Capital Structure and Transparency

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Abstract

Firms that are more highly levered are forced to raise capital more often, a process that generates information about the firm. Of course transparency can improve the allocation of capital. However, when the information about the firm affects the terms under which the firm transacts with its customers and employees, transparency has an offsetting negative effect. We show that good news may not improve much those terms, while bad news may substantially worsen them. This negative effect of transparency is likely to be more important for technology firms, which will protect against it by reducing their leverage.

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1 Introduction

A substantial amount of our intuition about optimal capital structure comes from simple static trade-off models. In these models, firms select their debt-equity ratios at some initial date, and depending on subsequent cash flows, either benefit from tax advantages or suffer the consequences of too much debt and financial distress. The implications of these models—that firms that are likely to suffer the greatest financial distress costs and benefit the least from the debt tax shield choose to be less levered—are roughly consistent with the empirical evidence.[1] However, it is not clear how the implications of this simple static model carry over to a framework where the capital structure choice is dynamic. Specifically, in the absence of additional market imperfections, firms should be able to enjoy the tax benefits of debt, and avoid the costs associated with financial distress, by committing to issue new equity in the future whenever their earnings or debt ratings fall sufficiently.

In reality, we do not observe firms implementing dynamic capital structure strategies that involve high debt ratios along with commitments to issue equity when they are doing poorly.[2] There are a number of potential reasons why this might be the case. The first possibility, considered in Fisher, Heinkel, and Zechner (1989) and in Titman and Tsyplakov (2001), is that there are transaction costs associated with issuing equity. However, these costs are not likely to be large relative to the tax benefits associated with higher leverage.[3] A second possibility has to do with the time-inconsistency of the commitment to issue equity. Firms may be reluctant to make firm commitments in an uncertain environment while ex post, without a firm commitment, may not want to issue equity because of either the wealth transfer to

[1]See, for instance, Titman and Wessels (1988) and Rajan and Zingales (1995).
[2]See Minton and Wruck (2001).
[3]See Graham (2000).

bondholders or concerns about dilution a la Myers and Majluf (1984). The problem with this second argument is that it applies the least to the firms with the greatest financial distress costs. Firms with substantial costs of financial distress are the most willing to transfer wealth to debtholders by issuing equity.

A potential missing element of the extant analysis of dynamic capital structure strategy relates to the information that is generated when firms issue equity. For a variety of reasons, the incentives of analysts and investors to generate information about a firm increase when the firm issues equity. Specifically, the underwriter of an equity issue is required to do so by "due diligence." In addition, there is likely to be a greater incentive for investors to collect information when a large liquidity trade (by the firm) is expected. Hence, since more levered firms must access external capital markets more often, there will be more information generated about them.

While the relation between capital structure and information production warrants additional research, it is not the focus of this paper. Rather, we take as given that more information is generated about more levered firms, making them more transparent, and explore the implications of this fact.[4] In particular, we examine the extent to which transparency affects a firm's expected profitability by altering the terms of its relationship with its non-financial stakeholders.

Although we believe that we are the first to formally analyze this aspect of the relation between transparency and capital structure, others have considered related issues. In particular, existing research suggests that resources are allocated more efficiently when firms are more efficiently priced. For example, Easterbrook (1984) discusses the fact that firms that are forced to pay out a higher fraction of their cash flow will be subject to greater scrutiny because of their need to access external capi-

[4]The interest in producing information about a highly levered firm may also come from credit rating agencies and creditors concerned about its credit risk.

tal. Easterbrook argues that this greater scrutiny reduces agency problems between shareholders and managers and thereby improves firm values. Subramanyam and Titman (1999) suggest that because of a positive relation between stock prices and the quality of investment choices, firms that are more accurately priced will be more valuable on average. In each of these cases, more transparent firms allocate resources more efficiently and are thus more valuable.

In contrast, the model developed in this paper considers a case where increased transparency can reduce firm values. Our argument is based on the idea that a firm's profitability depends, in part, on how the firm is perceived by its stakeholders, e.g., its employees, customers, and suppliers. Our focus is on a case where some employees develop better human capital working for more innovative firms, and hence are willing to accept lower wage rates to work for a firm that is perceived to be a potentially strong innovator. Some employees, however, may gradually realize that they are not able (or motivated enough) to take advantage of working for an innovator, and the wage that they demand may no longer depend on the firm's potential as an innovator. As we show, in this case, a firm may find it costly to issue equity following, say, a decline in its earnings.

To see this, notice that, on the positive side, the equity issue may generate information that shows that the decline in earnings is only transitory and the firm has strong potential as an innovator. Yet, because of the existence of the second group of less able or less motivated employees, this good news may not allow the firm to substantially reduce its wages. On the negative side, the information may reveal that the situation is really bad and the firm will never be a strong innovator. In this case, retaining the first group of motivated employees may oblige the firm to substantially increase its wages.[5] Hence, on average, the news generated by the equity issue are

[5]Although the analogy is far from perfect, the issues raised in this paper are tangentially related to

likely to increase the firm's expected employment costs.[6]

Our analysis of this model focuses on two related issues. The first relates to the circumstances under which transparency affects firm values and, by extension, the implications of transparency considerations on the firm's capital structure decision. The second relates to how the capital structure, and its effect on transparency, modifies the firm's incentives to undertake investments that increase its stakeholders' experience gains. The overall conclusion is that firms that benefit the most from being perceived as an innovator are likely to opt for conservative capital structures.

The rest of the paper is organized as follows. Section 2 describes the model. Section 3 analyzes the later stages of the model in order to show the effect of transparency on the firm's expected cost of retaining its stakeholders. Section 4 extends the analysis to a dynamic setting, and examines the extent to which those costs translate into a decline in firm value and distort the firm's capital structure decision. Section 5 considers the general model in which the firm controls both its capital structure and some investment that increases the value of its stakeholders' experience gains. Section 6 shows the robustness of our results to generalizations of the contractual setting. Section 7 shows that the analysis can extend to stakeholders different from those considered in the model. Section 8 concludes.

the recent Enron bankruptcy. Less than one year prior to their bankruptcy, Enron was clearly viewed as an innovator, which made the firm a very attractive employer and business partner. However, because they were so highly levered, they were forced to access external capital markets when they were doing poorly, and under the scrutiny of the capital markets, it was revealed that Enron had made a number of bad investments, which contrasted sharply with prior perceptions. This change in perception, made the firm a less attractive trading partner, which ultimately contributed to the firm's demise.

[6]A similar mechanism can apply to the relationship between an innovative firm and its customers. See Section 7 for a discussion.

2 The model

Consider a firm that operates in a risk neutral economy where the market rate of return is normalized to zero. There are four relevant dates in the life of the firm, $t = 0, 1, 2, 3$. The firm chooses its capital structure at $t = 0$. It hires its workers at $t = 1$ and provides them some firm-specific training that makes them essential for the firm. At $t = 2$ the workers recontract with the firm. If workers are retained, the firm generates a revenue of Y at $t = 3$. If the firm fails to retain its workers, its revenue is zero.[7]

The workers are hired at $t = 1$ from a population of ex-ante identical workers with a reservation utility $\overline{U} \geq 0$. A proportion μ of the workers, which we call *quick learners* benefit from working with innovative firms, which we call *winners.* The remaining proportion $(1 - \mu)$, which we call *slow learners,* do not build human capital that is externally marketable, but are equally productive within the firm. The workers do not know their type when hired but privately acquire this information during their training. As a result, at $t = 2$, quick learners enjoy better outside opportunities and, thus, a larger reservation utility, U_h, than slow learners, U_l. We denote by ΔU the difference between these reservation utilities, $U_h - U_l > 0$. In addition, quick learners continue to obtain valuable experience by working for a winner; providing them an additional *experience gain* of z. Intuitively, we think of a winner as a firm which sets the future technological and organizational standards for its industry and hence has the potential to provide its workers with especially valuable experience. The size of the experience gain z is determined by non-verifiable investments (e.g., R&D activities) that cost the firm $C(z)$.

The firm has a probability γ of being a winner and a probability $1 - \gamma$ of being

[7] As explained later, Y is the revenue of a 100% equity firm, gross of labor costs and the net benefits from leverage.

a loser. None of the players in this game initially observe the firm's type, however, with probability d, the firm's type i is *revealed* to all parties right before $t = 2$, and with probability $1 - d$, the firm's type i is revealed at $t = 3$.

We assume that the firm interacts with the workers through spot labor markets where workers commit their labor and wages are set for just one period.[8] So a worker hired at $t = 1$ is free to leave the firm at $t = 2$. However, since the firm needs the worker, it must make a sufficient wage offer w_1 at $t = 1$ and w_2 at $t = 2$ that will induce the worker to stay regardless of its type.[9] Workers have no wealth and enjoy limited liability so wages at both dates must be non-negative.[10]

Finally, we characterize the capital structure or *leverage ratio* chosen by the firm at $t = 0$ as the probability d that its type is revealed before $t = 2$.[11] The idea is that greater leverage makes the firm more exposed to a financial shortfall at $t = 1$ (i.e., the worker's training period) and, thus, increases the probability that the firm needs to tap the capital markets either to renegotiate its debt or to issue new equity, which, we assume generates information about the firm's type. In addition, we capture the standard advantages and disadvantages of leverage by postulating that debt adds some net benefits $X(d)$ to the firm's potential revenue Y.[12] Consistent with the traditional *trade-off theories* of capital structure, we assume that $X(d)$ is a single-peaked function that reaches a maximum for some interior value d^* of the leverage ratio.[13]

[8] In Section 6, we explore how long-term contracts could affect matters.

[9] The problem is similar to the basic screening problem of a monopolist who faces customers of two unobservable types and finds it profitable to serve both of them; see Maskin and Riley (1984). The interest to retain the worker in all circumstances requires both $\mu Y > \Delta U + \mu U_l$ and $(1 - \mu)Y > U_l - \mu U_h + \mu z$.

[10] The robustness of our results to this assumption is commented at various points below.

[11] With minor modifications, the analysis would remain valid under any monotonically increasing relationship between the relevant leverage ratio and the probability of early disclosure of information.

[12] So Y represents the revenue of a 100%-equity firm while $X(d)$ is the incremental revenue (net of financial distress costs) due to the positive (tax-related or incentive-related) effects of leverage.

[13] Technically we guarantee that $d^* \in (0, 1)$ by assuming $X'(1) \leq 0 \leq X'(0)$ and $X''(d) < 0$.

The events considered in this analysis are summarized in the time line described in Figure 1.

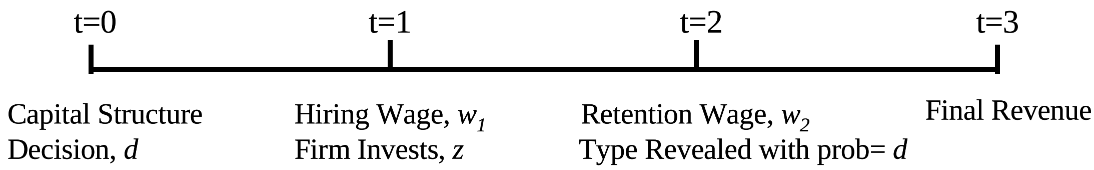

Figure 1: Sequence of events.

3 Capital structure and expected retention wages

We start by considering the wage that must be offered to retain both types of worker at date 2, which is determined by the firm's type, if it is in fact revealed. To understand the expected advantages or disadvantages of transparency, we will be comparing the wage rate, when the firm's type is not revealed, with the expected wage rate when the firm's type is revealed.

As we will show, an important feature of our model is the fact that in almost all cases, the wage rate that allows the firm to retain both type of workers provides one of the two types with rents. These rents, which ultimately reduce firm value, are determined by whether or not the firm's type is revealed.

3.1 Retention wages

Three possible states can occur at $t = 2$: what we call the *opaque* state in which the firm's type remains unknown ($s = u$), and the *transparent* states, in which the firm is revealed to be a winner ($s = g$) or a loser ($s = b$). If the firm's type is not revealed, the minimum wage required to retain both types of worker is

$$w^u = \max\{U_l, U_h - \gamma z\}, \tag{1}$$

where U_l is the minimum wage required to retain a slow learner (his reservation utility) and $U_h - \gamma z$ is the minimum wage required to retain a quick learner (his reservation utility minus the expected experience gain).

If the firm is revealed to be a winner, the wage required to retain both types is

$$w^g = \max\{U_l, U_h - z\} \tag{2}$$

where the wage required to retain a slow learner is again U_l, but the wage required to retain a quick learner is now $U_h - z$ since, due to transparency, a quick learner is now certain about his experience gain.

Finally, if the firm is revealed to be a loser, the minimum wage that retains both worker types is

$$w^b = \max\{U_l, U_h\} = U_h, \tag{3}$$

since, due to transparency, a quick learner knows that his experience gain will be zero.

Clearly, the required wage is lower when the firm is revealed to be good rather than bad ($w^g < w^b$) and when its type remains unknown rather than revealed as a loser ($w^u < w^b$). Moreover, $w^g \leq w^u$, where this inequality holds strictly when $\Delta U > \gamma z$. To understand why this is the case, note that:

1. If $\Delta U \leq \gamma z$, the opaque firm is attractive enough to the quick learner so that the retention wage is the reservation utility of a slow learner. Hence $w^g = w^u = U_l$.

2. If $\gamma z < \Delta U < z$, the retention wage of a winner firm is determined by the reservation wage of a slow learner, but that of a opaque firm is determined by the reservation wage of a quick learner. Hence $w^g = U_l$ and $w^u = U_h - \gamma z$, which implies that $w^g < w^u$.

3. If $\Delta U \geq z$, retaining a quick learner is always more difficult than retaining a slow learner. Hence $w^g = U_h - z$ and $w^u = U_h - \gamma z$, which also implies $w^g < w^u$.

Intuitively, if there were only one type of worker, the expected wage rate of the transparent firm would equal the wage rate of the opaque firm. However, with multiple type workers, this need not be the case. With multiple type workers, at least one of the types earns rents in each of the three possible states. As we show, the expected value of these rents are higher for the transparent firm.

3.2 Expected retention wage bill

Let $w_2(d)$ denote the firm's expected cost of the retention wage as a function of the probability d that its type is disclosed before $t = 2$. Clearly,

$$w_2(d) = d[\gamma w^g + (1-\gamma)w^b] + (1-d)w^u.$$

The expressions for w^g, w^b, and w^u obtained above, together with the identification of the probability that firm type is disclosed before $t = 2$, allow us to prove the following result:

Lemma 1 *The expected retention wage is given by*

$$w_2(d) = \begin{cases} U_l + (1-\gamma)\Delta U d, & \textit{if } \Delta U \leq \gamma z, \\ U_h - \gamma z + \gamma(z - \Delta U)d, & \textit{if } \gamma z < \Delta U < z, \\ U_h - \gamma z. & \textit{if } \Delta U \geq z, \end{cases} \tag{4}$$

In the first two cases, w_2 is increasing *in the probability of the firm being transparent, d. In the third case, w_2 is independent of d.*

When the quick learners' reservation utility premium is large relative to their experience gains (i.e., $\Delta U \geq z$), retention wages are driven by the requirements of the quick learners in each of the three possible states attainable before $t = 2$. In this case, the average wage required when firm type is disclosed, $\gamma w^g + (1-\gamma) w^b = U_h - \gamma z$, coincides with the wage required when it is not, $w^u = U_h - \gamma z$, which in turn implies that the firm's expected wage bill is *independent* of the firm's transparency. In other cases, the worker type which is the most costly to retain differs across states. In these cases, the wage bill of an opaque firm, w^u, is strictly lower than the average wage bill of a transparent firm, $\gamma w^g + (1-\gamma) w^b$.[14] Due to the shift in the type that binds, the additional compensation that the firm must incur when bad news about its type is revealed ($s = b$) is not fully compensated by the wage reduction when good news is revealed ($s = g$). Hence, on average, the wage bill is *smaller* if the firm's type is not revealed.

Summing up, transparency increases the firm's date 2 expected costs. Specifically, a higher probability of revelation at least weakly increases the cost of retaining workers with heterogenous types.

4 Capital structure and the total wage bill

The analysis in the previous section described how, depending on the state, the workers of at least one of the two types earn rents at $t = 2$. This does not necessarily imply that when we examine the total wages across $t = 1$ and $t = 2$, the workers expect to earn rents. Indeed, as we will show, if the workers are not financially constrained, they will be willing to take a lower wage at $t = 1$, which exactly offsets their expected rents at $t = 2$. As a result, transparency need not affect total expected wages.

Let $w_1(d)$ denote the wage offered by the firm to the workers at $t = 1$, which

[14] In particular, w^u reflects the requirement of just one type—quick learners if $\Delta U < \gamma z$ and slow learners if $\gamma z < \Delta U < z$. Instead, w^g is always driven by the requirements of slow learners and w^b is always driven by the requirements of quick learners, so $\gamma w^g + (1-\gamma) w^b$ mixes the requirements of both worker types.

accounts for the fact that forward-looking workers anticipate the rents that they expect to obtain at $t = 2$. Specifically, $w_1(d)$ must satisfy,

$$w_1(d) + [w_2(d) + \mu\gamma z] - (U_l + \mu\Delta U) \geq \overline{U}, \tag{5}$$

where the term in brackets accounts for the expected wage and experience gains at $t = 2$ while the term in parenthesis reflects a worker's expected reservation utility at that date.[15] The difference between both terms, which is always positive, measures the rents that workers obtain at date $t = 1$, as a result of asymmetric information about their types.

To simplify the presentation, we focus on the case where $\Delta U \in (\gamma z, z)$, where, according to (4), the expected retention wage is

$$w_2(d) = U_h - \gamma z + \gamma(z - \Delta U)d, \tag{6}$$

which is strictly increasing in the probability that firm type is disclosed before $t = 2$. In this case, the minimum $w_1(d)$ that satisfies (5) is given by

$$\widehat{w}_1(d) = \overline{U} - (1 - \mu)(\Delta U - \gamma z) - \gamma(z - \Delta U)d. \tag{7}$$

So the expectation of rents in the retention game makes the worker accept an initial wage lower than his reservation utility at $t = 1$, $\overline{U}$. Such a wage is decreasing in d because leverage increases the firm's transparency and this, in turn, increases the expected retention wage. Yet, workers' lack of wealth imposes a possibly binding non-negativity constraint on the initial wage. Thus:

Lemma 2 *At $t = 1$ workers are hired at a wage $w_1(d) = \max\{\widehat{w}_1(d), 0\}$.*

[15] We assume that all workers, irrespectively of being hired by the firm or not, learn their type and, thus, their continuation reservation utility before $t = 2$. The experience gains that quick learners may obtain in other firms (if any) are implicitly included in U_h.

When the non-negativity constraint on the initial wage is not binding, (5) holds with equality, so the firm's total labor costs per worker are

$$W(d) = \widehat{w}_1(d) + w_2(d) = \overline{w},$$

where $\overline{w} \equiv \overline{U} + (U_l + \mu\Delta U) - \mu\gamma z$ is workers' average reservation utility net of expected experience gains. Notice that $\overline{w}$ does not depend on d. In contrast, when the non-negativity constraint is binding, the firm's total labor costs per worker are $W(d) = w_2(d)$, which is increasing in d. By inspection of (7), we can distinguish three cases:

1. If $\overline{U} - (1-\mu)(\Delta U - \gamma z) \leq 0$, then $W(d) = \overline{w}$ for all d.
2. If $0 < \overline{U} - (1-\mu)(\Delta U - \gamma z) < \gamma(z - \Delta U)$, then there exists some
$$\overline{d} \equiv \frac{\overline{U} - (1-\mu)(\Delta U - \gamma z)}{\gamma(z - \Delta U)} \in (0,1) \tag{8}$$
such that $W(d) = \overline{w}$ for $d \leq \overline{d}$ and $W(d) = w_2(d)$ for $d > \overline{d}$.
3. If $\overline{U} - (1-\mu)(\Delta U - \gamma z) \geq \gamma(z - \Delta U)$, then $W(d) = w_2(d)$ for all d.

More compactly,

Proposition 1 *The total expected labor costs per worker are given by* $W(d) = \max\{\overline{w}, w_2(d)\}$, *which is* increasing *in the firm's leverage ratio* d *when the workers' wealth constraint is binding and, otherwise, independent of* d.

At $t = 0$, if the number of workers hired by the firm is normalized to one, the present value of its revenue net of total labor costs is

$$V(d) \equiv Y + X(d) - W(d). \tag{9}$$

Thus, except if $d = \overline{d}$, in which case $W(d)$ is non-differentiable, the firm's optimal leverage ratio solves the first order condition:

$$X'(d) = W'(d), \tag{10}$$

so the "standard" marginal benefits from leverage, $X'(d)$, must equal its marginal cost due to greater transparency, $W'(d)$.

The form of $W(d)$ allows us to distinguish three cases:

1. $d < \overline{d}$. In this case we have $W(d) = \overline{w}$ so (10) reduces to $X'(d) = 0$, whose solution is $d = d^*$. Hence if $d^* < \overline{d}$, the firm's optimal leverage ratio is d^*, which is just determined by the standard trade-offs.

2. $d > \overline{d}$. In this case we have $W(d) = w_2(d)$ so, using (6), (10) becomes $X'(d) = \gamma(z - \Delta U)$, whose solution is some $\widehat{d} < d^*$. Hence if $\widehat{d} > \overline{d}$, the firm's optimal leverage ratio is $\widehat{d}$, which is tilted down (relative to d^*) due to the costs of transparency.

3. $d = \overline{d}$. Given the form of $W(d)$, having a maximum at the non-differentiability point $\overline{d}$ requires $0 \leq X'(\overline{d}) \leq \gamma(z - \Delta U)$, that is, $\overline{d} \in [\widehat{d}, d^*]$.

Summing up:

Proposition 2 *When the workers' wealth constraints are binding ($\overline{d} < d^*$), the firm's capital structure decision becomes conservative, $d = \max\{\widehat{d}, \overline{d}\} < d^*$. Otherwise it is driven by the standard trade-offs, $d = d^*$.*

Hence, whenever the workers' wealth constraints are binding ($\overline{d} < d^*$), the cost of transparency distorts the firms capital structure decision towards a conservative leverage ratio $d < d^*$. Notice from (8) that $\overline{d}$ is a linearly increasing function of workers' reservation utility at $t = 1$. Thus, financial conservatism arises when the initial reservation utility $\overline{U}$ is small. Transparency is costly in this case because offsetting the increase in future labor costs due to higher leverage would require a negative initial wage, which we assume is infeasible.[16]

5 Capital structure and experience gains

In this section we proceed to solve the general model of Section 2. To do so, we endogenize the experience gains z. We assume that those experience gains derive from investments undertaken by the firm during workers' training period, i.e., after they have been hired ($t = 1$) but before the possible disclosure of firm type ($t = 2$). The investments that we have in mind include training programs that allow workers to acquire the firm's know-how, R&D investments that widen the applicability of the firm's proprietary technologies, or the establishment of confidentiality procedures and licensing practices that increase the protection of workers' monopoly on the relevant know-how. As we show, the firm's capital structure has an influence on the investment z, which in turn affects the relationship between the firm and its employees.

We assume that these investments, while observable for both the firm and the workers, are unverifiable and hence non-contractible.[17] For simplicity, we model them as a direct choice of z at a cost given by a strictly increasing and strictly convex function $C(z)$. We focus on the same case analyzed in Section 4 by assuming that the choice of z is restricted to an interval $[\underline{z}, \overline{z}] \subset (\Delta U, \Delta U/\gamma)$.[18] Additionally, in order

[16] Interestingly, irrespective of the size of workers' initial reservation utility, our analysis predicts that capital structure and, more generally, a firm's transparency, has implications for the time profile of workers' compensation. Opaqueness is related to flatter wage profiles than transparency. Then, as the leverage ratio d increases, initial wages fall and both the average and the dispersion of future wages increase.

[17] Grossman and Hart (1986) emphasize the importance of relationship-specific investments in their theory of the firm. See also Hart (1995).

[18] Thus, $\Delta U \in (\gamma z, z)$. Technically, this would be guaranteed, without further constraints, if

to highlight the effects channelled through the investment level z, we initially assume that $\overline{U}$ is large enough for the worker's wealth constraint not to be binding so that total labor costs are:

$$\overline{w} \equiv \overline{U} + (U_l + \gamma \Delta U) - \mu\gamma z, \tag{11}$$

which does not *directly* depend on the leverage ratio d. At the end of the section we briefly comment on the case in which $\overline{U}$ is small and, hence, total labor costs are increasing in d, as in (6).

5.1 The first-best case

We first examine the relationship between capital structure and experience investment in the case in which the latter, i.e., z, is contractible. This will tell us how things would work in a *first-best* world, to which we later compare the results obtained for the case of noncontractible z. As we focus on a case in which the limits to the transferability of wealth between the worker and the firm are not binding, total firm value includes the worker's ex ante valuation $\mu\gamma z$ of the z investment (which the worker transfers to the firm by accepting a lower initial wage).[19] So, neglecting constants, value maximization requires

$$\max_{d\in[0,1],\ z\in[\underline{z},\overline{z}]} \quad X(d) + [\mu\gamma z - C(z)]. \tag{12}$$

Thus the first-best solution (d^*, z^*) is implicitly defined by the first order conditions

$$X'(d^*) = 0, \tag{13}$$

$$\mu\gamma = C'(z^*). \tag{14}$$

$\lim_{z^+\to\Delta U} C'(z) = 0$ and $\lim_{z^-\to\frac{\Delta U}{\gamma}} C'(z) = +\infty$.

[19] The marginal value of the z investment, $\mu\gamma < 1$, follows from our assumption that only a quick learner in a winner firm enjoys the experience gains, z. As it will be clear, our results generalize as long as the marginal valuation of the investments remains different across worker types.

Clearly, in the first best world the capital structure decision d^* and the investment decision z^* are separable. The leverage ratio d^* is determined by the standard trade-offs—exactly as in the case of exogenous z and nonbinding wealth constraints considered in the previous section—while the investment z^* equalizes the marginal (social) value of the investment to its marginal cost.

5.2 Analysis when z is non-contractible

We now turn to solve the model when the investment z is non-contractible. We proceed by backward induction: when z is chosen, the leverage ratio d and the worker's initial wage $w_1(d)$ have already been fixed. So z is set to maximize the firm's continuation value. Increasing z reduces the expected retention wage,

$$w_2(d,z) = U_h - \gamma z + \gamma(z - \Delta U)d, \tag{15}$$

but increases the investment cost, $C(z)$. Thus, after eliminating all constants from the objective function, the program for the optimal choice of z is reduced to

$$\max_{z\in[\underline{z},\overline{z}]} \quad \gamma(1-d)z - C(z),$$

whose first order condition is

$$(1-d)\gamma = C'(z). \tag{16}$$

For each possible value of d, this equation defines the solution $z = h(d)$ to the investment problem, where, by the implicit function theorem, $h'(d) = -\gamma/C''(z) < 0$. Then,

Lemma 3 *When the investment z is non-contractible, its level $h(d)$ is a* decreasing *function of the firm's leverage ratio d.*

Equation (16) captures an important feature of the analysis. In contrast to the first-best case, the investment z and the capital structure decision d are no longer separable. In fact, a more conservative capital structure leads the firm to invest more in its relationship with the workers, because greater opacity makes retention wages more sensitive to the workers' value of such a relationship. So the capital structure decision works as a commitment device for setting z at an adequate level. The use of such a device, however, is not costless because the leverage ratio which implements the first-best level of z is generally different from the first-best leverage ratio.

Specifically, the *second-best* leverage ratio, d^{**}, is set taking into account its effect on the investment z, and thus:

$$\max_{d\in[0,1]} \; X(d) + [\gamma\mu h(d) - C(h(d))], \tag{17}$$

where we have substituted $h(d)$ for z in the terms (in brackets) which account for the impact of the investment on labor costs and, thereby, on firm value. Under our assumptions, the objective function in the above maximization is quasi-concave so a necessary and sufficient condition for a maximum is:

$$X'(d^{**}) = -h'(d^{**})[\gamma\mu - C'(h(d^{**}))]. \tag{18}$$

which uniquely determines d^{**} and, recursively, $z^{**} = h(d^{**})$.

It is clear from (13) and (14) that, if $h(d^*) = z^*$, then $d^{**} = d^*$ solves (18) and, thus, the second-best solution coincides with the first-best solution. Generally, however, one of the following cases will arise:

1. The first-best leverage ratio d^* induces a level of z lower than the first-best one, z^*. In other words, d^* makes the firm *too transparent* for the implementation of z^*. Then (18) is solved with a *conservative* capital structure, $d^{**} < d^*$, that partially corrects the problem of *underinvestment* in z: $h(d^{**}) \in (h(d^*), z^*)$.

2. The first-best leverage ratio d^* induces a level of z higher than the first-best one, z^*. That is, d^* makes the firm *too opaque* for the implementation of z^*. Then (18) is solved for an *aggressive* capital structure, $d^{**} > d^*$, that partially corrects the problem of *overinvestment* in z: $h(d^{**}) \in (z^*, h(d^*))$.

A parameter that determines which of the above cases holds is μ, i.e., the proportion of quick learners in the population of workers. Specifically, by comparing (13) and (16), and noting that if $h(d^*) = z^*$ then $\mu = \mu^* \equiv 1 - d^*$, we establish the following result:

Proposition 3 *When the proportion of quick learners in the population of workers is above (below) a critical level μ^*, the firm is financially conservative (aggressive) and underinvests (overinvests) in z. Furthermore, as the proportion of quick learners increases, the firm reduces its leverage and raises its z investment.*

These results are related to the *time inconsistency* problem that affects the decision z. Forward-looking workers are willing to compensate the firm for their experience gains by reducing their initial wages. However, the firm decides on the investment z after the initial wages are already fixed, and hence, it only considers the effect of z on retention wages. A more conservative capital structure implies lower transparency and, thus, a higher sensitivity of retention wages to experience gains. Hence, if the firm anticipates a problem of underinvestment in z, it may partially correct it by choosing a conservative capital structure. Similarly, if the firm is tempted to overinvest in z, it may ameliorate the problem by choosing an aggressive capital structure. Our analysis predicts that financial conservatism occurs when the proportion of quick learners is large, since in this case the z investment brings greater savings on the total expected wage bill.

5.3 Binding wealth constraints

We finalize this section with a brief discussion of the case in which the low value of workers' initial reservation utility, $\overline{U}$, makes their wealth constraints binding, that is, leads the initial wage to its lower bound of zero. In this case, the future rents that workers appropriate under greater transparency cannot be transferred to the firm. Hence, in addition to the effect channelled through the investment z, the leverage ratio d has a direct effect on the firm's total labor costs. Since in this case the initial wage is zero, the ex ante value and the continuation value of the firm (which are the criteria relevant for the choice of d and z, respectively) coincide and equal $X(d) + w_2(d, z) - C(z)$, where $w_2(d, z)$ is given by (15). Maximizing this expression with respect to d and z leads to the following result:

Proposition 4 *When workers' wealth constraints are binding, the firm always chooses a conservative leverage ratio, $\widetilde{d} < d^*$, which is independent of the proportion of quick learners in the population of workers. Over- and under-investment in z are possible.*

This results leads us back to the logic of Proposition 2. When workers' wealth constraints are binding, all labor costs are incurred after the investment z takes place so the capital structure decision plays no role as a commitment device. The endogeneity of z does not alter the conclusions reached about the capital structure choice under exogenous z: financial conservatism makes the firm less transparent, which by reducing the wages required to retain the workers, saves on total expected labor costs.

6 Robustness

The analysis in previous sections has been developed under the assumption that labor contracts are short-term in both workers' commitment to work for the firm and the firm's commitment to pay a wage to its workers. We have identified two scenarios in which concerns on a firm's future transparency distort its capital structure decision. In the first scenario, the distortion stems from workers' wealth constraints which impede them to fully compensate the firm for the larger expected retention wages needed under greater transparency. In the second scenario, wealth constraints are not binding but there is a non-contractible investment that enhances the value of workers' experience gains in the firm and is boosted by conservative capital structure decisions. In this section, we briefly show that allowing for long-term labor contracts would not substantially change our conclusions.

Consider first the scenario with binding wealth constraints and exogenous experience gains. There, the key question is whether a long-term contract might help reduce the firm's total expected labor costs so that no further distortions on capital structures are required. It is straightforward to see that long-term contracts do not reduce labor costs, except in the trivial—and unrealistic—case in which workers can fully commit to work for the firm up to termination. In such a case, workers would accept a total intertemporal wage of $\overline{w}$ when hired and, since this wage is independent of d, the firm's capital structure decision would be determined by the standard tradeoffs.

If workers cannot directly commit to work for the firm for more than one period, the same effect might, in principle, be obtained by establishing some pecuniary penalty, L, for the workers who depart early. Yet workers' wealth constraints impede L to be higher than the initial wage w_1 (that, say, could be deposited in a safe account as a guarantee for the payment of L). Hence, a penalty of L can reduce workers' retention wage to $w_2 = w_2(d) - L$ only if their initial wage is (at least) $w_1 = L$. In such a case, the total expected labor costs per worker would be $w_1 + w_2 = L + [w_2(d) - L] = w_2(d)$ exactly as in the case without penalties analyzed in Section 4.

Consider next the scenario with non-binding wealth constraints and endogenous z. In such a case, long-term contracts could improve matters only if they contributed to a better alignment between the firm's ex post incentive to invest in z (that depends on the sensitivity of retention wages to z) and the objective of ex ante value maximization (that calls for minimizing its total labor and z costs). Notice, however, that long-term contracts do not address the fundamental non-contractibility of z. The reason is that long term contracts either leave the sensitivity of w_2 to z unaffected, or fully eliminate the sensitivity of the effective retention wage to z. The two ways in which this sensitivity would be eliminated is by either (i) committing the firm to a very high retention wage (so that workers are willing to stay in all states, irrespectively of the value of z) or (ii) fixing a very high penalty for the workers who leave early (so that workers are willing to stay at a zero retention wage in all states, irrespectively of the value of z). Both ways, the firm would completely lose its incentive to invest in z so workers' experience gains will stick at their minimum value $\underline{z}$. But then the firm would have no reason to distort its capital structure decision, which would determined by the standard tradeoffs.

This polar no-investment solution is unlikely to dominate the solution without long-term contracts characterized in Proposition 3. To be sure, if the proportion of quick learners in the population of workers is above the critical level μ^*, the solution in Proposition 3 is by definition better than the also feasible solution with $d = d^*$ and $z = h(d^*) < z^*$, which clearly dominates the solution with $d = d^*$ and $z = \underline{z} < h(d^*)$; in words, the no-investment solution would only aggravate the problem of underinvestment in z.

In contrast, when the proportion of quick learners in the population of workers is below μ^* (so that the firm overinvests in z) it is possible that fully eliminating the sensitivity of the retention wages to z is valuable since the alternatives of no-investment and overinvestment are not unambiguously ranked.[20] Interestingly, in this case, the first-best incentives to invest in z yield somewhere in the middle of those prevalent under the short-term and long-term contracts. This implies that some controlled randomization across both contracts—say, a contract for which the enforceability of the stipulated retention wage or early departure penalty is uncertain—might implement the "first-best" sensitivity of the total expected labor costs to the investment z. For instance, a contract with "random penalties" will reduce the incentives for the firm to invest in z relative the short-term contract with no penalties, but would increase them relative to the long-term contract in which the penalty applies with certainty. This argument suggests that the problem of overinvestment in z (and the remedy based on financial aggressiveness) is likely to be less pervasive than the problem of underinvestment in z (and the remedy based on financial conservatism).

7 Other stakeholders

Up to this point, our model has focused on the dynamics of the relationship between the firm and its workers. However, the intuition we have developed is really quite general and can be applied to almost any situation in which information about a firm's type influences the terms of trade between the firm and its stakeholders. To illustrate the generality of our argument, this section examines the relation between a firm and its customers. As we show, there is a direct parallel between an example in which customers develop human capital using a product and one in which workers develop human capital working for a firm.

To understand this, consider a firm that sells a product like a computer system. The firm sells the system to customers at some initial date, and in order to remain in

[20] In fact, firm value may or may not increase with the long-term contract solution.

business must sell an improved version of the system to its customers at some second date. If the firm is an innovator, future generations of the system will improve in ways that benefit the firm's more sophisticated customers, who can take advantage of the new improvements. However, if the firm is not viewed as an innovator, these sophisticated customers will continue to buy the system from the firm at the second date only if the system is steeply discounted. The less sophisticated customer is not interested in the innovations, and is willing to pay less than the sophisticated customer for the system if the firm is an innovator, but since such consumers are not concerned about future innovations, they are willing to pay more for the system in the event that the firm turns out not to be an innovator.

With minor adaptations, the analysis in Section 3 can be applied to show that, under reasonable parameters, in order to sell the system to both sophisticated and unsophisticated customers, the firm will price the product so that the sophisticated customers realize consumer surplus when the firm is learned to be an innovator and unsophisticated customers realize consumer surplus when the firm is learned not to be an innovator. In this case, it follows that the average price of the system across the states in which the firm's type is revealed, is lower than in the state in which it remains unknown. In other words, greater transparency leads to lower expected future sale prices. Clearly, with this linkage in place, the results obtained in previous sections would extend to the case in which customers are the relevant stakeholders.

8 Concluding remarks

We have developed a simple model where a firm's ability to continue operating profitably depends on its stakeholders' perceptions of the firm's prospects. If the firm is perceived to be less innovative, it will find it more expensive to retain its customers and employees, and this will, in turn, lower the firm's profits. Within the context of this model there is an asymmetry between the effects of favorable and unfavorable information about the firm's type. Specifically, the negative effect of unfavorable information exceeds the positive effect of positive information.

Our model should be contrasted to Titman (1984), which previously suggested that stakeholder considerations would influence the capital structure choice. The capital structure choice in the Titman's model is relevant because it determines the conditions under which the firm's control is transferred from equityholders (or managers) to debtholders, who are likely to make choices that impose costs on other stakeholders.

In contrast, the analysis in this paper does not require that the capital structure choice can trigger a change in control. Rather we assume that more levered firms are more likely to be forced to go to the capital markets, and that in doing so, information about the firm is generated. Due to its effect on information generation, the capital structure choice affects the terms of trade between the firm and its stakeholders. This, by itself, does not necessarily imply that the capital structure choice affects firm value. For example, without additional frictions, the more highly levered firm enjoys more favorable terms of trade in the initial period because its stakeholders benefit from the firm's greater transparency. As we show, this more favorable terms of trade exactly offset the less favorable terms that the firm will face on average in the future when its type is revealed. There are, however, various contracting problems that may negate this capital structure irrelevancy result. The first is that there may be wealth or marketing constraints that limit the firm's ability to benefit in the initial period from its greater transparency in the future. Second, the firm's incentive to make investments that benefit its stakeholders is reduced if the firm is more transparent, and hence less able to extract benefits from its stakeholders in the future.

The issues raised in this paper are not likely to apply to all firms equally. We expect that the cost associated with transparency is greatest in leading edge technology companies, which are unable to compete if they are perceived to have lost their ability to innovate. These companies should probably have relatively low leverage ratios. Companies in commodity type businesses probably benefit from greater transparency for reasons that have been left out of our model. For these companies, the agency issues discussed by Easterbrook (1984) may be more applicable.

Although our emphasis has been on the effect of capital structure on information revelation, our analysis can also be applied to other choices that can affect a firm's transparency. For example, a firm might put in place a more detailed accounting system or hire a more competent auditor; or it might go public and start receiving the attention of market analysts. These choices, which increase the information content of the firm's accounting numbers and lead to the production of additional information about the firm's prospects, are likely to have merits along a number of dimensions. Our analysis, however, suggests that they can also create costs, and therefore, that managers and regulators should exercise caution before endorsing reforms that require firms to increase their transparency.

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