EC1340-Fall 2019
Problem Set 7 solutions

(Updated 25 September 2019)

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1. To make this problem easier to handle, define $\delta_1 = \frac{1.015}{1+r}$ and $\delta_2 = \frac{1.005}{1+r}$. With this notation in place, we have

$$
\begin{aligned}
W_1 &= \sum_{t=0}^{\infty} \delta_1^t Y_0 \\
&= \frac{1}{1-\delta_1} Y_0 \\
W_2 &= \sum_{t=0}^{49} \delta_1^t Y_0 + \delta_1^{50} \sum_{t=0}^{\infty} \delta_2^t Y_0 \\
&= \frac{1-\delta_1^{50}}{1-\delta_1} Y_0 + \delta_1^{50} \frac{1}{1-\delta_2} Y_0 \\
W_3 &= \sum_{t=0}^{99} \delta_1^t Y_0 + \delta_1^{100} \sum_{t=0}^{\infty} \delta_1^t (0.95 Y_0) \\
&= \frac{1-\delta_1^{100}}{1-\delta_1} Y_0 + \delta_1^{100} \frac{1}{1-\delta_1} (0.95 Y_0)
\end{aligned}
$$

   (a) We evaluate $W_1 - W_2$ using the formulas above, to get

$$
\begin{aligned}
W_1 - W_2|_{r=.02} &= 6700 \text{ trillion} \\
W_1 - W_2|_{r=.055} &= 48.11 \text{ trillion}
\end{aligned}
$$

   (b) We evaluate $W_1 - W_3$ using the formulas above, to get

$$
\begin{aligned}
W_1 - W_3|_{r=.02} &= 393.12 \text{ trillion} \\
W_1 - W_3|_{r=.055} &= 1.74 \text{ trillion}
\end{aligned}
$$

   (c) From figure 5-1 the value of the backstop policy is about 17 trillion dollars.

   (d) The discount rate is very important in determining the value of climate change policy. However, since the growth rate also enters in to our calculations exponentially,it too is very important. In particular, even if we use Stern's discount rate, it's hard to conclude that global warming is a catastrophe if it just causes a 5% drop in GDP in 100 years. When we start to consider impacts on the growth rate, however, it becomes much easier to generate catastrophic impacts on welfare. That is, global warming starts to look like an important problem.