Economics 4905
Spring 2016
Cornell University
Financial Fragility and the Macroeconomy

Prelim #2 - Solutions

202 Uris Hall

May 2, 2016 2:55PM to 4:10PM

1. Government Sponsored Enterprises (GSEs) (10 minutes):

"GSEs, such as Fannie Mae and Freddie Mac, served an important need in their beginnings, but now that need is being served by other institutions."

Discuss. Include the relevant histories of banking and finance in the United States.

Solution:

Until the 1980's (and even somewhat later), American banks were very local. There was no inter-state banking. In most states, branch banking was highly restricted or even banned. Depository institutions were banned by the Glass-Steagall Act from investment banking. Federal Reserve Regulation Q banned interest payments on checking accounts and regulated interest payments on savings accounts.

Fannie Mae (FNMA) and her cousin Freddie Mac were started during the New Deal (the 1930's). These institutions and some similar GSE's bought mortgages from banks and other depository institutions. This was helpful in allowing banks to diversify away from holding relatively large amounts in narrow, local-area mortgages.

With the de-regulation of financial institutions in the latter part of the 20th century, many depository institutions expanded their branch networks. Some of these depository institutions became truly nation-wide or even international. This lead to diversification of their mortgage risk - away from the local market and into the broader mortgage market, lessening somewhat the social importance of the GSE's.

Also in the latter part of the 20th century, Wall Street investment banks and hedge funds securitized mortgages into packages called mortgage-backed securities (MBS). Banks no longer needed to hold in their own portfolios the mortgages that they wrote, except for short periods. This allowed for nearly complete diversification of mortgages by region, type, and quality, and into or out of the mortgage market entirely.

This made the GSE's socially redundant. In fact, since the GSE's were very lightly regulated (if at all), they speculated on MBS's with disastrous effects.

2. Diamond-Dybvig Post-Deposit Game (20 minutes):

- Probability of impatience is $\lambda = 30\%$.
- Utility is $u(c) = \frac{c^{1-b}}{1-b}$, where $b = 1.01$.
- Costless storage.
- Each individual has endowment $y = 100$.
- If the illiquid asset is harvested early the rate of return is zero, if harvested late the rate of return $(R-1)$ is 100%.
- Let (d_1, d_2) be the deposit contract.

(a) What is a depositor's expected utility W as a function of early consumption c_1 and late consumption c_2?

Solution:
$W = \lambda u(c_1) + (1-\lambda)u(c_2)$
$W = \frac{\lambda c_1^{1-b}}{1-b} + \frac{(1-\lambda)c_2^{1-b}}{1-b}$
$W = \frac{.3c_1^{-(.01)}}{-(.01)} + \frac{.7c_2^{-(.01)}}{-(.01)}$

(b) Show that the smoothed allocation $(\bar{c}, \bar{c})$, where $\bar{c} = \lambda c_1 + (1-\lambda)c_2$, is preferred to (c_1, c_2) if $c_1 \neq c_2$.

Solution:
$u'(c) = \frac{(1-b)c_1^{-b}}{1-b} = c^{-b} > 0$
$u''(c) = -bc^{-b-1} < 0$

So $u(c)$ is strictly concave (the consumer is risk-averse). Concave functions lie above their chords (Jensen's inequality):
$u(\lambda c_1 + (1-\lambda)c_2) > \lambda u(c_1) + (1-\lambda)u(c_2)$ when $c1 \neq c2$,
So $W(\bar{c}, \bar{c}) > W(c_1, c_2)$ where $\bar{c} = \lambda c_1 + (1-\lambda)c_2$.

(c) What is the resource constraint RC?

(c1) Write down the algebra.
Solution:
$(1-\lambda)d_2 \leq (1-\lambda d_1)R$

Where d_t is the withdrawal allowed in period $t = 1, 2$.

(c2) Give the economic intuition.
Solution:
The LHS of the inequality is the funds to be withdrawn in period 2. The RHS is the resources available in period 2. If the inequality is violated, the bank is insolvent.

(d) What is the incentive compatibility constraint ICC?

(c1) Write down the algebra.
Solution:
$d_1 \leq d_2$ is the ICC.

(c2) Give the economic explanation.
Solution:
If the inequality does not hold, everyone will attempt to withdraw early: the depositors do not self-select correctly.

(e) Assume that there are 2 equilibria in the post-deposit game, one non-run, the other run. What do you make of the 2 equlibria? Give your answer in a concise, well-reasoned paragraph.

Solution:

One of the equilibria is the "good" non-run equilibrium. Because the post-deposit game is BIC but not DSIC, the other equilibrium is a bad one, the run-equilibrium. The so-called "optimal contract" for the post-deposit game does not lead to a uniquely implementable equilibrium. This is because the "optimal contract" is based on unconstrained optimization in which a depositor's type is public (or at least, bank) knowledge. The bank run equilibrium indicates that there is likely to be financial fragility, but it is not a full answer since the run-equilibrium is not a true equilibrium to the sequential game in which consumers decide whether or not to deposit in this bank. For this, one must analyze in detail the pre-deposit game.

3. Outside Money and the Price-Level (10 minutes):

- One commodity, $l = 1$.
- Four consumers, $n = 4$.
- One-money taxes, $\tau = (\tau_1, \tau_2, \tau_3, \tau_4)$.
- $P^m \geq 0$ is the goods price of money.
- τ_h is the money tax on consumer $h = 1, ..., 4$.

Find $\mathcal{P}^m$ the set of equilibrium P^m and the set of equilibrium allocations $x = (x_1, ..., x_4)$ when endowments are

$$\omega = (20, 15, 10, 5)$$

and money taxes are:

(a) $\tau = (1, 1, 1, -1)$,
Solution: not balanced. not bonafide.
$\mathcal{P}^m = \{0\}$.
$x = (x_1, x_2, x_3, x_4) = (20, 15, 10, 5)$. Autarky.

(b) $\tau = (5, 2, -2, -5)$,
Solution: balanced. bonafide.
$x_1 = 20 - 5P^m > 0, \qquad P^m < 4$
$x_2 = 15 - 2P^m > 0, \qquad P^m < 15/2$
$x_3 = 10 + 2P^m$
$x_4 = 5 + 5P^m$
$\mathcal{P}^m = [0, 4)$.
$x = (x_1, x_2, x_3, x_4) \in \{(20 - 5P^m, 15 - 2P^m, 10 + 2P^m, 5 + 5P^m) | P^m \in [0, 4)\}$

(c) $\tau = (1, 0, 0, -1)$,
Solution: balanced. bonafide.
$x_1 = 20 - 1P^m > 0, \qquad P^m < 20$
$x_2 = 15$
$x_3 = 10$
$x_4 = 5 + P^m$
$\mathcal{P}^m = [0, 20)$.
$x = (x_1, x_2, x_3, x_4) \in \{(20 - P^m, 15, 10, 5 + 5P^m) | P^m \in [0, 4)\}$

(d) $\tau = (3, 2, 0, -5)$,
Solution: balanced. bonafide.
$x_1 = 20 - 3P^m > 0, \qquad P^m < 20/3$
$x_2 = 15 - 2P^m > 0, \qquad P^m < 15/2$
$x_3 = 10$
$x_4 = 5 + 5P^m$
$\mathcal{P}^m = [0, 20/3)$.
$x = (x_1, x_2, x_3, x_4) \in \{(20 - 3P^m, 15 - 2P^m, 10, 5 + 5P^m) | P^m \in [0, 20/3)\}$

(e) $\tau = (100, 50, -50, -100)$,
Solution: balanced. bonafide.
$x_1 = 20 - 100P^m > 0, \qquad P^m < 1/5$
$x_2 = 15 - 50P^m > 0, \qquad P^m < 3/10$
$x_3 = 10 + 50P^m$
$x_4 = 5 + 100P^m$
$\mathcal{P}^m = [0, 1/5)$.
$x = (x_1, x_2, x_3, x_4) \in \{(20 - 100P^m, 15 - 50P^m, 10 + 50P^m, 5 + 100P^m) | P^m \in [0, 1/5)\}$

4. Outside Money and Exchange Rates (10 minutes):

- One commodity, $l = 1$.
- 5 consumers, $h = 1, ..., 5$.
- Two monies, B ad R.
- Money taxes

$$\tau^B = (\tau_1^B, ..., \tau_5^B)$$
$$\tau^R = (\tau_1^R, ..., \tau_5^R)$$

- Goods prices of money, $P^B \geq 0$ and $P^R \geq 0$.

Find equilibrium exchange rates, equilibrium prices P^B and P^R, and equilibrium allocations $x = (x_1, ..., x_5)$ when endowments are $\omega = (25, 20, 15, 10, 5)$.

(a) $\tau^B = (1, 1, 1, -1, -1) \quad \tau^R = (1, 1, -1, -1, -1)$
Solution:
$\sum_{h=1}^5 \tau_h^B = 1 \qquad \sum_{h=1}^5 \tau_h^R = -1$
$P^B - P^R = 0$
$\frac{P^B}{P^R} = 1$
$x_1 = 25 - 1P^B - 1P^R = 25 - 2P^B > 0, \qquad P^B < 25/2$
$x_2 = 20 - 1P^B - 1P^R = 20 - 2P^B > 0, \qquad P^B < 10$
$x_3 = 15 - 1P^B + 1P^R = 15 - P^B + P^B = 15$
$\mathcal{P}^m = \{P^R, P^B | P^R = P^B \in [0, 10)\}$
$x = (x_1, x_2, x_3, x_4, x_5) \in$
$\{(25 - P^B - P^R, 20 - P^B - P^R, 15 - P^B + P^R, 10 + P^B + P^R, 5 + P^B + P^R)|$
$P^B = P^R \in [0, 10)\}$
$= \{(25 - 2P^B, 20 - 2P^B, 15, 5 + 2P^B) | P^B \in [0, 10)\}$

(b) $\tau^B = (2,1,0,-1,-2) \quad \tau^R = (0,0,0,0,0)$

Solution:

$\sum_{h=1}^{5} \tau_h^B = 0 \qquad \sum_{h=1}^{5} \tau_h^R = 01$

$0P^{mB} + 0P^{mR} = 0$

The exchange rate is indeterminate

$x_1 = 25 - 2P^B - 0P^R > 0, \qquad P^B < 25/2$

$x_2 = 20 - 1P^B - 0P^R > 0, \qquad P^B < 20$

$P^R = [0, \infty), \quad P^B = [0, 25/2)$

$x = (x_1, x_2, x_3, x_4, x_5) \in \{(25 - 2P^B, 20 - P^B, 15, 10 + P^B, 5 + 2P^B) | P^B \in [0, 25/2)\}$

(c) $\tau^B = (1,0,0,0,0) \qquad \tau^R = (0,0,0,0,-17)$

Solution:

$\sum_{h=1}^{5} \tau_h^B = 1 \qquad \sum_{h=1}^{5} \tau_h^R = -17$

$1P^B - 17P^R = 0$

$\frac{P^B}{P^R} = 17$

$x_1 = 25 - 1P^B - 0P^R > 0, \qquad P^B < 25$

$\mathcal{P}^m = \{P^R, P^B | 17P^R = P^B \in [0, 25)\}$

$x \in \{(25 - P^B, 20, 15, 10, 5 + 17P^R) | 17P^R = P^B \in [0, 25)\} =$

$\{(25 - P^B, 20, 15, 10, 5 + P^B) | P^B \in [0, 25)\}$

(d) $\tau^B = (1,1,1,1,0) \qquad \tau^R = (0,0,0,-1,-3)$

Solution:

$\sum_{h=1}^{5} \tau_h^B = 4 \qquad \sum_{h=1}^{5} \tau_h^R = -4$

$4P^{mB} - 4P^{mR} = 0$

$\frac{P^{mB}}{P^{mR}} = 1$

$x_1 = 25 - 1P^B - 0P^R > 0, \qquad P^B < 25$

$x_2 = 20 - 1P^B - 0P^R > 0, \qquad P^B < 20$

$x_3 = 15 - 1P^B - 0P^R > 0, \qquad P^B < 15$

$x_4 = 10 - 1P^B + 1P^R = 10 - P^B + P^B = 10$

$\mathcal{P}^m = \{P^R, P^B | P^B = P^R \in [0, 15)\}$

$x \in \{(25 - P^B, 20 - P^B, 15 - P^B, 10 - P^B + P^R, 5 + 3P^R) | P^B = P^R \in [0, 10)\} =$

$\{(25 - P^B, 20 - P^B, 15 - P^B, 10, 5 + 3P^B) | P^B \in [0, 15)\}$

5. Bank Liquidity Requirements (10 minutes):

What are the social costs and social benefits of forcing banks to be more liquid?

Solution:

It is possible (depending how it is done) that more bank liquidity promotes more bank stability, although this is not the case of bank runs in the separated banking system.

On the other hand, less liquidity means more investment in plant, equipment, and R&D. So less liquidity can mean more economic growth.