Hidden Debt and the Selectivity of Professional Partnerships

by

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First Draft: September 2006
This Draft: March 2008

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Abstract

Levin and Tadelis (2005) argues that the partnership form is a signal to uninformed clients that the firm will be very selective about the professionals it hires. In contrast, this paper shows that increases in debt obligations cause partnerships to lower their hiring standards. If debt levels are not observed by clients, then partnerships are nearly as profitable and as selective as corporations. Financial transaction costs cause partnerships to be more selective than corporations. Large expansions in the ranks of senior employees will be more costly to partnerships than corporations when there are costs to issuing debt. The Goldman Sachs IPO is discussed in light of this result. Finally, credit constraints can raise clients' expectations for the quality of the partners and the profitability of the partnership.

Keywords: debt, information, partnerships, and profit sharing

JEL Classifications: G32, G34, L2, L15

1. Introduction

Levin and Tadelis (2005) proposed that partnerships are a quality commitment by professional service firms. When clients are uninformed about the average quality of the firm's professionals, they will look to the firm's organizational structure as a signal of the firm's hiring intentions.

In the present paper, we examine whether or not the profit sharing structure of partnerships is a credible signal of the firm's hiring intentions. The present paper concludes that when capital structure is hidden from clients and there are no financial frictions, adoption of a profit sharing partnership structure is an uninformative signal of the partnership's hiring intentions. Indeed, we would expect that partnerships would hire exactly as corporations do in such a case. Yet, financial frictions can conceivably lead to partnerships being more selective and profitable than corporations.

Since Ward (1958), we have known that debt obligations can affect the hiring incentives of worker cooperatives. The professional partnership is a form of worker cooperative in which the principal employees are the owners of the enterprise. The tying of ownership stakes to employment services creates distortions in the hiring incentives relative to a traditional wage paying corporation.

For Modigliani and Miller (1958) the size of the pie is not affected by how it is sliced. Without taxes and financial frictions such as underwriting costs, the debt-to-equity ratio does not matter, holding investment policy as given. Modigliani and Miller (1963) and Miller (1977) comment on financial policy as affecting value through either corporate and/or personal income taxes. Underwriting costs, as documented in Chen and

Ritter (2000), can also be significant leakages of value. Yet, financial structure is seen as only affecting employment indirectly through investment policy. For example, risk shifting caused by excessive debt as in Jensen and Meckling (1976) destroys value, leading to investment in speculative, negative net present value projects. That paper argues that capital structure can also affect agency problems in the firm. Myers (1977) argues that too much debt may lead to debt overhang, which leads the firm to pass up positive net present value projects.

Here, capital structure affects firm value for another reason not pursued by the often cited studies summarized in the previous paragraph. Ward (1958) and the present paper find that debt can affect the *employment* policy directly in worker cooperatives where equity stakes are given to new employees. Therefore, according to Ward (1958), Modigliani and Miller (1958) will be violated if we assume away taxes, financial frictions, or changes to the firm's investment policy. Ward (1958)'s result is confirmed here. When the value of partnership stakes are reduced by debt obligations, the cost of taking on new partners falls. In this way, debt makes having a larger partnership more attractive to existing partners.

The transparency of a professional partnership's finances has a large impact on a partnership's equilibrium hiring behavior. The partnership cannot signal its hiring intentions by its choice of net-debt if clients cannot observe net-debt levels. Clients will rightly assume that the partnership will pursue financial policies which cause the partnership to exploit its information advantage and over-hire, relative to the full information optimum. This is because partners can maximize their consumption by issuing debt and consuming the proceeds prior to the hiring decision. When capital structure is hidden from clients, clients can infer that the partnership will hire exactly like a corporation, which maximizes total profits. The choice of the partnership organizational form has no effect on clients' beliefs when there are no financial frictions. Therefore, the curse of this lack of the financial transparency is that it encourages the partnership to behave just like a corporation.

When its capital structure is opaque to clients, financial frictions can make an opaque partnership more profitable and selective than a corporation. Financial transaction costs discourage the partnership from issuing debt. Dividends received from profits after production takes place do not carry the same financial transaction costs as dividends received prior to production, which must be raised from debt. The present paper finds that financial frictions aid the opaque partnership when net-debt levels are low but positive. In addition, binding debt covenants or credit constraints can lead to clients having higher quality expectations and make the partnership more profitable and selective than it otherwise would be if it were allowed to borrow freely. Large financial frictions or binding debt constraints are more consistent with Levin and Tadelis (2005)'s results where the partnership does not alter its capital structure.

This paper is closely related to Wilson (2008). That paper, as does this one, explores the optimal, static, capital structure decisions of the partnership, which faces the problem of uninformed clients introduced by Levin and Tadelis (2005). The key difference in assumptions and results comes from clients' ability to observe capital structure in the partnership. The present paper considers the case where capital structure and debt levels are not observed by clients. In contrast, Wilson (2008) considers the profitability and capital structure of a partnership where capital structure is transparent to clients. In Wilson (2008), net-debt levels are a fully informative signal to clients of the partnership's hiring intentions. In contrast, the partnership with hidden net-debt levels in the present paper is not able to signal its hiring intentions as effectively as the partnership in Wilson (2008). As a result, in the present paper, the opaque partnership is much more prone to over-hiring than the transparent partnership in Wilson (2008).

Period = 0	**1**	**2**	**3**	**4**
Nature selects the accuracy of market monitoring, $0 \leq \mu \leq 1$.	Partnership or corporation is formed. That is, $\gamma = 1$ or $\gamma = 0$, respectively.	Capital structure is chosen. Therefore, the financial variables α and F are determined.	N partners or employees are hired by firm.	•Consumers buy professional services. •Services are rendered to clients. •All factors are paid.

Figure 1: The sequence of events

2. Model

In this model there are employees, clients, outside suppliers of capital, and inside equity. All players have linear preferences over consumption and are, thus, risk-neutral. For simplicity, let the discount rate between consumption in any period be zero. Therefore, employees and claimants to the firm (shareholders and lenders) have no preference for consumption in any period. Suppose that the lowercase, c_t,, stands for a player's consumption in any period t = 0, 1, 2, 3, or 4. Then that player's utility, U, can be calculated:

$$U = \sum_{t=0}^{4} c_t$$

Employees (or period 4 partners in a partnership) will work in the productive period, period 4, as long as they receive their outside option wage, w. All potential employees have an outside option wage $w \geq 0$, regardless of their ability. Therefore, employees' (or period 4 partners') participation constraints are satisfied when they earn at least w in some period in exchange for their period 4 labors. There is no effort associated with productive work. Thus, we need not worry about employees' incentive constraints. Outside equity and suppliers of debt are price takers that only expect to be paid back in expectation for the amount of money they paid. Clients that demand professional services pay the expected benefit of those services. Inside equity can be partners in a partnership or the original shareholders in a corporation. Only these latter groups will potentially earn profits (surplus) in excess of their opportunity costs.

Let us denote N to be the number of employees or partners employed at the end of period 3 and for all of period 4. Let us assume that the firm has a production technology, $f(N) = N$, where N is both the number of employees and the firm's output. There is an exogenous fixed cost, $K > 0$, needed to operate. The firm has a fixed number of workers that it can potentially employ. Potential employees can be arranged from most able, or most productive, to least productive. Because the firm is unable to affect the distribution of abilities of its employees, the average quality of the firm's workforce declines in its size.

Employees are drawn from a continuous probability density function g(a) with a support $a \in [\underline{a}, \overline{a}]$. Let us assume that market price, $p(N)$, equals the average quality, $q(N)$, of the firm's employees times a parameter, $x > 0$. That is, $p(N) \equiv xq(N)$. Since all potential employees have the same opportunity cost w, but more able employees generate greater revenues, in equilibrium, only the most able employees will be selected for a given firm size. That is, $N \equiv \sigma \int_{a_N}^{\overline{a}} g(a)da = \sigma(1 - G(a_N))$. The parameter $\sigma > 0$ is the maximum size of the firm. Wilson (2008) proves that $p_N < 0$ regardless of distribution from which employees are drawn.

Further, we will assume that the marginal revenue, $\frac{\partial\{p(N)N)}{\partial N} = p_N(N)N + p(N)$, is declining for all hiring levels. That is,

$$Np_{NN}(N) + 2p_N(N) < 0. \tag{1}$$

The indicator variable, gamma (γ), will equal one if the partnership form is selected ($\gamma = 1$), and gamma will equal 0 if the corporate form is selected ($\gamma = 0$). The choice of organizational form only happens in period 1.

To contrast our results with Levin and Tadelis (2005) we will adopt that paper's definition of a partnership. In particular, adoption of the partnership form means that new partners hired or retained in period 3 do not purchase their stake in either periods 3 or 4.[1] Further, in the productive period, period 4, partners will share equally in the residual profits of the firm. Because partners must dilute their stake in the firm for every new employee (partner), the period 3 partners will only agree to take on partners that raise profits per partner. In contrast in the corporation, profits are divided based on shares which are not tied to employment. Shareholders in a corporation will support the hiring of employees that raise total profits.

We alter the presentation of Levin and Tadelis (2005) by allowing partners in the partnership, and shareholders in the corporation, to alter capital structure prior to the hiring decision in period 3. We will assume that the Coase theorem of Coase (1960) holds for the partnership (and corporation) in period 2. Regardless of the initial

[1]Dow (1986) proves that, when membership markets are as competitive as stock markets, labor-managed firms (LMF)—partnerships here—will have the same objective functions as capital-managed firms (CMF)—corporations here. Therefore, LMFs need not be associated with different hiring objectives than CMFs. Ward (1958) and Levin and Tadelis (2005) assume that there are no membership markets. In the present paper, employees do not buy their way into the firm. Nevertheless, as Dow (1986) proves, all that is necessary for LMF's to have different objectives than CMF's is that membership shares trade for less than their full net present value.

One of the obstacles to efficient membership markets is the fact that he highest bidder for the partnership's shares may not be the most able employee. Therefore, membership shares cannot be awarded merely to the highest bidder if that employee is ill suited for the job. The quality of the employees hired is at the core of the discussion in the present paper and Levin and Tadelis (2005).

As Morrison and Wilhelm (2004) also observes, membership shares in professional services appear to trade for considerably less than their fully capitalized value in professional partnerships. In the consulting firm McKinsey, Schleler (2000) reports that the practice of retiring partners selling back their shares at book value began with the retirement of the firm's founder Marvin Bower and still continues today.

allocation of property rights between period 2 partners, bargains can be struck such that joint surplus is maximized through the firm's financial policy. Therefore, period 2 partners will pursue a policy that maximizes the firm's value.

Because we have assumed that the Coase theorem applies, the identity of the period 2 partners is irrelevant. Nevertheless, further specifying the composition of the partnership's period 2 control group may aid readers in seeing how capital structure changes can raise partners' consumption. The other benefit of specifying a period 2 control group is that it allows us to interpret the model as not only of a new firm, but also as an established partnership that periodically revisits its capital structure decision. Let us assume that the period 2 partners are the most able partners drawn from the distribution of talent $g(a)$, in which the lowest ability partner is of ability a_2. That is,

$$N_2 \equiv \sigma \int_{a_2}^{\bar{a}} g(a)da.$$

We will define profits before fixed costs as $\pi(N) \equiv p(N)N - wN$. Let α be a non-voting equity stake sold to outside investors in period 2 that pays a single dividend when profits are realized at the end of period 4. F will stand for a net-debt payment due at the end of period 4. If $F > 0$, then F is a debt obligation. If $F < 0$, it is cash available to residual claimants. Net-debt is defined as total debt obligations minus cash available at the end of period 4. We will assume that potential clients are bounded rational in that they cannot observe net-debt levels, F, when they bid on the partnership's services. Nevertheless, we will assume that existing employees observe the firm's capital structure. In addition, if there are any new hires in period 3, they get to observe the firm's net-debt F, before they join. It is assumed that neither the firm nor its employees can credibly disclose net-debt levels to clients.

We will assume that suppliers of capital are rational price takers. Nevertheless, we will assume that raising outside finance incurs transaction costs. One of the direct costs of finance for public companies is measured by the gross spread. Kim, Palia, and Saunders (2003) define the gross spread as the difference of gross proceeds from the security sale minus the proceeds given to the issuing firm as a percent of the total gross proceeds. They report a range of gross spreads for the period of 1970 to 2000. For debt the 5th and 95th percentiles are 0.250 to 3.829 percent, respectively. For equity IPOs (initial public offerings), the 5th and 95th percentiles are 6.000 to 10.000 percent, respectively.

We will capture the presence of financial frictions by defining a cost of finance function that is piecewise defined. The exogenous costs of finance $c(F)$ is defined below:

$$c(F) \equiv \begin{cases} \theta_d F, \text{ where } F > 0 \quad \& \quad 1 > \theta_d \geq 0 \\ 0, \text{ where } F = 0 \\ \theta_e F, \text{ where } F < 0 \quad \& \quad -1 < \theta_e \leq 0 \end{cases} \qquad (2)$$
$$\& \quad |\theta_d| \leq |\theta_e|$$

We will refer to the cost of finance parameter θ_i, where "i" can take on the value "d" or "e." When the firm raises debt and takes on positive net-debt, $i = d$. When the firm takes on negative net-debt and thus has to raise non-voting equity to do so, $i = e$.

As with Levin and Tadelis (2005), we assume price takes the following form:

$$p(N, N^e; \mu) = \mu p(N) + (1-\mu) p(N^e(\mathbf{r})) \qquad (3)$$

μ*100 percent of the firm's clients observe the firm's size, N. $(1 - \mu)$*100 percent of the clients make conjectures, $N^e(\mathbf{r})$, about the size of the firm based on a vector of variables that they observe.

Let us define this as the vector **r.** The observations in the rational vector is used by uniformed clients to conjecture about firm size. The "rational" vector, **r**, includes knowledge of distribution of employee abilities and thus the inverse demand function $p(N)$. It includes parameters such as outside option wages of employees, w, fixed costs, K, the fraction of informed clients, μ, and the cost of finance parameters, θ_d and θ_e. Yet, the actual size of the firm, N, and level of net-debt, F, are not contained in the rational vector. This is because uninformed clients observe neither the firm's size nor its level of net-debt. (This is the key difference between Wilson (2008) and the present paper. Clients cannot observe net-debt levels, F, in the present paper. In contrast, in Wilson (2008), clients do observe the firm's capital structure when forming their expectations about the firm's selectivity.)

The "informed" clients, μ*100 percent of the firm's clients, are uninformed about the firm's capital structure. Yet, unlike the "uninformed" clients, the $(1 - \mu)$*100 percent of the clients, the informed clients do not need information about the firm's capital structure because they observe firm size and thus can always compute firm quality directly.

We will focus on the cases where clients form rational expectations; therefore, this means that, in equilibrium, expectations about the firm's size, $N^e(\mathbf{r})$ match the actual hiring, $N(\mathbf{r})$. That is,

$$N^e(\mathbf{r}) - N(\mathbf{r}) = 0. \tag{4}$$

Suppose that χ is a generic parameter of an element of the vector of **r**, which is observed by all potential clients. Any shifts in the observed parameters, which cause equilibrium hiring to shift, will also cause expectations to shift in lock-step:

$$\frac{dN^e(\mathbf{r})}{d\chi} - \frac{dN(\mathbf{r})}{d\chi} = 0. \tag{5}$$

Yet, changes in the unobserved variables N and F will have no effect on expectations, $N^e(\mathbf{r})$. That is,

$$\frac{dN^e(\mathbf{r})}{dN} = 0, \text{ and } \frac{dN^e(\mathbf{r})}{dF} = 0. \tag{6}$$

3. The hiring problem

We solve this game by moving backwards through the game tree to find the best response strategies of the firm. Based on the organizational choice signal, $\gamma = 0$ for a corporation or $\gamma = 1$ for a partnership, clients need to determine what hiring levels are best responses for the firm's controlling shareholders. That is, uniformed clients are trying to determine what hiring behavior is "on the equilibrium path" of the game. To do this, they must work backward through the best responses of the firm.

The firm's controlling shareholders have three actions in periods 1, 2, and 3. In period 1 they choose the organizational form. That is, they decide whether or not to form a partnership or a corporation. This is the publicly observed γ signal. In period 2, controlling shareholders decide on the firm's capital structure $\{\alpha, F\}$. This is a secret decision in the present paper. In period 3, hiring levels are chosen, taking organizational choice and capital structure as given. Firm size is observed by μ*100 percent of the clients and unobserved by $(1 - \mu)$*100 percent of the clients. The firm's period 3 hiring objectives are pursued here. Below we show the best responses of the period 3 corporation and partnership, respectively. The optimal hiring level for the corporation does not depend on capital structure choices. In contrast, we will find that the dominant hiring strategy of the period 3 partnership depends on the dominant capital structure strategies of the period 2 partnership. We will focus on the interior solutions, and the first order conditions, which apply to the firm's period 3 problem below.

3.1 The corporation's problem in period 3

Let us define profit before financial costs as the following:

$$\pi(N, N^e; \mu) - K \equiv \{\mu p(N) + (1-\mu) p(N^e(\mathbf{r}))\} N - wN - K \tag{7}$$

The corporation's objective function is to maximize the shares of the controlling equity holders. This is the following:

$$\begin{aligned} \max_N \quad V^C &= (1-\alpha)(\pi(N, N^e; \mu) - K - F(1+\theta_i)) \\ &= (1-\alpha)(\{\mu\, p(N) + (1-\mu)\, p(N^e(\mathbf{r}))\} N - wN - K - F(1+\theta_i)) \end{aligned} \tag{8}$$

We will denote the corporation's optimal choice of *N* by the superscript "*C*."

$$\left.\frac{dV^C}{dN}\right|_{N=N^C} = \mu\, p_N(N^C)\, N^C + \{\mu\, p(N^C) + (1-\mu)\, p(N^e(\mathbf{r}))\} - w = 0 \tag{9}$$

The first order condition above does not depend on any financial variables. The second order condition is the following:

$$\left.\frac{d^2V^C}{dN^2}\right|_{N=N^C} = \mu\{2 p_N(N^C) + N^C p_{NN}(N^C)\} < 0 \tag{10}$$

The sign of equation (10) above follows from the assumption in equation (1). When expectations converge as in equation (4), the first order condition in equation (9) becomes the following:

$$\left.\frac{dV^C}{dN}\right|_{N=N^e=N^C} = \mu\, p_N(N^C)\, N^C + p(N^C) - w = 0 \qquad (11)$$

To consider the negative impact of incomplete market monitoring, $\mu < 1$, on hiring, let us consider the inverse elasticity rule of microeconomic textbooks. The first-order condition for the corporation's profit maximization problem can be written in terms of the inverse elasticity rule below:

$$p(N^C)\left(1 - \frac{\mu}{\left|\varepsilon^C\right|}\right) = w \qquad (12)$$

The first-best level of output, and hiring in this case, for the monopolist occurs when $\mu = 1$ and marginal revenue equals the wage, or marginal cost.[2] When $\mu < 1$, the firm will over-hire because it is unable to affect the expectations of $(1 - \mu)*100$ percent of its clients. When $\mu = 0$, the firm will behave as if its output and hiring decisions have no effect on the price.

3.2 The partnership's problem in period 3

[2] The optimal hiring rule is the marginal revenue product equals the wage. The marginal product of labor is $f_N = 1$. Therefore, marginal revenue is equivalent to the marginal revenue product in this case.

Let us consider the partnership's period 3 problem. Under equal profit sharing the partnership will maximize returns to the controlling shareholders. Under a regime of equal ownership stakes for all partners, this means that the objective function will attempt to maximize profits per partner. That is, the objective function is as follows:

$$\begin{aligned} &\max_{N} \quad S(N,N^{e};\mu;F,\alpha)=(1-\alpha)\left(\frac{\pi(N;\mu,N^{e})}{N}-\frac{K+F(1+\theta_{i})}{N}\right)\\ &=(1-\alpha)\left(\{\mu p(N)+(1-\mu)p(N^{e}(\mathbf{r}))\}-w-\frac{K+F(1+\theta_{i})}{N}\right). \end{aligned} \tag{13}$$

In this setup, all partners are paid their outside option wage. Therefore, their participation constraints are always satisfied when profit shares are non-negative. The first order condition is the following:

$$S_{N}\equiv\left.\frac{dS}{dN}\right|_{N=N^{e}=N^{P}}=\mu\, p_{N}(N^{P})+\frac{K+F(1+\theta_{i})}{(N^{P})^{2}}=0 \tag{14}$$

The wage, w, term drops out of the first order condition above. Let N^P denote the number of partners, which the period 3 partnership will select. Let us assume that the second order condition of this problem is satisfied as is necessary and sufficient for a maximum at N^P.

In the appendix section 6.1 we derive the unambiguous comparative static in equation (15) that the size of the period 3 partnership is increasing in the net-debt levels.

$$\left.\frac{\partial N}{\partial F}\right|_{N=N^e=N^P} > 0 \tag{15}$$

The first order condition, and thus the comparative static above, implies that financial structure does indeed matter for the hiring decisions of the partnership. This is what Ward (1958) found. Yet, these results indicate that only certain kinds of financial policies affect the partnership. Namely, higher net-debt levels cause the partnership to expand. Yet, selling an outside equity stake, α, does not affect the equilibrium size of the partnership. (The first order condition in equation (14) does not depend on α.) Therefore, financial changes in period 2 can have an impact on period 3 hiring.

The intuition for this result is that period 3 partners would be loath to share an asset, cash, with new partners; but they would be more eager to share a liability, debt. Period 3 partners will be reluctant to offer partnership stakes when F is negative, and thus there are cash balances, because they will have to share this cash with new partners. Alternatively, if the partnership has debt obligations, and F is positive, then existing partners will be more eager to hire new partners in period 3 and dilute their stakes because these stakes are not as valuable as stakes in an all equity partnership.

Nevertheless, raising debt by itself does not affect the period 3 hiring decision. Suppose that financing costs are $\theta_i = 0$. In particular, if the partnership raised debt in period 2 and let the proceeds sit within the firm's coffers until period 3, then there would be no effect on the period 3 partnership's hiring decision. They could use the proceeds from the debt sale $F > 0$ to pay off the period 4 liability of $-F$. In effect, raising debt had no effect on net-debt if the proceeds from the debt sale sit inside the firm. It is the distribution of the debt that affects the hiring here. To change the period 3 decision problem of the partnership, the debt proceeds must be spent. The best way to do this is give a dividend to the owners worth F in period 2.

Alternatively, selling an outside equity stake leads to a cash inflow that does affect the period 3 hiring without any period 2 dividends. Suppose that the firm raises $-F > 0$ from selling an outside equity stake, α. If the partners do nothing and let this cash sit in the firm until period 3, this has a real impact on the firm's output and hiring! This increase in cash reduces the number of partners hired, according to equation (15). Yet, the sale of the outside equity stake, α, will have no effect on the hiring decision if the partners distribute the proceeds from the sale of equity in period 2 prior to the period 3 hiring decision.

Therefore, if the period 2 partners want to affect the equilibrium hiring decision of the period 3 partners, there are two things that they can do which are summarized in the proposition below.

Proposition 1

- *If the period 2 partnership wants the period 3 partnership to be* ***less selective****, the former will issue debt worth $F > 0$ and distribute the proceeds in period 2.*
- *If the period 2 partnership wants the period 3 partnership to be* ***more selective****, the former will raise negative net-debt ($F < 0$) with a non-voting equity stake, α. The proceeds from this sale of equity will be allowed to remain in the firm until period 4.*

The upshot of this recipe, which follows from our discussion above and equations (14) and (15), is that the timing of the partners' compensation also depends on whether they raise debt or equity. With debt, period 2 partners get at least some of their compensation in period 2. This is because they want to make sure that the proceeds of the debt raised cannot be used to pay off the debt in period 4. Alternatively, if the firm raises $F < 0$ with outside equity, α, partners will get all of their compensation in period 4. This is because the negative net-debt raised from an equity stake must stay in the firm for it to have an effect on the period 3 hiring decision.

It is important to underscore that the comparative static in (15) only applies to the period 3 partnership that takes financial structure as given. For the period 3 partnership F is exogenous. As we will see in subsequent sections, given a partnership does form (γ = 1), there is a joint size, N, and capital structure decision, F, which the period 2 partnership makes. For the period 2 partnership, net-debt levels are the endogenous best responses.

4. The capital structure decision in the partnership

We know that capital structure matters for the partnership's hiring incentives, but the corporation does not change its hiring in response to changes in capital structure. These observations follow from the first order conditions in equations (14) and (11). Therefore, uninformed clients will only be concerned about capital structure choices made by the period 2 partnership when trying to form expectations about the firm's hiring level $N^e(\mathbf{r})$. Yet, these clients cannot observe capital structure choices directly. Clients infer capital structure choices based on the best response strategies of the period 2 partnership.

Here we focus on the optimal capital structure choices of the period 2 partnership without and with financial frictions. Without financial frictions, the partnership with hidden net-debt levels will choose high debt levels that induce it to hire like a corporation. Therefore, adopting the partnership form will be a totally uninformative signal of the firm's hiring intentions. With non-zero costs of finance, high debt levels become costly. We will argue that, as the costs of debt rise, it is ambiguous if the opaque partnership becomes more profitable.

4.1 Costless ($\theta_i = 0$) financial adjustments

When the partnership can adjust its capital structure secretly and without cost, it falls into the same trap that the corporation does. It over-hires just like the corporation. Nevertheless, the mechanism by which the partnership achieves over-hiring involves its capital structure decision. In particular, the period 2, opaque partnership will choose some level of debt, $F^C(\mu)$, that causes the period 3, opaque partnership to hire the corporation's imperfect market monitoring level of employment, N^C.

The equilibrium choices of the firm, when capital structure is opaque to clients and there are no financial frictions, will be denoted by the superscript "*C*." When financing entails transaction cost, we will add a subscript; but the lack of a subscript will denote that there are no transaction costs to raising net-debt. As we will show, the superscript "*C*" happens to match up well with how a partnership hires when capital structure is secret and there are no financial leakages. We will see that the partnership hires exactly like the corporation.

Period 2 partners can raise debt and spend its proceeds in period 2 prior to the period 3 hiring decision or production taking place in period 4. Their joint consumption will rise if they pursue financial policies that maximize firm value. Without constraints to dividing the spoils, any allocation of ownership rights between the period 2 partners will lead to a profit maximizing financial policy. This is an application of the Coase theorem introduced in Coase (1960).

Uninformed clients expectations about the number of partners are unaffected by the actual level of net-debt and the actual number of partners employed. This relationship is reflected in equation (6). In this case, maximizing total profits in period 2 involves endowing the period 3 partnership with hiring incentives that take advantage of the informational asymmetries between clients and the firm. The partnership, just like the corporation, will want to exploit these informational asymmetries in the absence of a commitment to do otherwise. In effect, choosing the partnership form, $\gamma^C = 1$, with zero financing costs, $\theta_i = 0$, and opaque finances is a completely uninformative signal about the firm's period 3 hiring. It does not signal any changes in equilibrium hiring by the firm.

The partnership will attempt to hire $N^C(\mu)$ partners. Why? It does this because this is the action that will cause the period 3 partnership to maximize total profits. N^C is the N implied by the first order condition in equation (11). To achieve this, the period 2 partnership will choose a level of net-debt that causes the first order conditions in both (14) and (11) to be satisfied at $N^C(\mu)$. Let us rearrange equation (11) and multiply all terms by N^C.

$$-\mu\, p_N(N^C)(N^C)^2 = (p(N^C) - w)N^C = \pi(N^C;\mu) \tag{16}$$

Further, for the right level of net-debt, which we will denote $F^C(\mu)$, the partnership's first order condition in (14) will be satisfied when N^C employees are hired. The first order condition in equation (14) when $\theta_i = 0$ can be rearranged to yield the following:

$$F^C(\mu) = -K - (N^C)^2 \mu p_N(N^C) \tag{17}$$

If we substitute in the right hand side of (16) for $-\mu\, p_N(N^C)(N^C)^2$ in equation (17), then the level of debt chosen by the partnership with opaque capital structure is the following:

$$F^C(\mu) = \pi(N^C;\mu) - K \geq 0. \tag{18}$$

Since $F^C(\mu)$ always equals the equilibrium profits generated by the firm, the net-debt-to-value ratio must be 100 percent for the partnership to achieve the full corporate profits.   This is the solution that Ward (1958) proposed. Yet, unlike Ward (1958), hiring like a corporation is no longer a virtue when $\mu < 1$. We know that the corporation over hires relative to the optimum for a monopolist. That is, when $\mu < 1$, from equation (12) we know that the partnership violates the inverse elasticity rule.   (A monopolist maximizes profits when the inverse elasticity rule is followed.) Ideally, the partnership would do less hiring than a corporation when market monitoring, μ, is less than unity. Certainly, Levin and Tadelis (2005) argued that the partnership would be more selective than an identical corporation. Nevertheless, when there are no financial frictions and net-debt levels cannot be observed by clients, there is no reason to believe that a partnership will be any more selective than a corporation.

It is also safe to conclude that no firm with either a partnership or corporate form will come into being unless profits are non-negative. Therefore, the net-debt in $F^C(\mu)$ must also always be weakly positive.   That is, the partnership always takes on debt obligations, or it does not alter its financial structure in period 2.

Proposition 2

Suppose that the partnership's capital structure cannot be observed by clients and there are no costs to adjusting financial structure, $\theta_i = 0$. In this case, the partnership will choose a level of debt equal to its profits, and it will make the same hiring decision as a corporation.

This follows from equation (18) and our discussion above.

It seems reasonable that financial structure in partnerships is somewhat hidden from clients, and debt ratios are much less than 100 percent. For this reason, the incentives to adopt such a capital structure must be blunted by the fact that capital markets are imperfect. There is a cost to raising outside finance. The impact of financial frictions on the perfect Bayesian equilibrium set of $\{\gamma, N, F\}$ are discussed in the next subsection.

In the appendix sections 6.5 we develop an example where $\mu = 0.1$. In equation (49), first-best profits are \$40 and the first-best number of employees is 50. The partnership with hidden debt and the corporation will hire $N^C(0.1) \approx 90.91$ employees. Under rational expectations, $N^e(\mathbf{r}) \approx 90.91$. Suppose that the period 2 control group consists of the 40 most able employees, $N_2 = 40$. Those period 2 partners will raise debt $F^C(0.1) = \$6.53$. They will split that \$6.53 between themselves for about \$0.16 each and consume it in period 2. They and the other 50.91 partners will not only be paid their reservation wages, but also their period 4 profit share, which is worth zero. Suppose that—out of equilibrium—the period 2 control group raised no debt. The low expectations of the uninformed consumers, $N^e(\mathbf{r}) \approx 90.91$ would mean that the period 4 profits would be \$5.71 split between 70.71 partners.[3] That is about \$0.08 per partner. Certainly, the period 2 control group would be better off following the equilibrium strategy of raising and consuming the debt of $F^C(0.1) = \$6.53$.

4.2 Costly financial adjustments ($\theta_i \neq 0$)

In this section, we will denote endogenous choices by a combination of superscripts and subscripts. The superscript "*C*" denotes that net-debt is not visible to clients. This is similar to section 4.1. In addition, the subscript is introduced to denote the presence of financial adjustment costs, $\theta_i \neq 0$. The subscript can be the generic "*i*" or take on the more specific value "*d*" or "*e*." The latter two subscripts denote positive or negative net-debt, respectively. (The firm must raise debt to increase its net-debt or sell outside equity to raise negative net-debt, cash.)

A partnership that has an opaque capital structure and costless financial adjustments will be tempted to set net-debt levels $F^C(\mu)$ in equation (18) so that it hires like a corporation. This was discussed in section 4.1. Nevertheless, when it is costly to obtain outside finance, then it is costly to hire like a corporation. This is because, in order to hire about the same number of employees as a corporation, a partnership will probably have to take on a non-zero level of net-debt, F_i^C. The financing of this net-debt involves leakages of value outside the firm. In contrast, a corporation can adopt the profit maximizing hiring level for a given amount of market monitoring without adjusting its capital structure.

[3] The out-of-equilibrium numbers can be obtained by combining the parameter values in equation (48) with

We have added a term to the period 2 partnership's objective function. The cost of finance function below measures the cost of finance in terms of the number of partners selected by the period 3 partnership. We found this by solving for *F* as a function of *N* from the first order condition in equation (14). Then that function was combined with the costs of debt and equity function defined in equation (2). The cost of finance function is

$$\begin{aligned} &c(N) = \theta_i F = -\frac{\theta_i}{1+\theta_i}(\mu N^2 p_N(N) + K) > 0 \\ &\text{when } \theta_i \neq 0 \ \& \ F \neq 0. \end{aligned} \tag{19}$$

Equation (19) only makes sense for positive financing costs.

Here the period 2 maximization problem for the partnership takes into account the non-zero financing costs:

$$\begin{aligned} &\max_N \quad V_i^C = \pi(N; N^e, \mu, \theta_i) - K - c(N; \mu, \theta_i) \\ &= \{\mu\, p(N) + (1-\mu)\, p(N^e(\mathbf{r}))\}N - wN - K + \frac{\theta_i}{1+\theta_i}(\mu N^2 p_N(N) + K) \end{aligned} \tag{20}$$

The first order condition is below.

$$\begin{aligned} &\left.\frac{dV_i^C}{dN}\right|_{N=N_i^C} = \mu N_i^C p_N(N_i^C) + \{\mu p(N_i^C) + (1-\mu) p(N^e(\mathbf{r}))\} - w \\ &+ \frac{\theta_i}{1+\theta_i}\mu\{2 N_i^C p_N(N_i^C) + (N_i^C)^2 p_{NN}(N_i^C)\} = 0 \end{aligned} \tag{21}$$

---

equations (66) and (64) when F = 0.

The second order condition the following

$$\left.\frac{d^2V_i^C}{dN^2}\right|_{N=N_i^C} = \mu\{N_i^C p_{NN}(N_i^C) + 2p_N(N_i^C)\}$$
$$+\frac{\theta_i}{1+\theta_i}\mu\{2p_N(N_i^C) + 4N_i^C p_{NN}(N_i^C) + (N_i^C)^2 p_{NNN}(N_i^C)\}. \tag{22}$$

If N_i^C is to be a non-trivial stationary point, it must be the case that it is a maximum point. (That is, the period 2 partnership would not choose a minimum profit point!) Therefore, in the non-trivial case, equation (22) must have a negative sign.

Let us turn to the equilibrium level of net-debt chosen when $\theta_i \neq 0$. This can be expressed as a function of the profits before financing costs. To do this we substitute back the period 3 partnership's first order condition into the period 2 partnership's first order condition in (21). When we are done, we are left with

$$F_d^C = \max\left\{\frac{1}{1+\theta_d}\left(\pi(N_d^C;\mu) - K - N_d^C\frac{dc(N_d^C)}{dN}\right), 0\right\}. \tag{23}$$

where $(p(N_d^C) - w)N_d^C \equiv \pi(N_d^C;\mu)$.

The derivation and sign of equation (23) above is left for the appendix section 6.3. In that appendix section, we show that the firm will never take on negative net-debt, $F_e^C < 0$.

Let us examine the relationship between the costs of finance and the overall profitability of the opaque partnership. When $\theta_i = 0$ the partnership mirrors the corporation in both profitability and selectivity. This one-to-one correspondence is broken when the cost of finance becomes non-zero. To do this we can employ the envelope theorem to differentiate the value function in equation (20) with respect to θ_i. The opaque partnership's value is affected by shifting expectations $\frac{dN^e(\mathbf{r})}{d\theta_i}$.

$$\left.\frac{dV_i^C}{d\theta_i}\right|_{N=N_i^C} = (1-\mu)\, p_N(N^e(\mathbf{r}))\frac{\partial N^e(\mathbf{r})}{\partial \theta_i} N_i^C + \frac{1}{(1+\theta_i)^2}\mu\{\mu(N_i^C)^2 p_N(N_i^C)+K\} \tag{24}$$

Rational expectations will converge to the actual choices of the partnership, according to equations (4) and (5). We know from appendix 6.3 and equation (23) that the firm will never take on negative net-debt. Therefore, we will focus on the case where net-debt is positive. This is denoted by the subscript "*d*." Further, we can substitute in the definition $F(N)$ in equation (19) into (24) where $F(N_d^C) \equiv F_d^C$. This leaves us with

$$\left.\frac{dV_d^C}{d\theta_d}\right|_{N=N^e=N_i^C} = (1-\mu)\, p_N(N_d^C)\frac{\partial N_d^C}{\partial \theta_d} N_d^C - \frac{1}{1+\theta_d} F_d^C \underset{>}{\overset{<}{}} 0 \tag{25}$$

The sign in (25) is ambiguous. That is, the opaque partnership may find its value rising as the cost of debt rises. The proposition below follows from equation (25) above.

Proposition 3

The partnership with hidden net-debt levels may or may not become more profitable as the absolute value of the cost of debt θ_d rises.

In the appendix section 6.4, we can derive the sign of the comparative static for $\frac{\partial N_d^C}{\partial \theta_d} \leq 0$. Since price is declining in the number of employees, or $p_N < 0$, the first term in (25) is weakly positive. That is, $(1-\mu) p_N (N_d^C) \frac{\partial N_d^C}{\partial \theta_d} N_d^C \geq 0$. The second term is easier to sign. The second term, $-\frac{1}{1+\theta_d} F_d^C < 0$, must be negative.

When debt is close to zero (this is when debt is very low but non-negative), then the opaque partnership is becoming weakly more profitable as the cost of debt parameter θ_d rises. This is because the "selectivity effect" $(1-\mu) p_N (N_d^C) \frac{dN_d^C}{d\theta_d} N_d^C \geq 0$ dominates. Yet, as the level of debt becomes large, $F_d^C > 0$, the increase in the cost of debt financing will outweigh the increase in revenues from greater selectivity. Therefore, for high levels of debt, the "cost of finance effect," $-\frac{1}{1+\theta_d} F_d^C < 0$, will dominate.

Proposition 4

When the equilibrium level of net-debt, F_d^C, approaches 0+, the opaque partnership will become weakly more profitable as the cost of debt parameter θ_d rises.

This is fairly straightforward from our discussion above. To prove the proposition above, let us take the limit of equation (25)

$$
\begin{aligned}
&\lim_{F_d^C \to 0+} \left(\left. \frac{dV_d^C}{d\theta_d} \right|_{N=N^e=N_d^C} \right) \\
&= \lim_{F_d^C \to 0+} \left((1-\mu) p_N (N_d^C) \frac{dN_d^C}{d\theta_d} N_d^C - \frac{1}{1+\theta_i} F_d^C \right) \qquad (26) \\
&= (1-\mu) p_N (N_d^C) \frac{dN_d^C}{d\theta_d} N_d^C \geq 0.
\end{aligned}
$$

We know that (26) is positive because $p_N < 0$ and $\frac{\partial N_i^C}{\partial \theta_i} \leq 0$ when condition (1) holds. *Q.E.D.*

When the historic obligations, *K*, are large enough to give the partnership sufficient incentives to come close to its hiring targets, increases in the cost of debt finance both induce the partnership to be more selective and do not lead the partnership to incur large financing costs. Therefore, when target debt is close to zero, an increase in the debt financing cost parameter weakly increases the partnership's value. This is because the selectivity effect is dominant. Therefore, when large expansions in the partnership are attractive (F_d^C is large), this paper predicts that professional service firms will switch to the corporate form. Therefore, rapid expansions in the ranks of senior members of the professional service firm are likely to be preceded by public ownership of the firm. In contrast to the traditional reasons for going public, this decision is driven by employment considerations, not the need for capital investments.

In the special case of Levin and Tadelis (2005), financial adjustments were implicitly assumed to be prohibitively costly. Net-debt levels were zero. The partnership was more selective because $F_d^C = 0$. Further, it did not suffer from a decrease in firm value due to financial transaction costs because net-debt was zero. Therefore, the partnership form signaled greater selectivity without the downside of taking on costly finance. In contrast, proposition 3 and equation (25) tells us that with intermediate levels of debt, the partnership may be less valuable than a corporation because it must incur sizable transaction costs, $\theta_d F_d^C > 0$, to reach its target hiring levels.

Debt Covenants and Credit Rationing

Here we have argued that financial transaction costs can make partnerships more selective. Nevertheless, such transaction costs may or may not make the partnership form of governance more profitable than the corporate form of governance. We have not modeled the debt covenants or credit rationing. Debt covenants and credit rationing may act more like a constraint on the financial policy of the professional partnership. The penalties for violation of covenants may be so large that the partnership may want to avoid violations at the cost of not having the profit maximizing number of partners. Further, credit rationing as described by Stiglitz and Weiss (1981) may prevent the professional partnership from obtaining its target debt ratio at any rate of interest. Such obstacles may constrain the opaque partnership from pursuing its most profitable financial policy. The equilibrium result of such constraints may mean that uninformed clients may have higher expectations for the quality of partners in a professional service firm.

Beneish and Press (1993) look at the violations of debt covenants for public corporations in the United States from 1983 to 1987. Common financial or accounting ratios that they found in debt covenants are the debt-to-tangible net worth, current ratio, various leverage ratios, and interest coverage ratios. Nevertheless, these covenants may not be an effective commitment as Beneish and Press (1993) document. Out of the 128 violations observed temporary waivers were granted in 24 cases and permanent waivers were granted in 33 cases. They find that waivers are more likely to be granted when the bankruptcy probability is low and the debt is secured. When waivers are not granted, violation of debt covenants lead to acceleration of payments and higher interest rates.

To the extent that these covenants are common and strictly enforced or credit rationing is present, clients may be aware that the partnership is prevented from issuing as much debt as it wants. In such a case, covenants and credit rationing may actually raise the profitability of the opaque partnership by allowing the partnership to commit to be more selective about its top employees than a corporation.

In the appendix 6.5.2, we consider a numerical example where the partnership faces transaction costs, but no debt covenants or credit rationing. In this example, the costs of issuing debt are $\theta_d = 0.02$ and market monitoring is $\mu = 0.1$. The period 2, partners will issue debt worth \$6.29 and consume the proceeds in period 2. If there are $N_2 = 40$ period 2 partners who split period 2 profits evenly, each will receive about \$0.16 from the period 2 distribution. The partnership will then hire about 50.59 additional partners in period 3. The 90.59 period 4 partners will receive a profit share, over and above their reservation wages, of less than $.01. Overall, the partnership will be more profitable than the corporation, reaping total profits in period 2 and period 4 of $6.93, compared to $6.53 to the corporation which hires about 90.91 employees. (These results are reported in equations (50) and (61) of the appendix sections 6.5.2 and 6.5.3, respectively.)

If the partnership faced credit constraints and binding debt covenants that capped its borrowings, it could be even more valuable. Suppose the partnership could only have a leverage ratio of debt-to-equity in period 4 of one. Further suppose that this limit on borrowing was widely known by clients, but clients still could not observe debt levels directly. In this case, the period 2 partnership would only issue debt worth about $5.42 in period 2. Assume that the control group of $N_2 = 40$ partners splits the proceeds equally for about $0.14 per partner. (The aggregate numbers will not exactly agree with per partner numbers because of rounding.) In period 3, the partnership will hire 48.11 additional partners for a total of 88.11 partners. In addition to receiving their reservation wages, those 88.11 period 4 partners will split net profits of $5.42 or about $0.06 each. The perfect Bayesian equilibrium total profits generated by the partnership that must maintain a debt/equity ratio of 1 in period 4 is about $10.84. This is higher than the profits of $6.93 the partnership would have generated in equilibrium if it did not face this binding debt covenant. The presence of the credit constraints implicit in such a debt covenant raises the quality expectations of uninformed clients and makes the partnership more profitable than it would be in a world of no credit constraints.

The present paper with credit constraints can be seen as a more general version of Levin and Tadelis (2005). That paper implicitly assumes that the partnership faces credit constraints so severe that the firm's debt-to-equity ratio must be zero. In contrast, the present paper allows for the possibility that the partnership can have debt-to-equity ratios that exceed zero, but may have a finite upper bound.

<u>Goldman Sachs' Initial Public Offering (IPO)</u>

Endlich (2002) and Morrison and Wilhelm (2008) argue that the going public decision for the investment bank Goldman Sachs was driven in part by the need for financial capital. Nevertheless, the demise of the partnership at Goldman Sachs also appeared to coincide with a rapid expansion in the senior ranks of the enterprise as the present paper predicts. When the ranks of top employees, who carry the reputation of the firm, must rise rapidly, the "cost of debt" effect in equation (25) becomes too high for the partnership. The paper predicts that a large increase in the senior ranks will make the corporate form of governance more profitable.

The senior ranks of Goldman Sachs were under great pressure to expand in the 1990s consistent with the theory presented in the present paper. In 1994 as part of its two-year partnership promotion cycle Goldman Sachs invited 58 new partners to join the firm in its largest ever class Endlich (2002, 326). Consistent with the theory, this rise in invitations coincided with a fall the partnership's equity capital account Endlich (2002, 330). Indeed, most new partners accepted less annual compensation than they had as vice presidents in the previous year.

After its IPO discussions of 1996, which tabled the decision of going public, Endlich (2002, 365-9) discusses how partner titles were abolished in favor of the title of "managing director," which was the top rank before officer in Goldman Sachs publicly-traded rivals. Almost overnight the senior officer ranks doubled as non-partner managing directors were added to the top ranks. There were four hundred and ten managing directors in 1997. Yet, less than two hundred had equity stakes in enterprise. Further, the firm did away with the title of partner in place of managing director. While the new managing directors were not given stakes in the enterprise, there was no distinction in the literature of the company between the owners, the holders of partnership shares, and the managing directors who had no equity stake in Goldman Sachs. When the prospects for an IPO were brighter in 1999, the firm went public, Endlich (2002, 425). In December 2006, Goldman Sachs had one thousand seven hundred and fifty-two managing directors according to a press release compared to four hundred and ten in 1997. In 2007, the percent of managing directors to employees was 5.78 percent versus 3.85 percent in 1997.[4]

The rise in the absolute and relative numbers of managing directors at Goldman Sachs over the last decade supports the contention of this paper that the partnership, or cooperative, form becomes less attractive relative to the corporate form when a large expansion of senior employees in a professional service firm is optimal. The Goldman Sachs case is consistent with this paper's results when net-debt levels are hidden from clients and the costs of raising new debt is significant.

[4] The ratio of managing directors to employees is the number of employees reported in the previous fiscal year. There were 30,522 employees at the fiscal year ending November 2007 and 10,622 employees by the fiscal year ending in November 1997. The source for the number of employees is Goldman Sachs' 2007 and 2000 forms 10-K. Endlich (2002, 369) says in 1997 Goldman Sachs had 410 managing directors. A list dated December 17, 2007 from Goldman Sachs' website had 1,765 managing directors listed.

5. Conclusion

Here we have argued that the professional partnership can get around its profit sharing constitution and the hiring distortions that this profit sharing creates by adjusting its net-debt levels. If debt levels are secret and financial adjustment costs are minimal, clients will have little reason to believe that choosing a partnership versus a corporate organizational form will lead to radically different hiring objectives.

The present paper shows that it is ambiguous whether an opaque partnership becomes more profitable as financial leakages increase. Higher financing costs make it more costly for the opaque partnership to expand. In such a case, increased profitability due to increased selectivity in the opaque partnership may totally offset an increase in financing costs. This is especially true when debt targets are low. Yet, the relative magnitudes of these effects could reverse when the firm takes on a lot of debt in equilibrium. Therefore, professional partnerships may be better off converting to the corporate form of governance when rapid expansions in its senior ranks are profitable.

6. Appendix

6.1 Deriving equation (12)

Rearranging equation (11), we get the following:

$$p(N^C)\left(1+\mu\frac{dp}{dN}\frac{N^C}{p(N^C)}\right)=w,$$

Let ε stand for the price elasticity of demand where

$$\varepsilon=-\frac{dN}{dp(N)}\frac{p(N)}{N}.$$

If we substitute in the ε, then we have equation (12).

6.2 Derivation of equation (15)

From (14), the first-order condition, we derive the comparative statics that follow. Consider the second order condition below:

$$\left.\frac{d^2S}{dN^2}\right|_{N=N^e=N^p}\equiv S_{NN}\big|_{N=N^e=N^P}=\mu\, p_{NN}(N^P)-\frac{2(K+F(1+\theta_i))}{(N^P)^3}<0 \tag{27}$$

The sign of the second order condition of the partnership's problem in equation (27) must be negative because N^P is a maximum point. The use of the sign of the second order condition to determine the sign of comparative statics can at least be traced back to Samuelson (1983 [1947] p. 21).

Unlike equation (27), we can sign the cross partial derivative in equation (28) easily without resorting to Samuelson (1983 [1947])'s insights.

$$S_{NF}\Big|_{N=N^e=N^P} = \frac{1+\theta_i}{(N^P)^2} > 0 \tag{28}$$

The total differential of the FOC is $\partial(S_N) = \partial S_{NN}\partial N + \partial S_{NF}\partial F = 0$. This equation above can be rearranged to solve for $\frac{\partial N}{\partial F}$.

$$\frac{\partial N}{\partial F}\Big|_{N=N^e=N^P} = \frac{-S_{NF}}{S_{NN}} = \frac{-(1+\theta_i)/(N^P)^2}{\mu p_{NN}(N^P) - 2(K+F(1+\theta_i))/(N^P)^3} > 0 \tag{29}$$

The sign of $\frac{\partial N}{\partial F}$ evaluated at the maximum point, N^P, in (29) is unambiguously positive because of our knowledge of the signs of equations (27) and (28).

As mentioned in the main text, these comparative statics are only relevant to the period 3 partnership, which takes net-debt as given, or exogenous. F is a choice, or endogenous, variable of the period 2 partnership, but it is an exogenous variable to the period 3 partnership.

6.3 Derivation of equation (23)

When expectations converge to equilibrium hiring, $N^e(\mathbf{r}) = N_i^C$, and we rename the bottom term in equation (21) as $\frac{dc(N_i^C)}{dN}$, then we can get the following simpler first order condition.

$$\left.\frac{dV_i^C}{dN}\right|_{N=N^e=N_i^C} = \mu N_i^C p_N(N_i^C) + p(N_i^C) - w - \frac{dc(N_i^C)}{dN} = 0 \tag{30}$$

Given that net-debt of F_i^C is chosen by the period 2 partnership, the period 3 partnership will hire $N^P = N_i^C$ partners in period 3. We can rearrange equation (14), the first order condition of the period 3 partnership, so that

$$\mu N_i^C p_N(N_i^C) = -\frac{K + (1+\theta_i)F_i^C}{N_i^C} \tag{31}$$

We can substitute (31) this into (30). After this substitution we can rearrange the first order condition so that

$$F_i^C = \frac{1}{1+\theta_i}\left(\pi(N_i^C;\mu) - K - N_i^C \frac{dc(N_i^C)}{dN}\right). \tag{32}$$

Below we will attempt to show that it cannot be the case that both $F_e^C < 0,$ and equation (1) is satisfied.

When signing equation (23) what is in dispute is the sign of the $N_i^C \frac{dc(N_i^C)}{dN}$ term. Non-negative economic profits at the optimum implies that

$$\pi(N_i^C;\mu,\theta_i) - K \geq \pi(N_i^C;\mu,\theta_i) - K - c(N_i^C) \geq 0. \tag{33}$$

Therefore, if $N_i^C \frac{dc(N_i^C)}{dN} \leq 0,$ then this fact combined with equation (33) tells us that equation (32) must be non-negative.

Let us differentiate the cost function $c(N)$ in equation (19).

$$\frac{dc(N)}{dN} = \theta_i F_N = -\frac{\theta_i}{1+\theta_i}\mu N\{2p_N(N) + Np_{NN}(N)\} \tag{34}$$

Given that -1 < θ_i < 1, our conclusion about the sign of (34) depends on the sign of θ_i and the sign of the quantity in curly brackets "{}". Equation (1) says that the latter term's sign is negative. Further, we know that $\theta_e \leq 0$ and $\theta_d \geq 0$ from equation (2). Therefore, the marginal financing cost of an additional employee is weakly negative for debt. That is,

$$\begin{aligned}\frac{dc(N;\theta_e)}{dN} &= \theta_e F_N = -\frac{\theta_e}{1+\theta_e}\mu N\{2p_N(N)+Np_{NN}(N)\} \leq 0, \,\&\\ \frac{dc(N;\theta_d)}{dN} &= \theta_d F_N = -\frac{\theta_d}{1+\theta_d}\mu N\{2p_N(N)+Np_{NN}(N)\} \geq 0.\end{aligned} \tag{35}$$

If we combine the top sign in equation (35) with our net-debt equation in (23),

$$F_e^C = \frac{1}{1+\theta_e}\left(\pi(N_e^C;\mu) - K - N_e^C \frac{dc(N_e^C)}{dN}\right) \geq 0. \tag{36}$$

Equation (36) is a contradiction because equilibrium net-debt must be negative for the firm to take on outside equity.

The second inequality in equation (35) leaves open the possibility that net-debt could be negative when the firm takes on debt. This is also a contradiction. If the partnership raises positive debt at a percent of θ_d*100 percent of the value raised, it will not have negative net-debt.

Therefore, under these assumptions about the shape of the inverse demand curve at the optimum, net-debt cannot be negative for the opaque partnership with positive financing costs. That is,

$$F_i^C = F_d^C = \max\left\{\frac{1}{1+\theta_d}\left(\pi(N_d^C;\mu) - K - N_d^C \frac{dc(N_d^C)}{dN}\right), 0\right\}. \tag{37}$$

This is what we wanted to demonstrate.

6.4 Deriving the sign of $\frac{\partial N_i^C}{\partial \theta_i}$

Let us define the first order condition in equation (21) as the function "*h*." The first order condition evaluated at N_i^C is equal to zero. Therefore, $h = 0$. This allows us to perform comparative statics on this condition such that $h_N \partial N_i^C + h_\theta \partial \theta_i = 0$, where the partial derivatives of the "*h*" function are denoted by subscripts. This implies that

$$\frac{\partial N_i^C}{\partial \theta_i} = -\frac{h_\theta}{h_N}. \tag{38}$$

The second order condition in (22) is simply the partial derivative h_N, which we know is negative at the optimum. Let us differentiate the first order condition in equation (21) with respect to θ_i

$$\begin{aligned}\left.\frac{d^2V_i^C}{dNd\theta_i}\right|_{N=N_i^C} &= (1-\mu)\,p_N(N^e(\mathbf{r}))\frac{\partial N^e(\mathbf{r})}{\partial \theta_i} \\ &+ \frac{1}{(1+\theta_i)^2}\mu N_i^C\{2p_N(N_i^C) + N_i^C p_{NN}(N_i^C)\}\end{aligned} \tag{39}$$

Inserting the rational expectation conditions in equations (4) and (5) we can rewrite equation (39) as

$$h_\theta = \left.\frac{d^2V_i^C}{dNd\theta_i}\right|_{N=N^e=N_i^C} = (1-\mu)\,p_N(N_i^C)\frac{\partial N_i^C}{\partial\theta_i} \tag{40}$$
$$+\frac{1}{(1+\theta_i)^2}\mu N_i^C\{2p_N(N_i^C)+N_i^C p_{NN}(N_i^C)\}$$

Inserting equation (40) into equation (38) and solving for $\frac{\partial N_i^C}{\partial\theta_i}$ we get the following:

$$\frac{\partial N_i^C}{\partial\theta_i} = \frac{-1}{(1+\theta_i)}\frac{\mu N_i^C\{2p_N(N_i^C)+N_i^C p_{NN}(N_i^C)\}}{h_N+(1-\mu)\,p_N(N_i^C)} \le 0, \tag{41}$$
$$\text{when } 2p_N(N_i^C)+N_i^C p_{NN}(N_i^C) \le 0$$

The numerator is weakly positive given our assumption in equation (1). In contrast, the denominator is negative because the second order condition is negative, h_N < 0, and price is falling in output or hiring, p_N < 0.

This is what we wanted to derive. *Q.E.D.*

6.5 Numerical Examples

Let ability, a, be distributed uniformly on the continuous interval $[\underline{a}, \overline{a}]$, where $\overline{a}$ is the talent of the highest ability individual in the distribution of potential employees. In other words, $a \sim U(\underline{a}, \overline{a})$. Let $x > 0$ be the multiple of average quality, $q(N)$ that clients are willing to pay for. Wilson (2007, p. 190) and Wilson (2008) shows in this case average quality, $q(N)$, and price, $p(N)$ for a firm of size N will be as follows:

$$\begin{aligned} q(N) &= \overline{a} - \frac{N}{2\sigma}(\overline{a} - \underline{a}) \\ p(N) &= x\overline{q}(N) = x\left(\overline{a} - \frac{N}{2\sigma}(\overline{a} - \underline{a})\right) \end{aligned} \tag{42}$$

A corporation will hire according to the first order condition in (11), which can be rewritten for this example as the following:

$$\begin{aligned} &\left.\frac{dV^C}{dN}\right|_{N=N^e=N^C} = \left.\frac{\partial\{\pi - K\}}{\partial N}\right|_{N=N^e=N^C} = \\ &x\left(\overline{a} - \frac{N^C}{2\sigma}(\overline{a} - \underline{a})\right) - \frac{\mu x N^C}{2\sigma}(\overline{a} - \underline{a}) - w = 0 \end{aligned} \tag{43}$$

This implies that the corporation will hire

$$N^C = \frac{\sigma}{x}\left(\frac{x\overline{a} - w}{\overline{a} - \underline{a}}\right)\left(\frac{2}{1+\mu}\right). \tag{44}$$

The equilibrium price for the corporation will be

$$p(N^C) = \frac{1}{1+\mu}(\mu x\bar{a} + w). \tag{45}$$

The profits before fixed costs will be

$$\pi(N^C) = \frac{2\mu\sigma}{x(\bar{a}-\underline{a})}\left(\frac{x\bar{a}-w}{1+\mu}\right)^2. \tag{46}$$

From equation (18) we know that the perfect Bayesian equilibrium level of net debt for the partnership with secret net-debt levels is total profits. Inserting equation (46) into equation (18) we get the following formula for net-debt in the partnership when financial transaction costs are zero:

$$F(\mu) = \pi(N^C;\mu) - K = \frac{2\mu\sigma}{x(\bar{a}-\underline{a})}\left(\frac{x\bar{a}-w}{1+\mu}\right)^2 - K \tag{47}$$

We will use the same parameter values as in Wilson (2007, p. 193) and Wilson (2008). They are

$$\begin{aligned} \bar{a} &= 1 \\ \underline{a} &= 0 \\ \sigma &= 100 \\ x &= \$4 \\ w &= \$2 \\ K &= \$10. \end{aligned} \tag{48}$$

The maximum size of the firms is 100. The maximum price that clients will pay for quality is $x\bar{a}$ = \$4. The reservation wage of partners is \$2. In Wilson (2007, 193) and Wilson (2008) it is shown for these parameter values and distribution of talent that the first-best level of employees, price, and profits after fixed costs are:

$$\begin{aligned} &N^* = 50 \\ &p(N^*) = \$3 \\ &\pi(N^*) - K = \$40 \end{aligned} \tag{49}$$

6.5.1 No Financing Costs ($\theta_i = 0$)

Consider the problem of the corporation and the problem of the partnership with a hidden capital structure, $\rho = 0$. For these parameter values and market monitoring of μ = 0.1, the equilibrium output, price, profit before and after fixed costs are

$$\begin{aligned} &N^C(\mu) = N^C(0.1) \approx 90.91 \\ &p(N^C; 0.1) \approx \$2.16 \\ &\pi(N^C; 0.1) \approx \$16.53 \\ &\pi(N^C; 0.1) - K \approx \$6.53. \end{aligned} \tag{50}$$

The corporation can achieve these outcomes with any level of debt, but the partnership will maximize profits by taking on 100 percent net-debt-to-value ratio in period 2. That means that the opaque partnership will take on debt payments of

$$F^{C}(\mu) = F^{C}(0.1) = \pi(N^{C};0.1) - K \approx \$6.53. \tag{51}$$

The expected profits in an opaque partnership, and in a corporation are identical when financing costs are zero. In period 1, the founders of the firm will be indifferent to either organizational form. Therefore,

$$\gamma^{C}(0.1) = 0 \text{ or } 1.$$

6.5.2 Costly Financial Adjustments

When capital structure is hidden, the partnership will want to choose a hiring level that both takes into account the informational asymmetries between the clients and the firm and the financing costs of achieving that target level of hiring. The hiring level consistent with this objective is denoted N_i^C. Capital structure in the opaque partnership is chosen to maximize the objective of maximizing total profits after financing costs. The objective function in equation (52) below is obtained from combining the objective function in equation (20) with the inverse demand function for this example in equation (42). That is,

$$\begin{aligned} &V_i^C \equiv \pi(N, N^e; \mu) - K - c(N) = \\ &\left\{(1-\mu)p(N^e) + \mu x\overline{a} - \frac{\mu x N}{2\sigma}(\overline{a} - \underline{a})\right\} N - wN - K \\ &- \frac{\theta_i}{1+\theta_i}\left(\frac{\mu x(\overline{a} - \underline{a})}{2\sigma}\right) N^2 + \frac{\theta_i}{1+\theta_i} K \end{aligned} \tag{52}$$

In appendix 6.3, we found that the opaque partnership will never take on negative net-debt. This allows us to only focus on the case in which the opaque partnership raises positive net-debt, or debt. The equilibrium values below will have the subscript "*d*" to reflect the fact that the partnership only will take on debt.

The first order condition after expectations converge on the actual, $N^e = N_d^C$, is the following:

$$\left.\frac{dV_d^C}{dN}\right|_{N=N^e=N_d^C} = x\bar{a} - w - \frac{(1+\theta_d)+\mu(1+3\theta_d)}{2\sigma(1+\theta_d)}x(\bar{a}-\underline{a})N_d^C = 0 \tag{53}$$

The second order condition must be negative for this stationary point, N_d^C, to be a maximum. It is unambiguously negative for all *N*.

$$\frac{d^2V_d^C}{dN^2} = -\frac{1+2\theta_d}{1+\theta_d}\mu x(\bar{a}-\underline{a}) < 0. \tag{54}$$

The stationary point, N_d^C, implied by equation (53) is

$$N_d^C = \frac{2\sigma}{x}\left(\frac{x\bar{a}-w}{\bar{a}-\underline{a}}\right)\left(\frac{1+\theta_d}{(1+\theta_d)+\mu(1+3\theta_d)}\right). \tag{55}$$

The price for this level of output is

$$p(N_d^C) = \frac{x\overline{a}\mu(1+3\theta_d) + w(1+\theta_d)}{(1+\theta_d) + \mu(1+3\theta_d)}. \tag{56}$$

Total profits before fixed costs and finance costs are

$$\pi(N_d^C;\mu) = \frac{2\sigma\mu(1+3\theta_d)(1+\theta_d)}{x(\overline{a}-\underline{a})}\left(\frac{x\overline{a}-w}{(1+\theta_d)+\mu(1+3\theta_d)}\right)^2. \tag{57}$$

The financing cost can be derived by both differentiating the price function with respect to *N* in equation (42) and combining equations (19) and (55).

$$c(N_d^C) = \frac{2\sigma\mu\theta_d(1+\theta_d)}{x(\overline{a}-\underline{a})}\left(\frac{x\overline{a}-w}{(1+\theta_d)+\mu(1+3\theta_d)}\right)^2 - \frac{\theta_d}{1+\theta_d}K \tag{58}$$

Further, the choice of optimal capital structure depends on

$$\frac{\partial c(N_d^C)}{\partial N}N_d^C = \frac{2\sigma\mu\theta_d(1+\theta_d)}{x(\overline{a}-\underline{a})}\left(\frac{z\overline{a}-w}{(1+\theta_d)+\mu(1+3\theta_d)}\right)^2. \tag{59}$$

The partnership with opaque capital structure will need to raise debt F_d^C equal to total profits after finance costs. Total profits after finance costs are

$$F_d^C(\mu) = c(N_d^C)/\theta_d =$$
$$= \frac{2\sigma\mu(1+\theta_d)}{x(\overline{a}-\underline{a})}\left(\frac{x\overline{a}-w}{(1+\theta_d)+\mu(1+3\theta_d)}\right)^2 - \frac{1}{1+\theta_d}K \qquad (60)$$

If market monitoring, μ, is 0.1, and the gross spread on debt, θ_d, is 0.02, then the equilibrium values from equations (55), (56), (57), (58), and (60) are as follows

$$\begin{aligned}
&N_d^C(\mu,\theta_d) = N_d^C(0.1, 0.02) \approx 90.59 \\
&p(N_d^C;\mu,\theta_d) = p(N_d^C; 0.1, 0.02) \approx \$2.19 \\
&\pi(N_d^C;\mu,\theta_d) = \pi(N_d^C; 0.1, 0.02) \approx \$17.06 \\
&F_d^C(0.1, 0.02) = F(N_d^C; 0.1, 0.02) \approx \$6.29 \\
&\alpha_d^C(0.1, 0.02) = 0 \\
&\theta_d F_d^C(0.1, 0.02) \approx \$0.13 \\
&\pi(N_d^C; 0.1, 0.02) - K - \theta_d F(N_d^C; 0.1, 0.02) \approx \$6.93 \\
&\gamma_d^C(0.1, 0.02) = 1.
\end{aligned} \qquad (61)$$

In this case, the opaque partnership is more profitable than the corporation when it must raise costly debt. Compare the profit after fixed and financing costs in equation (61) to the corporations' profits from equation (50). Because \$6.93 > \$6.53, it is a perfect Bayesian equilibrium that the partnership form of organization will be selected over the corporate form.

6.5.3 Credit Constraints and Debt Covenants

With credit constraints the partnership cannot reach its optimal level of hiring which is implied by equation (55) because the period 2 partnership is constrained from raising net-debt equal to equation (60). With lower levels of net-debt, the period 3 partnership will hire fewer than N_d^C partners. Instead, the level of net-debt is determined by the maximum level of debt the firm's lenders will allow, which is likely to be significantly less than total profits.

Suppose that as a precondition of all borrowing the lenders impose a leverage ratio where the debt-to-equity ratio cannot exceed unity. That would mean that

$$\frac{F(\mu)}{\pi(N^P;\mu)-K-\theta_d F(\mu)-F(\mu)}=1 \tag{62}$$

We know from the first order and second order condition of (53) and (54), as long as $N^P \leq N_d^C$ the period 2 partnership will find its profits rising until it reaches the borrowing limit implied by (62).

Let us derive the optimal level of hiring and profits from the period 3 partnership. Inserting the inverse demand function in (42), into the optimization problem for the period 3 partnership in equation (13) we get the following optimization problem:

$$\begin{aligned}
&\max_N \quad S(N,N^e(\mathbf{r});\mu;F,\alpha)= \\
&=(1-\alpha)\left(\left\{\mu\left[x\left(\bar{a}-\frac{N}{2\sigma}(\bar{a}-\underline{a})\right)\right]+(1-\mu)\left[x\left(\bar{a}-\frac{N^e(\mathbf{r})}{2\sigma}(\bar{a}-\underline{a})\right)\right]\right\}\right. \\
&\left.-w-\frac{K+F(1+\theta_i)}{N}\right)
\end{aligned} \tag{63}$$

The first order condition for the period 3 partnership in this case is the following:

$$\left.\frac{dS}{dN}\right|_{N=N^e=N^P} = -\frac{\mu x}{2\sigma}(\overline{a}-\underline{a}) + \frac{K+F(1+\theta_i)}{(N^P)^2} = 0$$
$$\Rightarrow N^P = \sqrt{\frac{2\sigma(K+F(1+\theta_i))}{\mu x(\overline{a}-\underline{a})}} \tag{64}$$

In the rational expectations equilibrium, the price is the following:

$$p(N^P) = x\overline{a} - \sqrt{\frac{x(\overline{a}-\underline{a})(K+F(1+\theta_i))}{2\sigma\mu}}. \tag{65}$$

The profit after fixed costs of the partnership as a whole is

$$\pi(N^P) - K = (x\overline{a}-w)\sqrt{\frac{2\sigma(K+F(1+\theta_i))}{\mu x(\overline{a}-\underline{a})}} - \frac{K+F(1+\theta_i)}{\mu} - K \tag{66}$$

Let us denote the maximum allowable debt as $F = \overline{F}$. If we insert equation (66) into the debt-to-equity ratio in equation (62) we get the following ratio:

$$\frac{\overline{F}}{(x\overline{a}-w)\sqrt{\frac{2\sigma(K+\overline{F}(1+\theta_i))}{\mu x(\overline{a}-\underline{a})}} - \frac{K+\overline{F}(1+\theta_i)}{\mu} - K - \theta_d\overline{F} - \overline{F}} = 1 \tag{67}$$

It turns out that we can solve for $\overline{F}$ using the quadratic formula. Once we have solved for $\overline{F}$ we can also derive $N^P(\overline{F})$ in terms of the parameter values. There are closed-form solutions for both these equations in this setup in terms of the parameter values. In particular, there is one real, positive root to the quadratic function for

$\bar{F} \equiv \bar{F}(\mu, \theta_d)$. Since the closed-form solutions are somewhat involved, to save space, we will not report the general solutions for this distribution of talent. Instead, what is reported below are the solutions for the set of parameter values specified in equation (48) given that $\mu = 0.1$ and $\theta_d = 0.02$.

$$\begin{aligned}
&N^P(\bar{F}) \approx 88.11 \\
&p(N^P(\bar{F})) \approx \$2.24 \\
&\pi(N^P(\bar{F})) \approx \$20.95 \\
&\bar{F}(0.1, 0.02) \approx \$5.42 \\
&\theta_d \bar{F}(0.1, 0.02) \approx \$0.11 \\
&\pi(N^P(\bar{F})) - K - \theta_d \bar{F}(0.1, 0.02) \approx \$10.84 \\
&\gamma^P(0.1, 0.02) = 1.
\end{aligned} \tag{68}$$

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