 0)\): Debt is not fully backed by PDV of surpluses; \(PV_{2021}(D_{2221}) \not\to 0\) because we’re discounting at \(rf - g < 0\)

2. **Our Textbook Finance Approach** \((rp^y > 0)\): Debt is fully backed by PDV of surpluses; \(PV_{2021}(D_{2221}) \to 0\) because we’re discounting at \(rf + \text{term} + rp^y - g > 0\)
   - We cannot keep rolling over the debt because \(rf\) cannot always be smaller than \(g\) without creating arb. opps.

   \[
   \begin{array}{c|c|c}
   \text{Assets} & \text{Liabilities} \\
   \hline
   \text{Until 2221} & PV_{2021}(\{T\}_{2022}^{2221}) & PV_{2021}(\{G\}_{2022}^{2221}) \\
   \text{After 2221} & PV_{2021}(D_{2222}) & $0 \\
   \end{array}
   \]

   - Total wealth/GDP ratio \(pd^y \not\to \infty\)

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<tr>
<td>(PV_{2021} {T}_{2022}^{2221})</td>
<td>(PV_{2021} {G}_{2022}^{2221})</td>
</tr>
</tbody>
</table>
| \(PV_{2021}(D_{2221}) \not\to 0\) | \(PV_{2021}(\{T - G\}_{2022}^{2221} + D_{2221})\)
| \(PV_{2021}(D_{2221}) \not\to 0\) | \(D\) |
Textbook Finance vs. Bubbly Finance

1. **Deterministic Economies Approach** \((rpy = 0)\): Debt is not fully backed by PDV of surpluses; \(PV_{2021}(D_{2221}) \not\rightarrow 0\) because we’re discounting at \(r^f - g < 0\)

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   - Bubble in some long-lived assets, typically in models without long-lived investors; Total wealth/GDP ratio \(pd^y \rightarrow \infty\) (missing investors, missing wealth hypothesis)

Need to believe U.S. Treasury has special ability to engineer bubbles. U.K. has not been able to do this in 3 centuries.

<table>
<thead>
<tr>
<th></th>
<th>1729 – 1914</th>
<th>1729 – 1946</th>
<th>1946 – 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.K.</td>
<td>2.5%</td>
<td>1.2%</td>
<td>1.8%</td>
</tr>
<tr>
<td>(S/Y)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Outline

1. Simple Steady-State Example
2. Fiscal Capacity Measurement using CBO Projections
3. Duration Mismatch
feed in CBO surplus projections until 2052 and projected $(D/Y)_{2052}$ is 185%.

**Assumption:** Treasury runs surpluses of 2.16% after 2052 such that $(D/Y)_{2052} = 85.8 \times 2.16\% = 185\%$
CBO projects surpluses until 2052 and debt outstanding at 2052.

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<thead>
<tr>
<th></th>
<th>Assets</th>
<th>Liabilities</th>
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<tbody>
<tr>
<td>Until 2052 PV</td>
<td>$124.95</td>
<td>$146.11</td>
</tr>
<tr>
<td>After 2052 PV</td>
<td>$33.54</td>
<td></td>
</tr>
<tr>
<td>Fiscal Capacity</td>
<td></td>
<td>$12.38</td>
</tr>
</tbody>
</table>

Baseline fiscal capacity estimate of $12.38 trillion:

\[
P_{2021}^{upper}(\{T - G\}_{2022}^{2052}) + P_{2021}^{upper}(D_{2052}) = -21.16 + 33.54 = 12.38 \text{ tr.} < < 22.40 \text{ tr.}
\]

Fiscal capacity limited in spite of low rates

Market is pricing in large fiscal correction (relative to CBO projections) or financial repression (e.g., Japan)
U.S. Treasury Balance Sheet with Convenience Yields

- US. Treasurys are special and earn convenience yields.

- **Assumption**: Treasury collects $0.60\% \times 99.6\% = 0.598\%$ of GDP in convenience-yield revenues per year

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<td><strong>Until 2052</strong></td>
<td>$PV_{2021} ({T}_{2052}^{2022})$ $124.95$</td>
<td>$PV_{2021} ({G}_{2052}^{2022})$ $146.11$</td>
</tr>
<tr>
<td><strong>Until 2052</strong></td>
<td>$PV_{2021} ({CS}_{2052}^{2022})$ $4.04$</td>
<td></td>
</tr>
<tr>
<td><strong>After 2052</strong></td>
<td>$PV_{2021} (D_{2052})$ $33.54$</td>
<td>Fiscal Capacity $16.42$</td>
</tr>
</tbody>
</table>

- Extended fiscal capacity estimate of $16.42$ trillion:

\[
P_{2021}^{upper} (\{T - G\}_{2052}^{2022}) + P_{2021}^{upper} (D_{2052}) + P_{2021}^{upper} (\{CS\}_{2052}^{2022}) = 12.38 + 4.04 = 16.42 \text{ tr.}
\]
Creating a Bubble

▶ We can reverse-engineer $\frac{r_p y}{y} = 1.37\%$ to match the valuation of Treasurys at $22.40$ tr.

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<tr>
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<tbody>
<tr>
<td>Until 2052</td>
<td>$PV_{2021}({T}_{2052}^{2022})$</td>
<td>$150.57$</td>
</tr>
<tr>
<td>After 2052</td>
<td>$PV_{2021}(D_{2052})$</td>
<td>$48.38$</td>
</tr>
<tr>
<td></td>
<td>$PV_{2021}({G}_{2052}^{2022})$</td>
<td>$176.55$</td>
</tr>
<tr>
<td></td>
<td>Fiscal Capacity</td>
<td>$22.40$</td>
</tr>
</tbody>
</table>

▶ Fiscal capacity estimate boosted to $22.40$ trillion by increasing PDV of future debt:

$$PV_{upper}^{2021}(\{T - G\}_{2052}^{2022}) + PV_{upper}^{2021}(D_{2052}) = -25.98 + 48.38 = 22.40 \text{ tr.}$$

▶ We have generated a bubble: $pd^y \rightarrow \infty$

$$(r^f + \text{term}) + \frac{r_p y}{y} - g = 2.07\% + 1.37\% - 3.50\% < 0.$$ 

▶ All un-levered companies growing at rate of GDP have infinite valuations; Missing wealth hypothesis!
Outline

1. Simple Steady-State Example
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3. Duration Mismatch
Backloaded Surpluses

- Treasury runs primary deficits of 3.19% until 2052; projected $(D/Y)_{2052} = 185%$

- Treasury runs primary surpluses of 2.16% after 2052 such that $(D/Y)_{2052} = 85.8 \times 2.16% = 185%$

- Surpluses have high duration, but the Treasury’s debt does not.

<table>
<thead>
<tr>
<th>Until 2052</th>
<th>Net Cash Inflows</th>
<th>Cash Outflows</th>
</tr>
</thead>
<tbody>
<tr>
<td>$PV_{2021}({T-G}_{2022}^{2052})$</td>
<td>($21.16$)</td>
<td>$33.54$</td>
</tr>
<tr>
<td>$PV_{2021}(D_{2052})$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| After 2052 | |
|------------| $FC$ |
| $12.38$ |

- Treasury has not matched cash inflows and outflows.
Consider permanent rate shock of 100 bps.

- Treasury runs primary surpluses of 4.82% after 2052 such that 
  \[ \left( \frac{D}{Y} \right)_{2052} = 46.18 \times 4.82\% = 223\% \]

- An increase in steady-state surpluses by 2.67% of GDP

<table>
<thead>
<tr>
<th>Until 2052</th>
<th>Cash Inflows</th>
<th>Cash Outflows</th>
</tr>
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<tbody>
<tr>
<td>PV_{2021}({T - G}_{2052}) \quad ($18.07)</td>
<td>$18.07</td>
<td>$30.09</td>
</tr>
<tr>
<td>After 2052</td>
<td>\quad $30.09</td>
<td>FC $12.03</td>
</tr>
</tbody>
</table>

- Lower risk-free rates and \( r_p^y \) increase FC, but also increase duration mismatch.
What do you Think?

- Simple framework based in textbook finance for analyzing fiscal capacity using CBO projections

- U.S. Treasury’s fiscal capacity is probably more limited than you think, ..unless you think
  
  - U.S. GDP risk premium is very low and there is a more wealth than commonly thought
  - U.S. Treasury has engineered permanent violations of the no-bubble constraints in securities markets

- Backloading of Surpluses Exposes Treasury to Interest Rate Risk, especially if you think
  
  - GDP risk premium is very low and there is a more wealth than commonly thought