Prescriptive AND Theory + descriptive

3 comments on declining or lower discount rates

Thomas Sterner
<table>
<thead>
<tr>
<th>Country</th>
<th>Agency or sector</th>
<th>rate</th>
<th>Long-term rate</th>
<th>Theoretical approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>U K</td>
<td>HM Treasury</td>
<td>3.5%</td>
<td>Declining &gt; 30 yrs</td>
<td>SRTP</td>
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<tr>
<td>France</td>
<td>Commiss gén. du Plan</td>
<td>4%</td>
<td>Declining &gt; 30 yrs</td>
<td>SRTP</td>
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<tr>
<td>Italy</td>
<td>Central recommend</td>
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<td>SRTP</td>
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<td>Germany</td>
<td>Bundesmin. Finanzen</td>
<td>3%</td>
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<td>Federal refinancing</td>
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<td>Spain</td>
<td>Transportation</td>
<td>6%</td>
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<td>SRTP</td>
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<td></td>
<td>Water</td>
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<td>SRTP</td>
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<tr>
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<tr>
<td>Sweden</td>
<td>SIKA* - transport</td>
<td>4%</td>
<td></td>
<td>SRTP</td>
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<tr>
<td></td>
<td>EPA</td>
<td>4%</td>
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<td>SRTP</td>
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<td>Norway</td>
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<td>3.5%</td>
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<td>Gov borrowing</td>
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<td>7%</td>
<td>Sens. check, &gt;0%</td>
<td>SOC</td>
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<td>EPA</td>
<td>2%–3%</td>
<td>Sens check, 0.5%–3%</td>
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<tr>
<td>Canada</td>
<td>Treasury Board</td>
<td>8%</td>
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<td>SOC</td>
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<tr>
<td>Australia</td>
<td>Office of Best Practice</td>
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<tr>
<td>N Zealand</td>
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</table>
Declining rates in France and UK
Many Issues; Pick the important: I will focus on 2

• Discounting depends on Growth. There will be no growth in some sectors. We will not have "more" nature nor more time for our children.

• Some of the attraction of growth is that we become richer than the neighbour. This is a private motive but does not make sense socially as the whole society gets richer.

• Disaggregation into Rich and Poor has effects
Two sectors with different growth rates

C grows; E does not

\[ W = \int_{0}^{\infty} e^{-\rho t} U(C, E) \, dt \]

The appropriate discount rate \( r \) is then

\[
 r = \rho + \frac{-d}{dt} \frac{U_C(C, E)}{U_C(C, E)} 
\]
Relative price effect >>> Typically lowers discount in slow growth sector

\[ p = \frac{d}{dt} \left( \frac{U_E}{U_C} \right) = \frac{1}{\sigma} \left( g_C - g_E \right). \]
DISCOUNTING and relative income

\[ U_t = u(c_t, R_t) = u(c_t, r(c_t, z_t)) = v(c_t, z_t) \]

du/dc captures individual partial benefit of more c.
dv/dc captures total effect of more c
3 Welfare Functions

Max: \( w^p \equiv \int_0^T u(c_\tau, r(c_\tau, z_\tau)) e^{-\delta\tau} d\tau = \int_0^T v(c_\tau, z_\tau) e^{-\delta\tau} d\tau \quad \{c_0, ..., c_T\} \)

Max: \( w^s \equiv \int_0^T u(c_\tau, r(c_\tau, c_\tau)) e^{-\delta\tau} d\tau = \int_0^T v(c_\tau, c_\tau) e^{-\delta\tau} d\tau \quad \{c_0, ..., c_T\} \)

Max: \( w^R \equiv \int_0^T u(c_\tau) e^{-\delta\tau} d\tau \quad \{c_0, ..., c_T\} \)
Intuition Arrow Dasgupta

• Rat Race: Work/consume more to beat Jones.
• But people will be positional in future too
• Beat Jones’s now -->Lose in future
• Same optimal growth part IFF

\[ v_{2t}(c_t) = \beta v_{1t}(c_t) \]
Defining degree of positionality

\[ U_t = u(c_t, R_t) = u(c_t, r(c_t, z_t)) = v(c_t, z_t) \]

\[ \gamma_t = \frac{u_{2t} \cdot r_{1t}}{u_{1t} \cdot u_{2t} \cdot r_{1t}} \]
We find same results and more..

\[ \rho^s(t) = \delta - \frac{1}{t} \ln \left( \frac{v_{1t}}{v_{10}} - \frac{v_{1t}}{v_{10} + v_{20}} (\gamma_t - \gamma_0) \right) = \delta - \frac{1}{t} \ln \left( \frac{v_{1t}}{v_{10}} \left\{ \frac{1 - \gamma_t}{1 - \gamma_0} \right\} \right) \]
We find same results and more..

\[ \rho^s(t) = \delta - \frac{1}{t} \ln \left( \frac{v_{1t}}{v_{10}} - \frac{v_{1t}}{v_{10} + v_{20}} (\gamma_t - \gamma_0) \right) = \delta - \frac{1}{t} \ln \left( \frac{v_{1t}}{v_{10}} \left\{ \frac{1 - \gamma_t}{1 - \gamma_0} \right\} \right) \]

- Assume increasing positionality
- Then \( \rho^s > \rho^p \)
Assuming Constant Positionality

- Ramsey Discount rate > Optimal Rate

\[ \rho_R = \rho_S + \frac{v_{12}}{v_1} \text{(cg)} \]

- Generally \( \rho_R > \rho_S > \rho_p \)
THREE relevant Discount rates

1. The Privately optimal (assuming z unchanged)

2. The Socially optimal (assuming R unchanged)

3. Ramsey Rule which decision makers use
Comparing 3 discount rates

$$\rho^p = -\frac{1}{t} \ln \frac{\partial w^p}{\partial c_t} = \delta - \frac{1}{t} \ln \frac{v_{1t}}{v_{10}}$$

$$\rho^p = -\frac{\partial (\partial w^p / \partial c) / \partial t}{\partial w^p / \partial c} = \delta - \frac{v_{11}}{v_1} cg - \frac{v_{12}}{v_1} cg = \delta + \sigma g - \frac{v_{12}}{v_1} cg$$

$$\rho^s = \delta - \frac{v_{11} + 2v_{12} + v_{22}}{v_1 + v_2} cg = \delta + \sigma g - \frac{v_{12}}{v_1} cg + \frac{d\gamma / dt}{1-\gamma_t}$$

$$\rho^R = \delta - cv_{11} / v_1 g = \delta + \sigma g$$
\[ \rho^p = -\frac{1}{t} \ln \frac{\partial w^p}{\partial c_t} = \delta - \frac{1}{t} \ln \frac{v_{1t}}{v_{10}} \]

\[ \rho^p = - \frac{\partial (\partial w^p / \partial c) / \partial t}{\partial w^p / \partial c} = \delta - \frac{v_{11}}{v_1} c g - \frac{v_{12}}{v_1} c g = \delta + \sigma g - \frac{v_{12}}{v_1} c g \]

\[ \rho^s = \delta - \frac{v_{11} + 2v_{12} + v_{22}}{v_1 + v_2} c g = \delta + \sigma g - \frac{v_{12}}{v_1} c g + \frac{d \gamma / dt}{1 - \gamma_t} \]

\[ \rho^R = \delta - c v_{11} / v_1 g = \delta + \sigma g \]