Solution guide: Corporate Finance Theory Exam, December 2019 - January 2020.

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

You may discuss the questions with your fellow students, but you must write up your own individual answers 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.

Problem 1

Write 1 to 2 paragraphs for each of the following subquestions. For this problem you are encouraged to write your answers without the use of mathematical symbols. If you do include some mathematical symbols, then please keep their use to a minimum, and do not include any explicit calculations.

(a) Summarize what is meant by the IPO premium in Bayar and Chemmanur (2011). Informally describe why the size of this premium may depend on the entrepreneur's liquidity need in their theoretical setting.

Solution: By the IPO premium, Bayar and Chemmanur refer to the idea that the payoff for an entrepreneur who exits via IPO often seems to exceed the payoff from exiting via an acquisition. In their setting, the size of this premium is decreasing in the size of the entrepreneur's liquidity need. A high liquidity need means that a low-quality entrepreneur will be more tempted to choose IPO, and benefit from selling more shares that are overvalued. Investors should realize that this effect will reduce the average quality of firms choosing IPO, which will in turn result in a lower share price.

(b) Consider the static model of DeMarzo et al. (2014). What is the main tradeoff the owner faces when deciding whether to induce the agent to implement the safe project or the risky project? Discuss in what kind of situations you expect the owner would find it more attractive to have the risky project implemented.

Solution: The main tradeoff is that the safe project is more efficient, but also more costly to implement, due to the two-dimensional moral hazard problem in DeMarzo et al. (2014). The agent must be rewarded for reporting zero cash flow, to provide incentives to choose the safe project, but also rewarded even more for reporting a positive cash flow, to provide incentives not to divert cash. Trying to solve one part of the moral hazard problem can make the other part more severe, leading to a high expected payment to the agent. The owner will find it more attractive to have the risky project implemented if, for example, there is little deadweight loss in diverting cash, the probability of the disaster outcome is relatively low, or the severity of this outcome is not so severe.

(c) In the framework of Povel and Singh (2010), explain how the bidders' ability to default after winning the takeover contest affects the seller's incentive to offer stapled finance. Now choose another academic article we have seen during the semester in which default plays a role. Comment on the main similarity, and the main difference, between the role played by default in that article and the role played by default in Povel and Singh (2010).

Solution: In Povel and Singh (2010), it is precisely the bidders' ability to strategically default that makes stapled finance attractive for the seller. Low-valuation bidders will self select into accepting the offer of stapled finance, because they realize they can benefit from strategically defaulting, whereas high-valuation bidders will not. This causes bidders to bid more aggressively, which drives up the acquisition price, even though the stapled finance offer may not actually be taken up. Default also plays a role in many other articles on the syllabus, such as Admati et al. (2017) and Banal-Estañol et al. (2013). Povel and Singh (2010) is the only article we have seen in which default is *strategic*; this is a difference. A similarity with other articles is that the possibility of default ex post may often end up hurting players ex ante (e.g. default costs can make borrowing more costly in Admati et al. (2017) and Banal-Estañol et al. (2013), and strategic default drives up the acquisition price bidders pay in Povel and Singh (2010)).

Problem 2

This problem extends the baseline framework of Banal-Estañol et al. (2013) with binary project returns: it introduces possible correlation between these returns, along with possible asymmetric information about whether returns are correlated or not. For this problem, you are expected to explicitly work with mathematical expressions, but are also encouraged to use words to briefly help describe the key expressions.

A firm is looking to start two identical projects. Each project requires an investment of 1. The firm has no assets, but has access to outside financing in the form of debt from competitive, risk-neutral creditors. Once started, each project can either succeed or fail. Success generates high cash flow r_H and failure generates low cash flow r_L, with $r_H > 1 > r_L > 0$.

The firm is characterized by type $\tau \in \{C, N\}$, where C stands for 'correlated' and N stands for 'not correlated'. For a C-firm (i.e. a firm of type C), the returns of the projects are perfectly correlated: with probability p both projects succeed, and with probability $1-p$ both projects fail. For an N-firm (i.e. a firm of type N), the returns of the projects are independent of one another, where p is the probability of success for each project. The firm knows its own type, i.e. it knows whether its project returns are correlated or not. We assume $pr_H + (1-p)r_L > 1$.

We will consider the firm's decision whether to use separate financing or joint financing. Under separate financing, creditors for a particular project only have a claim on the cash flow from that project. Under joint financing, all creditors have a claim on the cash flows from both projects. For joint financing we focus on coinsurance, so that a high cash flow from one project allows the firm to pay the promised return to all creditors, even if the cash flow from the other project is low.

Creditors are repaid as a function of the realized cash flows. Let r denote the gross interest rate promised to creditors. If the cash flow exceeds r, then creditors are paid in full, and the firm keeps any remaining amount as profit. If the cash flow is below r, then the firm defaults, creditors receive a fraction γ of the cash flow, and the remaining fraction $1-\gamma$ of the cash flow is lost to default/bankruptcy costs. We assume $0 < \gamma < 1$, where $\gamma < 1$ means there is a deadweight loss associated with default/bankruptcy. We also assume that creditors are willing to lend at the interest rate r for which they expect to break even on average.

Recall from Banal-Estañol et al. (2013) that $r^* = \left[\frac{1-\gamma(1-p)r_L}{p}\right]$ denotes the equilibrium interest rate under separate financing, and that $r_m^* = \left[\frac{1-\gamma(1-p)^2 r_L}{1-(1-p)^2}\right]$ denotes the equilibrium interest rate under joint financing with coinsurance (in the absence of correlation). Throughout this question, you can assume that $r^* \leq r_H$ and $r_m^* \leq (r_H + r_L)/2$ both hold. This will mean that both separate financing and joint financing with coinsurance are feasible.

For now, assume that creditors can observe the firm's type. That is, the creditors know whether the firm's project returns are independent or perfectly correlated.

(a) Consider an N-firm. Let π_S^N denote the firm's expected profits per project under separate financing, and let π_J^N denote expected profits per project under joint financing with coinsurance. Write down an expression for π_S^N and for π_J^N, and show that the coinsurance gains, $\pi_J^N - \pi_S^N$, are equal to $p(1-p)(1-\gamma)r_L$.

   Solution: Directly following the lecture slides and Banal-Estañol et al. (2013), write $\pi_S^N = pr_H + (1-p)r_L - 1 - (1-p)(1-\gamma)r_L$ and $\pi_J^N = pr_H + (1-p)r_L - 1 - (1-p)^2(1-\gamma)r_L$, which implies $\pi_J^N - \pi_S^N = p(1-p)(1-\gamma)r_L$. The coinsurance gains from joint financing are equal to the reduction in expected default costs.

(b) Now consider a C-firm. Let π_S^C denote the firm's expected profits per project under separate financing, and let π_J^C denote expected profits per project under joint financing with coinsurance. Write down an expression for the coinsurance gains, $\pi_J^C - \pi_S^C$, and comment briefly on their magnitude. *Hint: it is fine to derive separate expressions for π_S^C and for π_J^C, and then take the difference between the two, but it is also possible to directly write an expression for the coinsurance gains.*

   Solution: The coinsurance gains are zero. As above, the coinsurance gains from joint financing are equal to the reduction in expected default costs, due to the fact that the firm can avoid default in situations where exactly one project succeeds. But such situations never arise if returns are perfectly correlated. For completeness, note that $\pi_S^C = \pi_J^C = pr_H + (1-p)r_L - 1 - (1-p)(1-\gamma)r_L = \pi_S^N$.

(c) For all remaining subquestions in Problem 2, you can assume the following: in order to use joint financing, the firm must pay an explicit cost $L > 0$ per project, over and above any payment it makes to creditors. For example, L might represent effort or administrative costs associated with merging the two projects. What form of financing will an N-firm and a C-firm choose in equilibrium? Comment on whether your answer will change depending on whether one assumes L to be relatively large or relatively small.

Solution: The firm will use joint financing if and only if the coinsurance gains exceed L. That is, a C-firm will always choose separate financing, whereas an N-firm will choose separate financing if $L > p(1-p)(1-\gamma)r_L$ and joint financing if $L \leq p(1-p)(1-\gamma)r_L$. Thus, the different firm types will choose different forms of financing if the cost L is small, but not if it is large, since then joint financing is too costly even for an N-firm.

From now on, assume that creditors cannot observe the firm's type. Creditors' prior beliefs are that the firm is an N-type with probability $\theta \in (0,1)$ and a C-type with probability $1-\theta$. Creditors update their beliefs about firm type after observing whether the firm chooses separate or joint financing. They do so using Bayes' rule, and taking into account the firm's equilibrium strategy. Creditors then lend to the firm at the interest rate for which, given their updated beliefs, they expect to break even on average.

(d) Show that there exists a separating equilibrium where an N-firm chooses joint financing and a C-firm chooses separate financing if and only if the following condition holds:

$$1 - [pr_m^* + (1-p)\gamma r_L] \leq L \leq p(1-p)r_L(1-\gamma). \tag{1}$$

Give an intuitive description of how this condition relates to the expected payoff of creditors if the firm deviates in its financing choice.

Solution: In a separating equilibrium, conditional on the firm choosing separate financing, creditors believe the firm is a C-type with probability one and lend at interest rate r^*. Conditional on the firm choosing joint financing, creditors believe the firm is an N-type with probability one and lend at interest rate r_m^*. Thus, a C-firm earns an equilibrium payoff of π_S^C and an N-firm earns an equilibrium payoff of $\pi_J^N - L$. If an N-firm deviates to separate financing, it can borrow at rate r^* and earn π_S^N. Hence, the condition to rule out this deviation is that $p(1-p)r_L(1-\gamma) \geq L$: the coinsurance gains must exceed the explicit cost of joint financing. A C-firm that deviates to joint financing can borrow at interest rate r_m^*, and earn $p(r_H - r_m^*) - L$. The condition to rule out this deviation is $\pi_S^C = p(r_H - r^*) \geq p(r_H - r_m^*) - L$, or equivalently $L \geq p(r^* - r_m^*) = 1 - [pr_m^* + (1-p)\gamma r_L]$: the cost of joint financing must exceed the coinsurance gains (which are zero in this case) plus the expected loss that the deviation imposes on the creditors. That is, creditors break even on average on the equilibrium path, but earn an expected payoff of $1 - [pr_m^* + (1-p)\gamma r_L] < 0$ given the deviation; they are 'fooled' into underestimating the probability of default, and thus lend at an interest rate that is too low.

(e) Suppose that L is sufficiently small so that condition (1) is violated, and hence no separating equilibrium exists. Explain intuitively whether there may exist a partial pooling equilibrium where one firm type chooses joint financing for sure, and the other firm type randomizes between separate and joint financing (*Hint: look at the equilibrium in Bayar and Chemmanur (2011)*). Can you write down one equation, involving the interest rate under joint financing, which must hold in such a partial pooling equilibrium? You are not expected to explicitly derive the equilibrium strategies.

Solution: Intuitively, the separating equilibrium will break down if the interest rate r_m^* is low enough to lead a C-firm to choose joint financing, and thereby take advantage of creditors. However, if creditors believe it increasingly likely that a C-firm will choose joint financing, then they will charge a higher interest rate, to compensate them for the higher associated default probability. This suggests that there may exit a partially pooling equilibrium, very much in line with the spirit of Bayar and Chemmanur (2011), where an N-firm chooses joint financing for sure, and a C-firm chooses joint financing with probability β, such that the interest rate $r_m^*(\beta)$ implied by the creditor break-even constraint leaves the C-firm indifferent between the two financing forms. That is, the relevant condition, involving the interest rate $r_m^*(\beta)$ under joint financing, would be $L = p[r^* - r_m(\beta)^*]$ or equivalently $1 - [pr_m(\beta)^* + (1-p)\gamma r_L] = L$.

(f) Using your answers above, comment on how positive correlation between project returns will tend to affect a firm's choice between separate and joint financing, compared to a baseline where project returns are independent. Does your answer depend on whether creditors can observe whether project returns are correlated (as in parts (a) - (c)) or not (as in parts (d) - (e))?

Solution: The answers above suggest that positive correlation reduces the firm's incentive to choose joint financing, by reducing the coinsurance gains. However, if creditors cannot observe whether project returns are correlated, then some firms with positive correlation may take advantage of this fact, and nonetheless choose joint financing, so as to shift costs onto creditors.

Problem 3

Please seek out and find a news story, describing a case that relates to some of the ideas from the course. Discuss to what extent the main points from the news story relate to the different academic articles we have seen throughout the semester (approximately 2-3 pages). In particular, comment on **both** of the following:

- Which theoretical results from the academic articles can (or cannot) shed light on the news story?
- Which of the key modelling assumptions behind these theoretical results are realistic, when applied to this real-life situation?

Note: you are not expected to relate the news story to every single academic article we have seen. Rather, you should select a few articles from the course which you believe are most relevant for the news story you have chosen. Moreover, your answer should include a link to, or a copy of, the news story in question.

Solution: Answers will vary depending on the news story chosen.