Weekly Problem Set: August 14th, 2021

Submit answers by direct messaging @ModMail on the Academic Economics Discord
or emailing academicecondiscord@gmail.com
Solve a problem for "Extra Credit" or "Novice Extra Credit" server tag for two weeks

Due before August 21st, 2021 @ 12:00 pm EST when answers are posted

1 Extra Credit Problem

Suppose that a bank has lent L to a firm that has invested in a risky technology with a net (unit) return $\tilde{y}$. In the absence of collateral, the net (unit) return to the bank will be $\min(r_L, \tilde{y})$. When $\tilde{y} < r_L$, the firm defaults, and the bank seizes the firm's assets, which are worth $(1+\tilde{y})L$. For all parts the profit of the bank is,

$$\tilde{\pi}(L, D, \tilde{y}) = [\min(r_L(L), \tilde{y}) - r]L + [r - r_D(D)]D$$

1. Assuming the bank has no equity, show that the bank itself will default if $\tilde{y}$ is below some threshold y^*. Compute this value.
2. Assume risk neutrality and limited liability of the bank. The bank chooses the volumes L^* of loans and D^* of deposits that maximize the expectation of the positive part of its profit. (If the profit is negative, the bank defaults.) Write the first order conditions that characterize L^* and D^*.
3. Show that L^* depends in general on what happens on the deposit side.

2 Novice Extra Credit Problem

As a chairman of the board of ASP industries, you estimate that your annual profit is given by the table below. Profit is conditional on market demand and the effort of your new CEO. The probabilities of each demand condition occurring are shown in the table.

Market demand	Low Demand	Medium Demand	High demand
Market probabilities	0.30	0.40	0.30
Low effort	π = \$5 million	π = \$10 million	π = \$15 million
High effort	π = \$10 million	π = \$15 million	π = \$17 million

You must design a compensation package for the CEO that maximizes the firm's expected profit. While the firm is risk neutral, the CEO is risk averse. The CEO's utility function is

$$U = W^{.5} - 100 * (1 - 1\{\text{High Effort}\})$$

Where W is the CEO's income. You know the CEO's utility function, and both you and the CEO know all the information in the preceeding table. You do not know the level of the CEO's effort at time of compensation or the exact state of demand. You do see the firm's profit, however.

Of the three alternative compensation packages below, which do you prefer? **WHY**?

1. Pay the CEO a flat salary of \$575,00 per year
2. Pay the CEO a fixed 6 percent of yearly firm profits

3. Pay the CEO a flat salary of $500,000 per year and then 50 percent of any firm profits above $15 million.