

AAE 343 Discussion Section 6

March 1st, 2019

Discounting

1. A positive **discount rate** reflects...
 - a. Time preference of money, that is, the need to be compensated more in the future in order to delay consumption today. (In essence, a risk premium)
 - b. The opportunity cost of investing elsewhere.
2. The magnitude of the discount rate reflects relative valuations of the present and the future: higher r corresponds to greater “impatience”.
3. Fun discounting formulae
 - a. One-time present value for X costs or benefits at some period t : $PV = \frac{X}{(1+r)^t}$
 - b. Infinite horizon with X costs or benefits in every period, starting at $t = 0$: $PV = X + \frac{X}{r}$
 - c. Infinite horizon with X costs or benefits in every period, starting at $t = 1$: $PV = \frac{X}{r}$

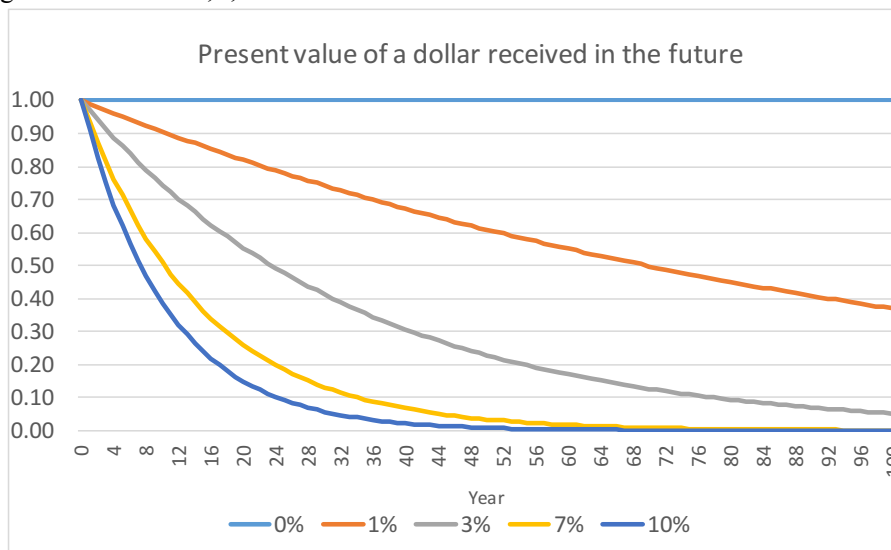
Problem 1 *Paying for college* - You can choose four years of a \$10,000 scholarship, where you get paid after every year of college you complete, or \$35,000 today. Which do you prefer when the interest rate is 4%? 6%?

Problem 2 *Grandmother’s Love* - For your graduation from UW, you’re given a U.S. Savings Bond by your favorite grandmother, redeemable for \$300 in 30 years. The interest rate on the savings bond is 8%. So your kid brother doesn’t feel left out, she buys him a Tumble Time Tigger for \$32.



- a. Who does your grandmother love more?

4. Increasing the discount rate, r , has a corrosive effect on future costs and benefits



Problem 2, continued... Now suppose the interest on the U.S. Savings Bond you received from your grandmother is 7%.

- b. Does this change your perception of your grandmother’s feelings for you and your kid brother?

Problem 2, continued... What if the interest rate is 10% but the savings bond is redeemable in 20 years? Moreover, your kid brother is an aspiring accountant and would rather have the bond than the Tumble Time Tigger.

- c. Should you trade the bond for the awesome plush toy with your brother?

TopHat Question 1 Using national GDP data from the period 1969-2010, Gollier (2011) found implied discount rates for 190 countries – these values varied significantly. For example, “developed” countries (US, France, Germany, Japan) had discount rates of 3-4% over this period, while China’s discount rate was near 15% and several African countries had *negative* historic discount rates. *What might China’s higher discount rate imply about their historic willingness to tackle problems with long-run consequences, i.e. climate change?* (answer graded)

Cost/Benefit Analysis

1. In order to make informed decisions about a policy, we consider the **present value (PV)** of its economic effects.
2. Translating into PV helps organize costs and benefits that can occur at different points in time, either once or as infinite cost/benefit streams.
3. When the present value of benefits exceed the present value of costs, a policy has positive **net present value**, and is beneficial.

Problem 3 Planting a forest today costs \$1,000, and will provide timber revenue of \$100/year starting next year (when $t = 1$) and lasting in perpetuity (i.e., forever). Should you plant the forest if the interest rate is 5 percent?

Problem 4 A new dam would cost \$2 billion to build, but would generate \$100 million per year in irrigation benefits forever, starting next year. Assume that these are the only benefits and costs. The interest rate is 10%. Should the dam be built?

Problem 5 Your government can either sell rights to drill for oil offshore or preserve a wetland ecosystem as a national park. Using the following values set up a table for the present values of costs and benefits from **selling the oil rights** at a given interest rate r .

- a. Construction of oil rigs: \$5 million
- b. Five years of oil revenues: \$500 million/year
- c. Five years of taxes on oil revenues: \$50,000/year
- d. Habitat and biodiversity loss from drilling: \$100 million/year forever
- e. Decreased human health from air pollution associated with drilling, shipping, and refineries: \$200m/year for 10 years

This list is by no means exhaustive. Can you think of any more costs and benefits that might be associated with a project like this? *What would a firm be willing to bid in an auction to have the right to drill in this area if the interest rate, r , were 5%?*

TopHat Question 2 The present value of a benefit with an infinite horizon will be non-negative when the discount rate is any positive number (answer graded).