Written Exam at the Department of Economics winter 2016-17

Corporate Finance Theory

Final Exam

Date: February 6, 2017

(Take-home exam: answers must be submitted before February 20, 2017, 10 AM)

This exam question consists of 5 pages in total (including this page).

Please answer all questions. Answers must be submitted in English.

You are allowed to discuss the questions with your fellow students, but you must write up your own individual answer to all questions.

Exam scripts may be checked for plagiarism. Note, in particular, that copy paste of each others' answers, or changing only a few words in sentences, etc. constitutes plagiarism.

1. Problem 1

Write 1 to 2 paragraphs for each of the following subquestions. You are welcome to use a limited number of mathematical symbols in your answer, but please do not include any explicit calculations.

(a) Summarize the main role played by bankruptcy costs in Banal-Estanol et al. (2013). If bankruptcy costs are zero, what will this imply about the optimal choice of financing regime (i.e. joint versus separate financing)?

(b) Describe the reason why, in Almeida et al. (2011), some firms are able to successfully borrow to meet a liquidity shock, but others are not. Discuss how this compares to the reason why some firms borrow more than others in Malenko and Malenko (2015).

(c) Consider the framework of Povel and Singh (2010), where multiple bidders bid against one another to acquire a target. Will bidders benefit from stapled finance being offered as part of this takeover contest? Explain intuitively why this is, or is not, the case.

2. Problem 2

This question is based on the static framework of DeMarzo et al. (2014), with two differences. First, whereas DeMarzo et al. (2014) consider a single firm, with one owner, one manager, and a safe/risky project, we allow for multiple firms (each with one owner, one manager, and a safe/risky project). We also allow wage payments to each manager to depend on both the cash flows he reports, as well as on the cash flows reported by managers in the other firms. Second, we assume that the state of the world ('Good' or 'Disaster') is unobservable. This implies that the wage a manager receives can only depend on cash flow reports, but not directly on the state.

Important: the set-up here is very similar to Problem 2 in the Corporate Finance Theory Exam of December 2016. The first difference relates to a manager's payoff if he diverts cash, which I will point out explicitly in the problem description. The second difference is that the contract $\mathbb{W}$ you are asked to consider is slightly more general than in the December 2016 Exam. You are most welcome to review the December 2016 Exam and solution guide.

The text that follows provides a detailed description of the problem. Keep in mind that, if we set $N = 1$, then this problem description would correspond to the static model of DeMarzo et al. (2014), except that wage payments cannot be conditioned on the realized state. When answering this question, you are expected to explicitly work with, and manipulate, the relevant mathematical expressions.

Consider a setting with $N \geq 1$ firms, and where the state of the world θ is either 'Good' ($\theta = G$) or 'Disaster' ($\theta = D$). Each firm $i \in \{1, 2, \ldots, N\}$ consists of an owner and a manager (both with subscript i). Neither of them observe the state of the world, but they hold the following prior beliefs: $\mathbb{P}(\theta = G) = 1 - \delta$, and $\mathbb{P}(\theta = D) = \delta$, with $0 < \delta < 1$.

The timing of the game is as followed. First, the state of the world is realized. Second, in each firm i, owner i offers a contract $w_i(r_1, \ldots, r_N)$ to manager i. This contract specifies the wage w_i the manager will later receive, conditional on the cash flow he reports, r_i, and the cash flows reported by other managers, $(r_1, \ldots, r_{i-1}, r_{i+1}, \ldots r_N)$ (more details below). Third, manager i observes this contract and chooses a project $p_i \in \{S, R\}$, where S stands for 'Safe' and R stands for 'Risky'. Fourth, the cash flow of this project is realized, which we denote by $Y_i(p_i, \theta)$. Fifth, manager i observes the cash flow $Y_i(p_i, \theta)$ and sends a public report about it, r_i. Sixth, owner i observes the set of reports from all N managers, $(r_1, \ldots, r_N)$, and pays manager i the wage $w_i(r_1, \ldots, r_N)$ specified under the contract. Finally, payoffs are realized and the game ends.

The realized cash flow $Y_i(p_i, \theta)$ can take on one of three values: 1, 0, and $-D < 0$. The probability of these different values depends both on the project $p_i \in \{S, R\}$ chosen by manager i, and on the state $\theta \in \{G, D\}$, in the following way:

Safe Project, Good State:

- $\mathbb{P}(Y_i = 1 | p_i = S, \theta = G) = \frac{\mu}{1-\delta}$
- $\mathbb{P}(Y_i = 0 | p_i = S, \theta = G) = 1 - \frac{\mu}{1-\delta}$
- $\mathbb{P}(Y_i = -D | p_i = S, \theta = G) = 0$

Safe Project, Disaster State:

- $\mathbb{P}(Y_i = 1 | p_i = S, \theta = D) = 0$
- $\mathbb{P}(Y_i = 0 | p_i = S, \theta = D) = 1$
- $\mathbb{P}(Y_i = -D | p_i = S, \theta = D) = 0$

Risky Project, Good State:

- $\mathbb{P}(Y_i = 1 | p_i = R, \theta = G) = \frac{\mu+\rho}{1-\delta}$
- $\mathbb{P}(Y_i = 0 | p_i = R, \theta = G) = 1 - \left(\frac{\mu+\rho}{1-\delta}\right)$

- $\mathbb{P}(Y_i = -D | p_i = R, \theta = G) = 0$

Risky Project, Disaster State:

- $\mathbb{P}(Y_i = 1 | p_i = R, \theta = D) = 0$
- $\mathbb{P}(Y_i = 0 | p_i = R, \theta = D) = 0$
- $\mathbb{P}(Y_i = -D | p_i = R, \theta = D) = 1$

where $0 < \mu < 1 - \delta$, and $0 < \rho < 1 - \delta - \mu$. Conditional on the state and project selection, the realized cash flow for manager i is independent of the realized cash flows of the other managers.

We will assume that manager i must truthfully report the realized cash flow if it is 0 or $-D$, i.e. $r_i = Y_i$ whenever $Y_i \in \{0, -D\}$. However, if the realized cash flow is 1, then manager i can choose to truthfully report, $r_i = Y_i = 1$, or to instead report $r_i = 0$ and divert cash. The manager's private benefit from diverting cash is λ, where $0 < \lambda < 1$.

Payoffs are as follows. If manager i reports truthfully, then his payoff is equal to the wage he receives: $\pi_i^M = w(r_1, \ldots, r_N | r_i = Y_i)$. If manager i does not report truthfully, then his payoff is $w_i(r_1, \ldots, r_N | r_i = 0) + \lambda$ i.e. the wage he receives, plus the private benefit of diverting cash **(Note: this assumption differs from that taken in the December Exam. There, we assumed that the manager's payoff after diverting cash was simply $\pi_i^M = \lambda$.)** The payoff to owner i is equal to the cash flow reported by manager i, minus the wage paid: $\pi_i^O = r_i - w_i(r_1, \ldots, r_N)$. The manager is protected by limited liability, so that wages must be non-negative: $w_i(r_1, \ldots, r_N) \geq 0$, for any vector of reports $(r_1, \ldots, r_N)$. You can also assume that the condition $\delta D - \rho > 0$ holds.

In terms of contracts, we now concentrate on the incentives of the owner and manager in a specific firm i. Suppose that owner i offers manager i the following contract, which we will call 'contract $\mathbb{W}$' : $w_i(r_1, \ldots, r_N) = \lambda + x$ if $r_i = 1$; $w_i(r_1, \ldots, r_N) = w > 0$ if $r_1 = \ldots = r_N = 0$; and $w_i(r_1, \ldots, r_N) = 0$ otherwise. That is, if manager i reports a cash flow of 1, then he will receive a wage of $\lambda + x$, no matter what. But if manager i reports a cash flow of 0, then his wage will depend on the other managers' reports. Specifically, manager i will receives a wage of w if all other managers also report zero cash flow, and a wage of 0 if at least one manager $j \neq i$ reports a cash flow of 1. Owner i specifies the exact values of x and w when offering the contract; our notation reflects the fact that x and w can be set at any positive values.

(a) Suppose that all N managers choose the safe project. Write down manager i's incentive-compatibility constraint for truthful reporting. That is, what mathematical condition must x and w satisfy to give manager i an incentive to always truthfully report cash flows, under contract $\mathbb{W}$? Comment on whether an increase in either x or w makes this constraint easier or harder to satisfy, and briefly explain why.

(b) Suppose that all $N - 1$ managers other than i choose the safe project. Write down the low-risk-taking constraint for manager i. That is, what mathematical condition must x and w satisfy to give manager i

an incentive to choose the safe project, under contract $\mathbb{W}$? Comment on whether an increase in either x or w makes this constraint easier or harder to satisfy, and briefly explain why.

(c) Suppose that all $N-1$ managers other than i choose the safe project and report cash flows truthfully. Suppose furthermore that owner i also wants to use contract $\mathbb{W}$ to implement the safe project and induce truthful reporting, but wants to minimize expected wage payments to manager i while doing so. What values of x and w should the owner set? That is, derive the optimal values of x and w (conditional on implementing the safe project and inducing the manager to report truthfully) from the owner's perspective.

(d) Now suppose that the number of firms is large, i.e. take the limit as N goes to infinity. What do the optimal values of x and w, derived in part c, tend to in this limit? Compare expected wage payments in the limit, under contract $\mathbb{W}$ with these optimal values, to expected wage payments from Problem 2 of the Corporate Finance Theory Exam of December 2016, and from Proposition 3 of DeMarzo et al. (2014), both of which were $(\mu + \rho)\lambda$. Explain any similarities or differences.

3. Problem 3

Choose a real-world case of a merger or acquisition that we did not explicitly examine in the course, but that relates to at least some theoretical ideas we considered during the semester. (*To find such a case, you can search e.g. in magazines, newspapers, Bloomberg.com, etc.)* Argue which article from the course can shed the most light on this real-world case, and explain why. Comment on whether the key modelling assumptions in this article are plausible for this particular case.