

Monetary Economics: Problem Set #6
Due Thursday October 23rd in class

This problem set is marked out of 100 points. The weight given to each part is indicated below. Please contact me asap if you have any questions.

1. **Optimal insurance and deposit contracts.** Consider the Diamond-Dybvig model. There are three dates $\{0, 1, 2\}$ and a unit mass of ex ante identical investors and a single bank. Each of the investors has an endowment of 1 to invest at date $T = 0$. The type of each investor is revealed at date $T = 1$. A fraction $t = 0.20$ are *impatient* and consume only at $T = 1$. The remaining fraction are *patient* and indifferent between consuming at either $T = 1$ or $T = 2$. An individual's realised type is her own private information.

Funds invested for *two* periods earn a gross return $R = 1.65$ (an *illiquid project*). Funds invested for only one period earn a gross return of 1 (i.e., the investor just gets their funds back).

Each investor has the CRRA utility function

$$U(c) = \frac{c^{1-\gamma}}{1-\gamma}$$

with coefficient of relative risk aversion $\gamma = 3$.

- Set up the optimisation problem the solution of which gives the efficient amount of risk-sharing (optimal insurance) between impatient and patient investors. (10 points)
- Using the numerical values given, solve the optimisation problem for the payments (c_1^*, c_2^*) to impatient and patient investors. (15 points)
- Explain how the optimal insurance scheme can be implemented by a liquid deposit contract with the bank that pays returns (r_1, r_2) on dates $T = 1$ and $T = 2$ respectively. What values would the returns (r_1, r_2) have to be? (15 points)
- Calculate the ex ante expected utility to an investor who enters into this deposit contract. Is this higher or lower than the ex ante expected utility of an investor who just invests and holds the illiquid asset? Explain. How would your answer change (if at all) if the investors were risk neutral (e.g., $U(c) = c$)? Explain. (15 points)
- Explain the *sequential service constraint* facing the bank if it offers deposit contracts. Explain why the bank is prone to a run. If the return on the deposit contract paid in the first period r_1 is the value calculated in part (c), what is the maximum number of withdrawals f^* beyond which any individual patient investor will find it optimal to withdraw? [the "*tipping point*"] (15 points)

2. **Leverage and balance sheet management.** Consider a bank with an initial balance sheet of:

Assets	Liabilities
Securities 200	Debt 180
	Equity 20

- (a) What is the bank's leverage ratio? Suppose the bank now decides to target a leverage ratio of 15, explain how the bank can expand or contract its balance sheet (as required) to meet this target [*Hint*: assume that the price of debt does not change]. Is this likely to put upwards or downwards pressure on the price of securities? Explain. (15 points)
- (b) Suppose the bank is now operating with a leverage ratio of 15 and the balance sheet calculated in part (a) but that subprime losses mean that the value of its securities are marked down by 5%. Explain how that bank will respond and how its balance sheet will change if it continues to target a leverage ratio of 15? What if it now decides that this is a good time to "de-lever" and to instead have a leverage ratio of 12? Is de-leveraging likely to amplify or mitigate the effects of the subprime losses on securities prices? (15 points)