Prescriptive AND Theory + descriptive

3 comments on declining or lower discount rates

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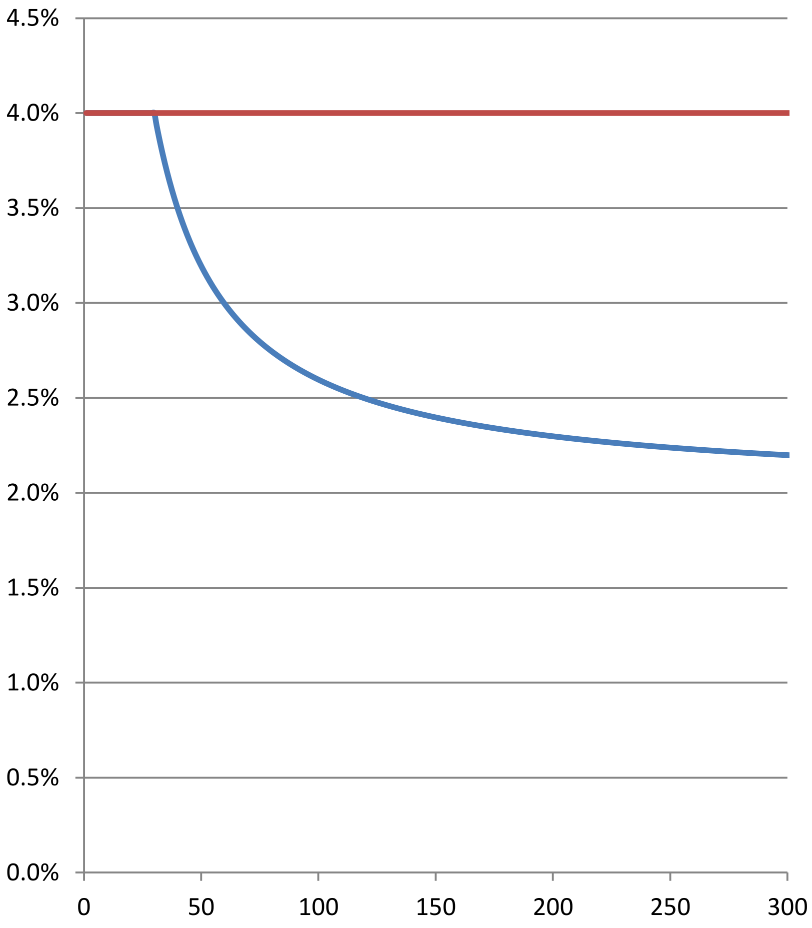
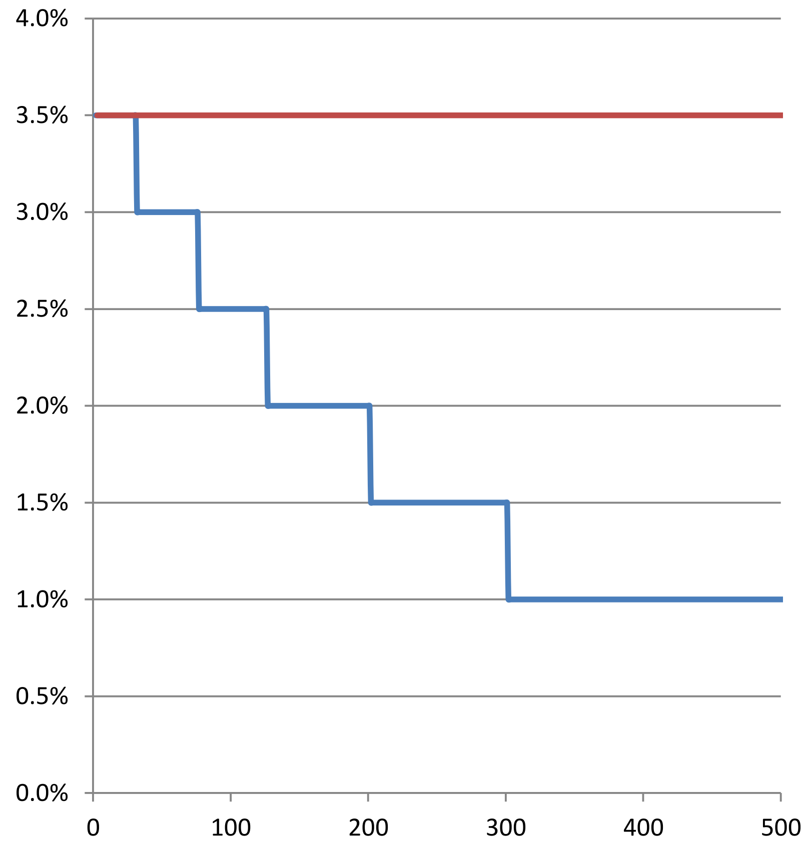
Country	Agency or sector	rate	Long-term rate	Theoretical approach
U K	HM Treasury	3.5%	Declining > 30 yrs	SRTP
France	Commiss gén. du Plan	4%	Declining > 30 yrs	SRTP
Italy	Central recommend	5%		SRTP
Germany	Bundesmin. Finanzen	3%		Federal refinancing
Spain	Transportation	6%		SRTP
	Water	4%		SRTP
Netherlands		4%		
Sweden	SIKA* - transport	4%		SRTP
	EPA	4%		SRTP
Norway		3.5%		Gov borrowing
USA	Office of Man & Budget	7%	Sens. check, >0%	SOC
	EPA	2%–3%	Sens check, 0.5%–3%	SRTP
Canada	Treasury Board	8%		SOC
Australia	Office of Best Practice	7%		SOC
N Zealand	Treasury	8%		SOC

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 diff 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

$$r = \rho + \frac{-\frac{d}{dt} U_C(C,E)}{U_C(C,E)}$$

Relative price effect >>> Typically lowers discount in slow growth sector

$$p = \frac{\frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{U_E}{U_C}\right)}{\left(\frac{U_E}{U_C}\right)} = \frac{1}{\sigma}(g_C - g_E).$$

DISCOUNTING and relative income

$$U_t = u\left(c_t, R_t\right) = u\left(c_t, r(c_t, z_t)\right) = v\left(c_t, z_t\right)$$

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

3 Welfare Functions

$$\underset{\{c_0,\ldots,c_T\}}{\text{Max}} : w^p \equiv \int_0^T u\left(c_\tau, r(c_\tau, z_\tau)\right) e^{-\delta\tau} d\tau = \int_0^T v\left(c_\tau, z_\tau\right) e^{-\delta\tau} d\tau$$

$$\underset{\{c_0,\ldots,c_T\}}{\text{Max}} : w^s \equiv \int_0^T u\left(c_\tau, r(c_\tau, c_\tau)\right) e^{-\delta\tau} d\tau = \int_0^T v\left(c_\tau, c_\tau\right) e^{-\delta\tau} d\tau$$

$$\underset{\{c_0,\ldots,c_T\}}{\text{Max}} : w^R \equiv \int_0^T u\left(c_\tau\right) e^{-\delta\tau} d\tau$$

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

$$U_t = u\left(c_t, R_t\right) = u\left(c_t, r(c_t, z_t)\right) = v\left(c_t, z_t\right)$$

$$\gamma_t = \frac{u_{2t}\, r_{1t}}{u_{1t} + u_{2t} r_{1t}}$$

We find same results and more..

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

We find same results and more..

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

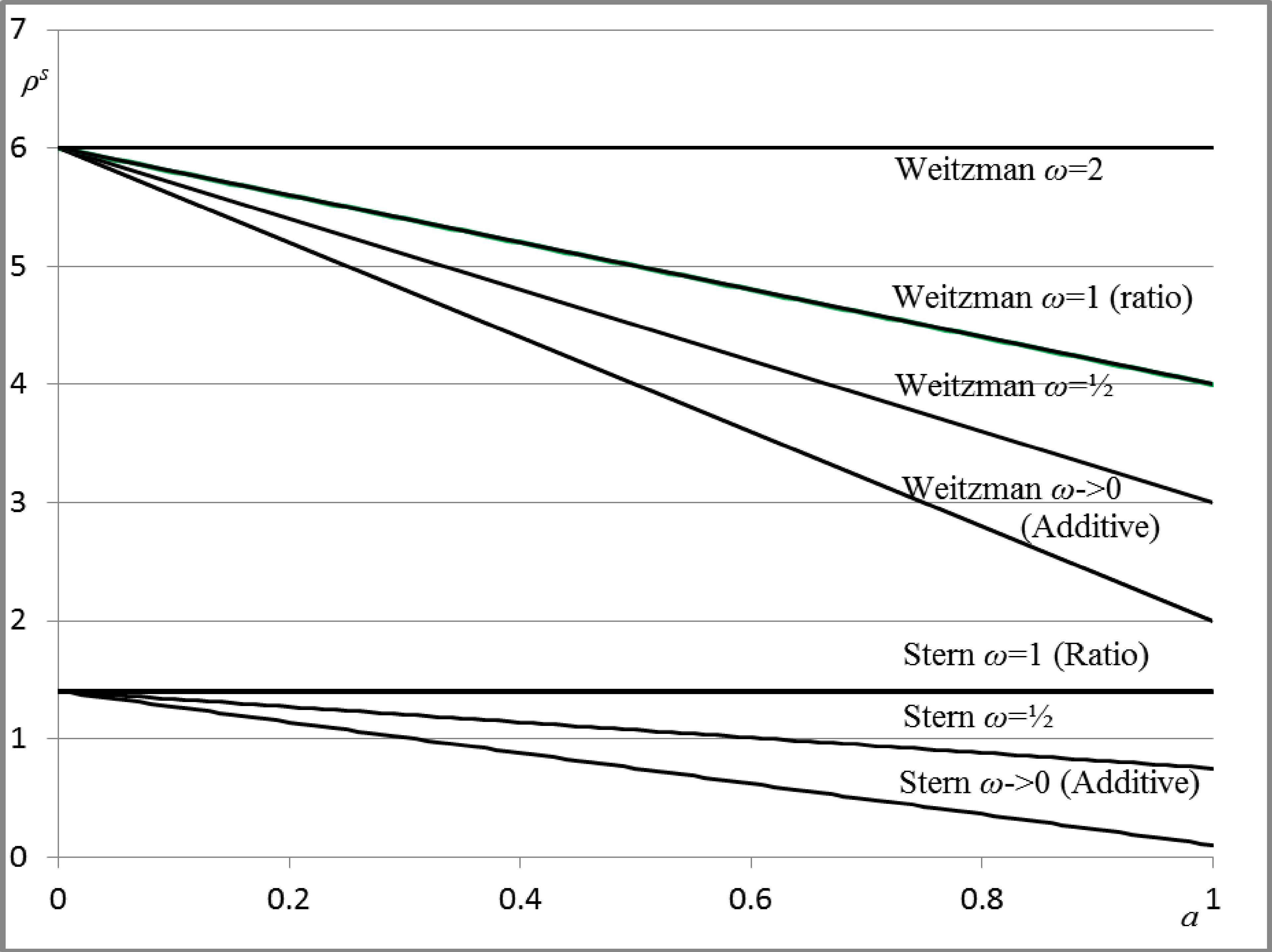
- Assume increasing positionality
- Then $\rho^s > \rho^p$

Assuming Constant Positionality

- Ramsey Discount rate > Optimal Rate

- $\rho_R = \rho_S + v_{12}/v_1\ (cg)$

- Generally $\rho_R > \rho_S > \rho_p$



ρ^s
Weitzman ω=2
Weitzman ω=1 (ratio)
Weitzman ω=½
Weitzman ω->0
(Additive)
Stern ω=1 (Ratio)
Stern ω=½
Stern ω->0 (Additive)
a
0
1
2
3
4
5
6
7
0
0.2
0.4
0.6
0.8
1

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

$$\rho^p = -\frac{1}{t}\ln\frac{\partial w^p / \partial c_t}{\partial w^p / \partial c_0} = \delta - \frac{1}{t}\ln\frac{v_{1t}}{v_{10}}$$

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

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

$$\rho^R = \delta - cv_{11} / v_1 g = \delta + \sigma g$$

Private < Social < Ramsey

$$\rho^p = -\frac{1}{t}\ln\frac{\partial w^p/\partial c_t}{\partial w^p/\partial c_0} = \delta - \frac{1}{t}\ln\frac{v_{1t}}{v_{10}}$$

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

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

$$\rho^R = \delta - cv_{11} / v_1 g = \delta + \sigma g$$