Errata for Tirole, *The Theory of Corporate Finance*

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p. 27: The reference to (3.5) just below eq (3.9) should be (3.4).

p. 128: In the text just below equation (3.15), "The shadow value of equity increases ... with the extent of the moral-hazard problem": "increases" should be "decreases".

p. 170: There should have been a discussion of what happens if the expression for $C(A)$ exceeds C^{max}; again, there is no funding, but it happens at a lower critical A than $\overline{A}$.

p. 186: Condition for $U_b^{\text{seq}} > U_b^{sim}$ should be:

$$\widehat{\rho}_0 < \frac{\rho_0 + \rho_1}{2} \iff d_2 = \frac{p_L}{p_H + p_L} < \frac{1}{2},$$

which is always satisfied.

p. 185: Last equation: The expression should be the same as the first one on that page, i.e., the 2 in the numerator should be erased.

p. 308: Last paragraph: A word is missing. "The search ...*proceeds* in an almost..."

p. 371: In the last equation, p_H should be p_L.

p. 627: Review Problem 3: There is a typo in the text in part (i): The difference $\overline{A}_p - \overline{A}_q$ should have the opposite sign, so that

$$\overline{A}_p - \overline{A}_q = \frac{p_H B - q_H b}{\Delta p} - (p_H - q_H)R.$$

In part (iii), the cost of hiring the active monitor is denoted M, whereas in Sec. 9.2.3, M denotes the monitor's rent. A notation more in line with the text in Chapter 9 would replace every occurrence of M in part (iii) of the Problem with C, where $C = c + M$ is the cost of hiring an active monitor, c is the monitoring cost, and M is the monitor's rent. With that new notation, one can correct another typo: The assumption in line 2 of column 2 should have a multiple p_H on the left-hand side and should read, with the above notation: $p_H(B - b)/(\Delta p) > C$.

Corrections on Corporate Finance text. May 29, 2007

- Footnote 7 page 204:

  (1) Delete current text "Here,… date 2".
  (2) Replace it by new text:
     "We adopt the accounting convention that, in the case of continuation $(\rho < \rho^*)$, the economized cash flow, $\rho^* - \rho$, is returned to some external shareholders."

- Page 583, line -17, right column:

  Replace "if" by "since":
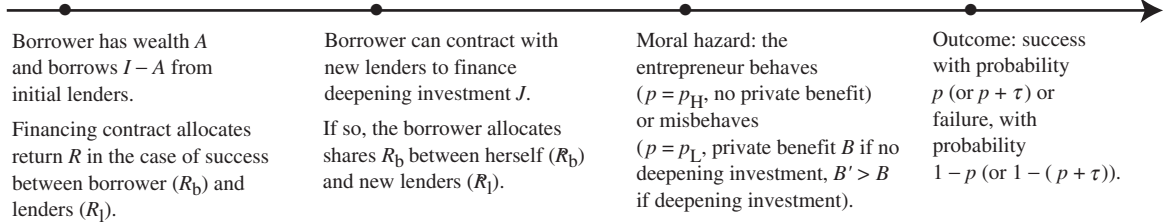   "which is never satisfied since $A > C$."

Borrower has wealth A and borrows $I - A$ from initial lenders.

Financing contract allocates return R in the case of success between borrower (R_b) and lenders (R_l).

Borrower can contract with new lenders to finance deepening investment J.

If so, the borrower allocates shares R_b between herself ($\hat{R}_b$) and new lenders ($\hat{R}_l$).

Moral hazard: the entrepreneur behaves ($p = p_H$, no private benefit) or misbehaves ($p = p_L$, private benefit B if no deepening investment, $B' > B$ if deepening investment).

Outcome: success with probability p (or $p + \tau$) or failure, with probability $1 - p$ (or $1 - (p + \tau)$).

Figure 3.2

prohibiting the dilution of creditors' claims through the issue of new securities, especially ones with equal or higher seniority. There are two basic reasons for such covenants. First, creditors obviously do not want the borrower to issue claims that have a higher or the same seniority as theirs, as this reduces the amount they can collect if the firm defaults. Second, and more subtly, the issue of new securities may alter managerial incentives and the size of the pie.

Let us illustrate the second reason in our simple context. Consider the borrowing contract above in which the lenders take claim R_l in the case of success and the borrower an incentive-compatibility claim $R_b \geqslant B/\Delta p$. Now suppose that there is an opportunity for a "deepening investment." This investment costs an extra J and increases the probability of success uniformly by τ. That is, the probability of success becomes $p_H + \tau$ if the entrepreneur behaves and $p_L + \tau$ if the entrepreneur misbehaves.[17] The deepening investment also increases the private benefit from shirking from B to $B' > B$ (but shirking is still undesirable). Assume that this deepening investment is inefficient in that its net cost C_1 is positive, or put differently the expected increase in profit is smaller than J:

$$C_1 \equiv J - \tau R > 0.$$

The timing goes as in Figure 3.2.

We assume away any negative covenant prohibiting further borrowing and so the borrower can contract with new lenders.[18] However, in the case of new financing, initial lenders are not formally diluted in

that they keep their stake R_l in success when the borrower contracts with new lenders. So the first motivation for inserting a covenant that prohibits the issuing of new securities is absent.

Note first that it is not in the interest of the borrower to contract with new investors if this results in the same effort, i.e., in no taking of private benefit. Intuitively, the new investment reduces total value by C_1, and so someone must lose in the process. Because the value of the initial investors' claim is increased (to $(p_H + \tau)R_l$) if the borrower still behaves, either the entrepreneur or the new investors must lose, which is impossible because the losing party would refuse to write the second financing contract. So assume that the new financing contract disincentivizes the borrower. This reduced incentive results in a second cost:

$$C_2 \equiv (\Delta p)R - B',$$

which we assume to be positive. As described in the timing, let $\hat{R}_b$ and $\hat{R}_l$ denote the new stake of the borrower and the stake of the new lenders, with

$$\hat{R}_b + \hat{R}_l = R_b.$$

Assuming that the new lenders are competitive, then

$$(p_L + \tau)\hat{R}_l = J.$$

The entrepreneur gains from overborrowing if and only if

$$(p_L + \tau)\hat{R}_b + B' > p_H R_b,$$

or, using the breakeven condition for the new investors, $[(p_L + \tau)R_b - J] + B' > p_H R_b$. After some manipulations, this condition becomes[19]

$$[p_H - (p_L + \tau)]R_l > C_1 + C_2.$$

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17. This additivity property is convenient because it separates the incentive compatibility constraint from the impact of the new investment.

18. More generally, the division of the pie ($R_l + R_b = R$) is not made contingent on the event of a deepening investment.

19. The reader will check that B' must strictly exceed B for this condition and the prior incentive condition $(\Delta p)R_b > B$ to be both satisfied.

This necessary and sufficient condition for the deepening investment to be financed has a simple interpretation. The right-hand side is the total cost of refinancing: direct cost plus incentive cost. The left-hand side of the inequality is the *externality* on the initial investors. Thus the total cost must be smaller than the loss of value for the initial investors.

When the borrower's balance sheet (as measured by A, say) improves, R_b increases, R_l decreases, and so this inequality is less likely to be satisfied. Put differently, in the absence of negative covenant, *overborrowing is more likely to happen with weak borrowers.*

Let us conclude this analysis of overborrowing with a few remarks. First, overborrowing in this situation can alternatively be avoided by forcing the entrepreneur not to dilute her own claim; this requirement is usually included in compensation contracts, although there have been attempts to evade it through derivative contracts (see Section 1.2.2). Second, the financing contracts need not be signed sequentially: simultaneous contracts also give rise to an overborrowing problem (see Bizer and DeMarzo 1992; Segal 1999). Third, the overborrowing problem arises with a vengeance in the context of sovereign borrowing, in which it is hard to specify a limit on indebtedness of the sovereign, if only because there are many different ways for a government to add new liabilities (see Bolton and Jeanne (2004) for an analysis of sovereign borrowing with the possibility of dilution). Finally, *in a multiperiod financing context, uncoordinated lending further leads to excessively short maturity structures of debt*, as investors scramble to obtain priority over other investors (see Exercise 5.9).

3.2.5 Boosting the Ability to Borrow: Reputational Capital and Capability

Recall from Chapter 2 that lenders do not only look at tangible assets such as cash, land, and equipment. Ceteris paribus, they are more likely to issue a loan if the borrower has a good reputation, as was stressed in particular by Diamond (1991). The role of this intangible capital is easily analyzed in the credit rationing model.

Suppose, for example, that the borrower has less attractive opportunities for misbehavior, in that the private benefit B from misbehaving is reduced to $b < B$.[20] This may have several interpretations. Along the lines of the "effort interpretation" of moral hazard, one might imagine that the project falls well within the core competency of the entrepreneur and therefore demands less attention or supervision of the subordinates: the task is just easier for the entrepreneur. Alternatively, one could imagine that the entrepreneur has less attractive outside options (focusing on other, separate projects of her own) or opportunities for fraud and embezzlement (e.g., it is harder to buy inputs at an inflated price from a friend or family).

With reduced scope for moral hazard, the asset threshold is accordingly lower: from equation (3.3),

$$\bar{A}(b) < \bar{A}(B),$$

where $\bar{A}(\beta) \equiv p_H(\beta/\Delta p) - (p_H R - I)$, and thus

$$\bar{A}(B) - \bar{A}(b) = \frac{p_H}{\Delta p}(B - b) > 0.$$

In this sense, a "more reliable borrower" (that is, a borrower who has a lower private benefit from misbehaving) is more likely to obtain a loan.

How does this fit with the idea that a good reputation helps raise external finance? Suppose now that the private benefit (B or b) is not directly observed by the lenders, who only have the borrower's track record at their disposal. That is, the lenders know whether the borrower's past projects have been successful or whether past loans have been reimbursed. They use this information to update their beliefs about the reliability of the borrower. A better track record is an (imperfect) indicator of good reliability, that is, in our example, of a low private benefit from misbehaving.

Consider an entrepreneur who got a loan for a first project, and may in the future have new projects that will also call for outside financing. Let us further assume that these future projects are not yet well-defined, and focus on short-term finance. (Chapter 5 will analyze long-term loans.) In this situation, the entrepreneur should adopt a long-term perspective.

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20. We could alternatively analyze the impact of a higher probability of success or of changes in other variables, with similar insights. The focus on the private benefit allows a cleaner analysis because changes in the private benefit keep the NPV of the project constant.