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Fiat without Authority under Vertical Integration

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Abstract

Relational contracts allow to enforce actions the parties would not undertake in an arm's length transaction. In an agency context, relational contracts will thus produce *fiat* — a principal's ability to dictate her agent's performance. This paper shows that, as the agent's task becomes more critical, vertical integration increases the principal's (informal) power of fiat, by reducing the agent's reneging temptation. The paper also shows that vertical integration increases the principal's (informal) power of fiat when the parties are in a closer relationship, suggesting that integration and relational contracts are *complements*. An implication of the model is that, while the level of fiat observed under separation is smaller than under integration, it is still greater than what would be feasible if integration governed the corresponding relation. This sheds new light on the classic tenet that fiat is an organizational advantage of firms over markets, suggesting it may be the result of selection bias.

Keywords: Fiat, Relational Contracts, Spillovers, Vertical Integration.

JEL codes: D23; L14; L22

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1. Introduction

In the last two decades a strong body of empirical evidence has emerged, suggesting that, in the presence of agency conflicts, units at different stages in the chain of production vertically integrate. For instance, franchisors own retail outlets that generate spillovers on the common brand (Yeap (2006)), motor carriers own trucks whose poor maintenance would harm the carrier's service and reputation (Nickerson and Silverman (2003)), and airline companies own regional carriers that serve routes between bad weather airports, in which frequent flight rescheduling preserves the network's reputation but causes short-term losses to the regional (Forbes and Lederman (2009)).[1]

The relations described in these and other studies are all plagued by an agency problem: upstream principals (franchisors, motor carriers, major airline carriers) rely on downstream agents (franchisees, truck drivers, managers of regional carriers) to perform onerous tasks (serving customers, driving efficiently, adapting flight schedules under time constraints), whose benefits are shared between the upstream and downstream units. Importantly, agency is present independent of whether the units are vertically integrated or separated — for instance, a car manufacturer needs outlet managers to implement service standards and spend sales effort both when these are franchised dealers, and when they are salaried employees. The question then is: why do agency problems conduce to vertical integration? What exactly does integration do to solve them?

[1] See Lafontaine and Slade (1997, 2007) for detailed reviews of the empirical literature on vertical integration.

Standard incentive theories (Grossman and Hart (1986), Lutz (1995)) are not well positioned to answer this question, as they predict that managers in vertically integrated firms, who do not appropriate the residual value of the assets they manage (Krueger (1991), Maness (1996)), have scarcer incentives to spend time and effort in production than if they owned the assets.[2]

As a possible explanation, transaction cost theory has suggested that agency conflicts disapear in vertically integrated firms, where employers use their power of fiat to direct employees (Coase (1937), Williamson (1971, 1979, 1991, 2000)), thus "economizing on contracting costs" (Klein *et al*. (1978), p. 299). While fiat is a commonly accepted feature of integrated firms (van den Steen (2007)), its origin is unclear. Particularly, the assumption that firms have greater authority over employees than independent contractors (Masten (1988), Williamson (1991)) seems often counterfactual. First, some agents' actions are hard to verify in court, so it is unclear how formal authority over them could be exerted in the first place. Second, formal authority can also (and perhaps more cheaply) be allocated via contracts between independent firms (Alchian and Demsetz (1972), Hart (2008)). Indeed, there is evidence that franchise contracts allocate to upstream firms formal authority on both their employees and franchisees (Hadfield (1990), Arruñada *et al*. (2001), Zanarone (2008, 2009)). Also, contracts between major and regional airlines allocate to the former the right to change flight schedules, independent of whether the regionals are vertically integrated or not (Forbes and Lederman (2009)).

[2] Although property rights models such as Grossman and Hart (1986) and Hart (1995) have been mainly applied to study the managers' incentives to increase firm-specific human capital, they can also be used to study the managers' incentives to spend effort in production. See Holmstrom and Milgrom (1994), Holmstrom (1999), and Gibbons (2005) for thorough discussions of this point.

This paper provides a novel explanation for why fiat occurs more under vertical integration than under separation, and, related, for why integration is usually the way major inter-firm conflicts are solved: a vertically integrated firm may be able to dictate conflictive decisions to managers (fiat) not by exerting formal authority, but, rather, by making the managers' *informal promise* to obey more credible. This point is illustrated through a simple agency model, in which an upstream principal and a downstream agent jointly produce a service, and surplus depends on a non-contractible action chosen by the agent. In a one-shot transaction, it is preferable to make the agent own the downstream unit, as that gives her stronger incentives to perform than vertical integration. This is not necessarily the case, however, when the principal and the agent can enter *relational contracts*, in which the agent promises to cooperate, in exchange for future rents. While relational contracts are potentially feasible under both integration and separation, the agent's reneging temptations differ between the two governance structures. Under integration, the agent is an employee with no stake in the business, so increasing performance always makes her worse off, because it reduces her free time. Conversely, under separation, the agent is residual claimant of the downstream profits, so she has an incentive to increase performance up to the level that maximizes such profits, and to decrease it thereafter. Hence, the agent's profit motive under vertical separation will mitigate her temptation to shirk and enjoy free time when the principal's request is not too demanding, and magnify it when the principal's request is very demanding. This has two implications: first, vertical integration is preferable when the parties are in a tight, long-term relationship, and, second, vertical integration is preferable when the agent's performance adds a great deal to the principal's profits. The reason is that, in both cases, the parties seek "ambitious" relational contracts—which

require sacrificing downstream profit to the benefit of the joint venture—and these are feasible under integration, but not separation.

In addition to explaining why inter-firm spillovers lead to vertical integration, the results in this paper have several implications for the theory of the firm. First, although conflicts are more frequently solved by fiat under vertical integration than under separation, even less fiat would be observed if firms that are optimally separated in equilibrium were integrated. This suggests that vertical integration cannot be treated as an automatic relief against contractual hazards; instead, it should be considered only when the environment favors the kinds of relational contract it handles best. Second, relational contracts and vertical integration should be seen as complements, as suggested by Williamson (1975, 1979), rather than substitutes, as suggested by Garvey (1995). Third, as the contractual hazards between principal and agent increase, relational contracts within integrated firms perform better than relational contracts between separated firms, which in turn perform better than arm's length relationships between separated firms. This echoes Williamson's (1991) taxonomy of markets (spot separation), hybrids (relational separation), and hierarchies (relational integration), with the difference that here, unlike in Williamson (1991), hybrids and hierarchies are distinguished by the extent of the principal's informal, rather than formal authority. Thus, a way to interpret hybrids is in terms of relational equilibria within a given formal governance structure (vertical separation), rather than distinctive governance structures that blend formal elements of integration and separation.

The work most closely related to this paper is Baker *et al*. (2002), which first developed a formal model linking vertical integration and relational contracts. This paper adopts the definition of relational contracts given there, but focuses on a different environment, and

generates different predictions. In Baker *et al*. (2002), the object of relational contracts is to make the principal hold, ex post, to the stream of bonuses he promised to the agent ex ante, in order to elicit unobservable performance; by reducing the agent's bargaining power, vertical integration shifts the temptation to renegotiate bonuses from the agent to the principal and, therefore, should be observed when the agent's actions are *less* important, and the promised bonuses are small. Conversely, here, the object of relational contracts is the agent's performance itself, and vertical integration, by shifting downstream profits to the principal, reduces the agent's temptation to renege on performance substantially above the profit-maximizing level. Hence, integration should be observed when the agent's actions are *more*, rather than less important. Also, in Baker *et al*. (2002), an increase in the interest rate may move the optimal governance structure from relational separation to relational integration, depending on the parameters. Hence, their model does not predict the complementarity between relational contracts and vertical integration, which is a key prediction of this paper.

The rest of the article is organized as follows. Section 2 introduces the model's definitions and assumptions. Section 3 discusses the choice between vertical integration and separation in a spot environment. Section 4 studies the choice between vertical integration and separation in a relational environment, and presents the main result of the paper. Section 5 discusses additional results and implications. Section 6 concludes.

2. The environment

Consider two specialized units, upstream and downstream, engaged in the joint production of a service. The service concept is developed by the upstream unit, run by manager U, and the service is delivered to consumers by the downstream unit, run by manager D. The joint surplus depends on D's non-contractible action $d \in \mathbb{R}^+$, and is given by $JS(d) = B(d) + V(d) - C_a(d) - C_p(d)$, where $B(d)$ is the residual value of the upstream unit, $V(d) - C_a(d)$ is the residual value of the downstream unit, and $C_p(d)$ is D's personal cost of performing. For example, *d* could be the degree of compliance of a McDonald's restaurant with the brand's outlet design and cleanness standards, $B(d)$ the correspondent value of the McDonald's brand, $V(d)$ the restaurant's long-term revenues from serving customers according to the standards, $C_a(d)$ the restaurant's forgone profit from following the standards, instead of offering a customized service, or a low quality service, and $C_p(d)$ the restaurant manager's stress from coordinating standard implementation.[3] I assume $B(d)$ and $V(d)$ are increasing in *d* and concave, $C_a(d)$ and $C_p(d)$ are increasing in *d* and convex, $B(0) = V(0) = C_a(0) = C_p(0) = 0$, and $C_a'(0) = C_p'(0) = 0$.

In this model, the upstream unit is owned by manager U, whereas the downstream unit can be either owned by manager D (*vertical separation*) or manager U (*vertical*

[3] The joint surplus may also depend on U's effort and investments in developing the service concept. See Lutz (1995) for a two-sided agency model that emphasizes upstream incentives.

integration), in which case D runs the unit as U's employee. I assume ownership of a unit conveys the right to appropriate its residual value (Holmstrom and Milgrom (1991, 1994), Baker *et al*. (2008)), that the units' residual values — $B(d)$ and $V(d)-C_a(d)$ — and D's cost of performing $C_p(d)$ are all non-contractible, and that no contractible measures of performance are available. These assumptions are consistent with the fact that firms tend to appropriate most of the profits generated by the assets they own (Krueger (1991), Maness (1996)), and imply that D's incentives to perform are completely determined by the allocation of ownership rights over the downstream unit, that is, by the choice between vertical integration and separation.

3. Spot governance

In this section, I assume U and D meet only once, with no opportunities to trade in the future. In this *spot environment*, trade occurs as follows. At stage 0, U and D assign ownership of the downstream unit; at stage 2, D chooses the action *d* and incurs the personal cost $C_p(d)$; finally, at stage 3, the units' residual values are realized as a function of *d*.

If effort were contractible, no matter who owns the downstream unit, U and D would agree, at stage 1, that D must choose *d* to maximize the joint surplus, in exchange for an upfront payment. The necessary and sufficient first order condition for this problem is

(1) $$B'(d)+V'(d)=C_a'(d)+C_p'(d)$$

yielding the first best action $d^{FB} > 0$, and the joint surplus $JS^{FB} = JS\left(d^{FB}\right)$. However, since *d* is non-contractible, U and D cannot, in general, achieve the first best in a spot environment. To achieve the second best, they must choose, at stage 0, between assigning ownership of the downstream unit to U (vertical integration) or D (vertical separation).

3.3. Vertical integration

Under vertical integration, D chooses *d* to maximize $-C_p\left(d\right)$, which has a corner solution at $d_{VI}^{SP} = 0$. Hence, the joint surplus under vertical integration is given by $JS_{VI}^{SP} = JS\left(0\right) = 0 < JS^{FB}$.

3.4. Vertical separation

Under vertical separation, D chooses *d* to maximize $V\left(d\right) - C_a\left(d\right) - C_p\left(d\right)$. The necessary and sufficient first order condition for this problem is

(2) $$V'\left(d\right) = C_a'\left(d\right) + C_p'\left(d\right)$$

which yields effort $d_{VS}^{SP} > 0$ and joint surplus $JS_{VS}^{SP} = JS\left(d_{VS}^{SP}\right) < JS^{FB}$. Since $d^{VS} > d^{VI}$, we can state the following

Proposition 1: In a spot environment, vertical separation is optimal.

This is the result one would expect from a standard agency model: if D spends more effort, in equilibrium, under vertical separation than under integration, but less than the first best under both governance structures, vertical separation should yield greater surplus than integration and, therefore, be preferred.

4. Relational governance

In this section, I assume that, while D's action cannot be observed by a court, it can be observed by the upstream manager U (i.e., it is *observable but not verifiable*). Hence, if U and D repeat their transaction forever (or, equivalently, if they do not know when their last transaction will occur), they can enter *relational contracts*, in which they use their mutual concern for future trade to enforce higher performance than can be achieved in a spot transaction. Following Levin (2003), I assume that, for a given governance structure, U and D choose the relational contract that maximizes the joint surplus, subject to the constraint that such contract is self-enforcing. The analysis involves two steps. First, I determine the conditions that make a given relational contract self-enforcing under vertical integration and separation. Then, I derive the conditions that make vertical integration or separation optimal, depending on the model's parameters.

Suppose the relational contract requires D to take the action d, such that $d^{VS} < d \leq d^{FB}$. At stage 1 of every period, U and D allocate ownership of the downstream unit, and U offers D a fixed payment w_g, where $g \in \{VI, VS\}$. At stage 2, D chooses an action, and incurs the related personal cost. At stage 3, the unit values are realized. If U fails to offer

w_g at stage 1, or D fails to accept it, the parties immediately terminate the relational contract. If D fails to choose the promised action *d* at stage 2, the parties earn their spot payoffs under the present governance structure in the current period, and then terminate the relational contract. After termination, U and D renegotiate asset ownership, and revert to the optimal spot governance structure—vertical separation—forever after.[4]

For the relational contract to be self-enforcing, each party's present gains from reneging must be smaller than the present value of her quasi-rents from future trade.[5] However, the self-enforcement conditions under vertical integration and separation are different, as shown in the next section.

4.2. Vertical integration

With a slight abuse of notation, let me denote U's and D's per period profits from honoring the relational contract, gross of the fixed transfer w_{VI}, as $U_{VI}(d) = B(d) + V(d) - C_a(d)$ and $D_{VI}(d) = -C_p(d)$, yielding joint surplus $JS(d) = U_{VI}(d) + D_{VI}(d)$. Let *r* be U's and D's common interest rate. Then, the relational contract is self-enforcing if, and only if

[4] Other relational contracting models assume the initial governance structure is maintained after termination (Klein and Murphy (1997), Halonen (2002)). If that was the case, vertical integration would have the additional advantage to reduce the downstream manager's fall-back option after reneging on the relational contract. However, assuming, as I do here, that the parties allocate asset ownership efficiently after termination, seems more realistic in many contexts. For instance, after termination, some franchisees sell their assets to the franchisor, whereas others keep the assets (except for those that carry the franchisor's logo) and continue the activity under different brands.

[5] See Bull (1987), MacLeod and Malcomson (1989), Levin (2003), and Baker *et al.* (2002, 2009), for related models of relational contracts.

(3) $$\frac{1+r}{r}\left(U_{VI}\left(d\right)-w_{VI}\right)\geq\frac{1+r}{r}U_{VS}\left(d_{VS}^{SP}\right)$$

(4) $$\frac{1+r}{r}\left(D_{VI}\left(d\right)+w_{VI}\right)\geq\frac{1+r}{r}D_{VS}\left(d_{VS}^{SP}\right)$$

(5) $$-C_{p}\left(d\right)+\frac{1}{r}\left(D_{VI}\left(d\right)+w_{VI}\right)\geq\frac{1}{r}D_{VS}\left(d_{VS}^{SP}\right)$$

Conditions (3) and (4) are U and D's participation constraints, whereas condition (5) is D's dynamic incentive compatibility constraint. We are now ready to state the following

Lemma 1: Under vertical integration, the relational contract between U and D is self-enforcing if D's reneging temptation, $C_{p}\left(d\right)$, is not greater than the present value of the parties' aggregate quasi-rent stream, $\frac{1}{r}\left(JS\left(d\right)-JS_{VS}^{SP}\right)$.

Proof: The largest w_{VI} satisfying both (3) and (4) is $\overline{w_{VI}}=U_{VI}\left(d\right)-U_{VS}\left(d_{VS}^{SP}\right)$. Plugging $\overline{w_{VI}}$ into (5) and rearranging yields the condition

(6) $$C_{p}\left(d\right)\leq\frac{1}{r}\left(JS\left(d\right)-JS_{VS}^{SP}\right)$$

Since $\overline{w_{VI}}$ satisfies both (3) and (4), (6) is sufficient for self-enforcement. QED.

Rearranging (6), we can conclude that the optimal relational contract under vertical integration will choose *d* to maximize the joint surplus $JS\left(d\right)$, subject to the self-enforcement condition that $JS\left(d\right)\geq JS_{VS}^{SP}+rC_{p}\left(d\right)$. This contract is represented in figure 1 below.

<FIGURE 1 HERE>

4.3. Vertical separation

Denote U's and D's per period profits from honoring the relational contract under vertical separation, gross of the transfer w_{VS}, as $U_{VS}(d) = B(d)$ and $D_{VS}(d) = V(d) - C_a(d) - C_p(d)$, yielding joint surplus $JS(d)$, as before. The relational contract is self-enforcing if, and only if

$$\frac{1+r}{r}\left(U_{VS}(d) - w_{VS}\right) \geq \frac{1+r}{r}U_{VS}\left(d_{VS}^{SP}\right) \tag{7}$$

$$\frac{1+r}{r}\left(D_{VS}(d) + w_{VS}\right) \geq \frac{1+r}{r}D_{VS}\left(d_{VS}^{SP}\right) \tag{8}$$

$$D_{VS}(d) + \frac{1}{r}\left(D_{VS}(d) + w_{VS}\right) \geq D_{VS}\left(d_{VS}^{SP}\right) + \frac{1}{r}D_{VS}\left(d_{VS}^{SP}\right) \tag{9}$$

Paralleling the analysis of vertical integration, we can state the following

Lemma 2: Under vertical separation, the relational contract between U and D is self-enforcing if D's reneging temptation $D_{VS}\left(d_{VS}^{SP}\right) - D_{VS}(d)$ is not greater than the present value of the parties' aggregate quasi-rent stream $\frac{1}{r}\left(JS(d) - JS_{VS}^{SP}\right)$.

Proof: The largest w_{VS} satisfying both (7) and (8) is $\overline{w_{VS}} = U_{VS}(d) - U_{VS}\left(d_{VS}^{SP}\right)$. Plugging $\overline{w_{VS}}$ into (9) and rearranging yields the condition

$$D_{VS}\left(d_{VS}^{SP}\right) - D_{VS}(d) \leq \frac{1}{r}\left(JS(d) - JS_{VS}^{SP}\right) \tag{10}$$

Since $\overline{w_{VS}}$ satisfies both (7) and (8), (10) is sufficient for self-enforcement. QED.

Rearranging (10), we can conclude that the optimal relational contract under vertical separation will choose *d* to maximize the joint surplus $JS(d)$, subject to the self-enforcement condition that $JS(d) \geq JS_{VS}^{SP} + r\left[D_{VS}\left(d_{VS}^{SP}\right) - D_{VS}(d)\right]$. This contract is represented in figure 2 below.

<FIGURE 2 HERE>

4.4. Comparison

Given Lemmas 1 and 2, we can state the following

Proposition 2: There is a critical agent's action $d^* > d_{VS}^{SP}$, such that D's temptation to renege on a given relational contract *d* is minimized under vertical separation if $d < d^*$, and under vertical integration if $d > d^*$.

Proof: From (6) and (10), it follows that D's temptation to renege on a given relational contract *d* is minimized under vertical integration if, and only if

$$V(d) - C_a(d) \leq V\left(d_{VS}^{SP}\right) - C_a\left(d_{VS}^{SP}\right) - C_p\left(d_{VS}^{SP}\right) \tag{11}$$

The left-hand side of (11) is the function $f(d) = V(d) - C_a(d)$, and the right-hand side is the function $g(d) = V(d) - C_a(d) - C_p(d)$, evaluated at its maximum d_{VS}^{SP}. Both $f(d)$ and $g(d)$ are concave and have an interior maximum, and $f(d) > g(d)$ for any given $d > 0$. Hence, there is a unique action $d^* > d_{VS}^{SP}$, such that $f(d) > g\left(d_{VS}^{SP}\right)$ for $d < d^*$, $f(d) = g\left(d_{VS}^{SP}\right)$ for $d = d^*$, and $f(d) < g\left(d_{VS}^{SP}\right)$ for $d > d^*$. QED.

Proposition 2 implies that "ambitious" relational contracts—that is, those requiring a large amount of performance from the agent—can be more easily sustained under vertical integration. The intuition is simple: under vertical integration, D is an employee with no stake in the business, so increasing the level of performance always makes her worse off, because it reduces her free time. Conversely, under vertical separation, D is residual claimant of the downstream profits, so she has an incentive to increase the level of performance up to d_{VS}^{SP}, and to decrease it thereafter. Hence, D's profit motive under vertical separation will mitigate her temptation to shirk and enjoy free time when the principal's request is not too demanding ($d < d^*$), and magnify it when the principal's request is very demanding ($d > d^*$).

Proposition 2 sheds new light on a classic tenet of transaction cost economics, according to which contractual opportunism can be internalized by bringing units together into an integrated firm, where conflicts with employees are resolved by fiat (Coase (1937), Williamson (1970, 1979, 1991), Klein *et al*. (1978)). If fiat is interpreted as formal authority, the statement seems dubious, at least in an agency context (Alchian and Demsetz (1972)).[6] Indeed, recent works have noted that integrated firms have similar formal authority over employees and independent contractors in several industries, such as franchising (Hadfield (1990), Arruñada *et al*. (2001), Zanarone (2009)),[7] trucking (Baker and Hubbard (2004)), and air transportation (Forbes and Lederman (2009)). However, one

[6] This abstracts from environments where vertical integration can transfer control over decisions, eliminating the agency problem altogether. See Hart and Holmstrom (2008), and Baker *et al*. (2008) for related models.
[7] This is not always true: for instance, Brickley *et al*. (1991) show that, in American states where the law protects franchisees from unfair termination, franchisors prefer to own the outlets, as that allows them to terminate non-performing outlet managers without facing legal restrictions. In this case, vertical integration clearly expands the franchisor's formal authority.

could also interpret fiat in terms of obedience induced by relational contracts, rather than formal authority. Then, for a given governance structure, the degree of fiat would be measured by how much cooperation above the spot market level the principal elicits through a relational contract under that governance structure. According to proposition 2, vertical integration (separation) should be observed when the relational contract requires greater (smaller) cooperation than d^*, implying that a greater degree of fiat should be observed under vertical integration than under separation.

While this is consistent with the prediction of transaction cost economics, the rationale is different. There, large (small) fiat is an exogenous feature of integration (separation); here, large (small) fiat emerges endogenously, in equilibrium. under integration (separation). This has an implication for managerial practice and empirical research: it is not sufficient to observe absence of conflicts and smooth cooperation under vertical integration, in order to conclude that vertical integration is an automatic relief against contractual hazards. Depending on the environment, only "modest" relational contracts—that is, contracts where $d < d^*$—may be feasible, and those are easier to sustain under vertical separation (see section 5 for more on this). Empirically, this means that a correlation between vertical integration and desirable organizational outcomes such as fiat, cooperation, and smooth relational contracts, may be, at least in part, the result of selection bias.

5. Additional results

This section studies the choice between vertical integration and separation as a function of three parameters: the interest rate, which measures the tightness of the relationship between U and D, the degree of spillover from the downstream to the upstream unit, and the cost incurred by U to monitor D. The results yield new testable predictions, and shed new light on a number of empirical results (Table 1).

<TABLE 1 HERE>

5.2. Complementarity between vertical integration and relational contracts

The relation between governance structure and the interest rate is given by the following

Proposition 3: There is a critical interest rate r^*, such that vertical integration is (weakly) optimal for $r < r^*$, and vertical separation is (weakly) optimal for $r > r^*$.

Proof: Let $\overline{d^{VI}}(r)$ and $\overline{d^{VS}}(r)$ be the maximum actions feasible under vertical integration and separation, respectively. Since $\overline{d^{VI}}(r)$ decreases in *r*, we can define as r^* the maximum interest rate such that $\overline{d^{VI}}(r) \geq d^*$. Because of Proposition 2, this implies that $\overline{d^{VI}}(r) > \overline{d^{VS}}(r)$ for $r < r^*$, and $\overline{d^{VS}}(r) > \overline{d^{VI}}(r)$ for $r > r^*$. Hence, it must be that

$JS_{VI}^{REL} \geq JS_{VS}^{REL}$ for $r < r^*$, with the inequality holding strictly for $\overline{d^{VS}}(r) < d^{FB}$, and

$JS_{VS}^{REL} \geq JS_{VI}^{REL}$ for $r > r^*$, with the inequality holding strictly for $\overline{d^{VI}}(r) < d^{FB}$. QED.

Proposition 3 suggests that, when the agent's contribution is substantial, relational contracts and vertical integration are *complements*: the closer the relationship between the principal and the agent, the greater the organizational advantage of vertical integration, relative to separation. This supports Williamson's informal argument that relational contracts are most effective within an integrated firm (Williamson (1975), pp. 107-8, Williamson (1979)), but with a caveat: integration facilitates "ambitious" relational contracts not because it replaces conflictive contractual relations with administrative fiat (Williamson (1979)), but because it reduces the agent's temptation to renege on the promise to provide a large level of performance. On the other hand, Proposition 3 stands in contrast with the result in Garvey (1995), according to which vertical integration and relational contracts are substitutes. The difference is that, in Garvey (1995), the value of assets is monotonically increasing in the parties' effort. Therefore, taking assets away from a party, by making her the other's employee, will always *increase* that party's reneging temptation, all else equal. Hence, when effort is needed from both parties, the aggregate reneging temptation can be reduced via a more even split of assets, which Garvey (1995) interprets as a movement from vertical integration towards separation. Conversely, in this paper, effort generates both revenues ($V(d)$) and opportunity costs ($C_a(d)$) for the owner of the downstream unit, implying that, when the agent is an employee, her temptation to renege on a large level of effort is smaller than when she owns the unit (Proposition 2). Therefore, vertical integration achieves greater performance than separation when the parties can aim

high—that is, when they are patient enough for a relational contract involving a large level of effort to be feasible at all. This modeling approach is arguably more suitable than Garvey's (1995) one in settings—such as franchising—where both revenues and opportunity costs from the agent's effort are difficult to contract, and are therefore appropiated by the party who owns the assets (Maness (1996)).

I do not know of empirical research on the link between relational contracts and vertical integration. However, the results in this paper seem consistent with some recent works on internet outsourcing (Kalnins and Mayer (2004)) and off-shore drilling (Corts and Singh (2004)), which found that, in the presence of repeated interactions, cost-plus contracts are fixed-price ones. According to the authors, the reason is that relational contracts neutralize incentive problems—for instance, a driller's incentive to shirk on drilling and maintenance effort—thus eliminating the main reason for using high-powered, fixed price contracts. This allows the parties to use cost-plus contracts, which are more flexible and, therefore, mitigate holdups and renegotiation costs.[8] An alternative interpretation, in the spirit—if not in the letter—of this paper, is that parties in a closer relationship can aim at higher performance. However, under a cost-plus contract, the agent's span of control is limited—for instance, cost-plus drillers are responsible for maintenance, but not drilling—and, consequently, her present gains from reneging on a demanding request by the principal are smaller than under a fixed-price contract. Hence, cost-plus contracts should be used when the relationship between the parties is closer. According to this interpretation, cost-plus contracts mute the agent's incentives—as vertical integration does in the model presented

[8] See Corts (2007) for a theoretical model along these lines.

here—although they do so by reducing the agent's span of control, rather than by shifting residual profits to the principal.

5.3. Vertical integration and spillovers

Redefine the value of the upstream unit as $B(d,b)$, where $B_b > 0$, $B_{db} > 0$, and $B_{bd} > 0$. The relation between governance structure and the spillover from the agent to the principal is then given by the following

Proposition 4: For a given interest rate, there is a critical value of the spillover parameter, $b^*(r)$, such that vertical separation is (weakly) optimal for $b < b^*(r)$, and vertical integration is (weakly) optimal for $b > b^*(r)$.

Proof: Let $\overline{d^{VI}}(r,b)$ and $\overline{d^{VS}}(r,b)$ be the maximum actions feasible under vertical integration and separation, respectively. For a given r, $\overline{d^{VI}}(r,b)$ increases in b. Hence, we can define as $b^*(r)$ the minimum spillover such that $\overline{d^{VI}}(r,b) \geq d^*$. Because of Proposition 2, this implies that $\overline{d^{VI}}(r,b) > \overline{d^{VS}}(r,b)$ for $b > b^*(r)$, and $\overline{d^{VS}}(r,b) > \overline{d^{VI}}(r,b)$ for $b < b^*(r)$. Hence, it must be that $JS_{VI}^{REL} \geq JS_{VS}^{REL}$ for $b > b^*(r)$, with the inequality holding strictly for $\overline{d^{VS}}(r,b) < d^{FB}$, and $JS_{VS}^{REL} \geq JS_{VI}^{REL}$ for $b < b^*(r)$, with the inequality holding strictly for $\overline{d^{VI}}(r,b) < d^{FB}$. QED.

Proposition 4 provides a novel explanation for why inter-firm spillovers lead to vertical integration. This has been observed in a variety of industries: for instance, restaurant chains

prefer to own upscale restaurants, dine-in restaurants, and restaurants with in-house food production, where the quality of customer service and the restaurant's cleanness and comfort are more critical to the chain's reputation (Yeap (2006)); motor carriers prefer to own trucks in less-than-truckload trucking, where pick-ups and deliveries are closely interconnected and, therefore, poor maintenance and driving effort cause delays that harm the carrier's reputation (Nickerson and Silverman (2003)); and major airline companies prefer to own regional carriers that serve routes between bad weather airports, where more flights must be rescheduled due to delays and cancellations—typically, by postponing a regional connection flight to let the major's flight leave on time—and failure of the regional carriers to do so harms the reputation of the whole major-cum-regional network (Forbes and Lederman (2009)).[9] In all these cases, a principal-agent relationship exists both under vertical integration and separation, and integration does not seem to expand the principal's formal authority. Nevertheless, as the agent's actions become more critical for the principal, integration is preferred to separation. The explanation provided by this paper is that, as spillovers increase, the agent's action generates greater surplus, so the principal demands more from her. Integration, by making the agent indifferent to downstream profits, reduces her temptation to renege on more demanding relational contracts. An alternative explanation, which does not involve relational contracts, has been proposed by multi-tasking models, where muting the agent's incentives avoids imbalances in her allocation of effort across tasks. An advantage of the theory presented here is that it does not require certain assumptions of multi-tasking models—such as the agent's risk-aversion (Holmstrom and Milgrom (1994), Bai and Tao (2000)), or her willingness to work up to a

[9] See Lafontaine and Slade (1997, 2007) for detailed reviews of the empirical literature on vertical integration.

substantial amount without incentives (Holmstrom and Milgrom (1991))—in order for the muted incentives to be optimal. These assumptions do not seem to apply in some of the industries where spillovers lead to vertical integration. For instance, previous works have noted that managers in risky retail stores receive greater, not smaller portions of outlet profits (Norton (1988), Martin (1988), Lafontaine (1992)), which is contrary to what one would expect if these managers were risk-averse. Also, it seems unlikely that truck drivers, whose job is burdensome and unpleasant, would be happy to drive at the speed and pace required by the motor carrier, without explicit incentives to do so.

5.4. Vertical integration and monitoring costs

Assume the terms in the joint surplus are separable functions of the action *d*, and of a stochastic event realized after *d* is chosen. This implies that U cannot infer D's action from the realized values. Assume, however, that U can observe D's action by incurring a monitoring cost $M(d,m)$, increasing and convex in *d* and *m*, with $M_d(0,m)=0$, $M_{dm}>0$, and $M_{md}>0$. To make matters simple, assume, further, that the stochastic event has 0 mean, and that both U and D are risk-neutral, so all the equations in section 4 are unaffected, except that the (expected) joint surplus now includes $M(d,m)$ as a negative term. The relation between governance structure and monitoring costs is then given by the following

Proposition 5: For any given *r* and *b*, there is a critical level of monitoring cost $m^*(r,b)$, such that vertical integration is (weakly) optimal for $m < m^*(r,b)$, and vertical separation is (weakly) optimal for $m > m^*(r,b)$.

Proof: Let $\overline{d^{VI}}(r,b,m)$ and $\overline{d^{VS}}(r,b,m)$ be the maximum *d* feasible through a relational contract under vertical integration and separation, respectively. For given *r* and *b*, $\overline{d^{VI}}(r,b,m)$ decreases in *m*. Hence, we can define as $m^*(r,b)$ the maximum monitoring cost such that $\overline{d^{VI}}(r,b,m) \geq d^*$. Because of Proposition 2, this implies that $\overline{d^{VI}}(r,b,m) > \overline{d^{VS}}(r,b,m)$ for $m < m^*(r,b)$, and $\overline{d^{VS}}(r,b,m) > \overline{d^{VI}}(r,b,m)$ for $m > m^*(r,b)$. Hence, it must be that $JS_{VI}^{REL} \geq JS_{VS}^{REL}$ for $m < m^*(r,b)$, with the inequality holding strictly for $\overline{d^{VS}}(r,b,m) < d^{FB}$, and $JS_{VS}^{REL} \geq JS_{VI}^{REL}$ for $m > m^*(r,b)$, with the inequality holding strictly for $\overline{d^{VI}}(r,b,m) < d^{FB}$. QED.

Proposition 5 is consistent with several empirical works on franchising, which found that retail outlets that are distant from the franchisor's headquarters (Brickley and Dark (1987), Arruñada, Vázquez and Zanarone (2009)) or geographically dispersed (Lafontaine (1992), Lafontaine and Shaw (2005))—and, therefore, more difficult to monitor—tend to be franchised, rather than integrated. As an explanation, Lafontaine and Slade (1996) have proposed that, in the presence of high monitoring costs, direct measures of the agent's performance are noisier, so the incentive compensation of a risk-averse agent should be based on indirect measures, such as sales or profits. They interpreted this as a move

towards vertical separation. An advantage of the explanation proposed here, based on relational contracts, is that it does not require agent's risk-aversion, which, as mentioned before, seems desirable, at least in retail contracting.

5.5. Markets, hybrids and hierarchies

Proposition 4 can be applied to revisit the categories of markets, hybrids and hierarchies. According to Williamson (1991), hybrid organizations, such as franchise networks, do better than spot markets in dealing with non-standard contractual hazards, and, in turn, integrated firms do even better than hybrids. Hence, as the hazards intensify and become more complex, one should expect governance structures to evolve from markets into hybrids, and from hybrids into hierarchies. If one interprets non-standard hazards as the non-contractible action d in the model, and the extent of such hazards as the spillover parameter b, the model predicts that, as hazards intensify, governance should evolve from relational separation into relational integration. Relational separation could be interpreted as a "hybrid", in that the performance it generates lays between the feasible levels under spot separation and relational integration. However, unlike in the hybrids envisioned by Williamson (1991), here the principal does not have greater formal authority under relational integration than under relational separation. Hence, the reason for moving from hybrids to hierarchies is not the availability of greater formal authority, or of more specific legal remedies, but, rather, the fact that the muted incentives of integrated firms are better equipped to support relational contracts that ask the agent to provide a substantial amount of non-contractible performance.

5.6. Regulation

Finally, the model could be extended to study when the State should supply a public good directly, delegating management to civil servants (vertical integration), and when it should outsource its provision to private contractors (vertical separation). This setting seems to fit the environment described here, because, insofar as the State does not face constitutional limitations in regulating private contractors, vertical integration does not reallocate formal authority. The model would predict State supply as the optimal solution when the State can estabilish a close relationship with its civil-servant managers, when the good supplied has substantial public value, and when the State's monitoring costs are low. While I do not know of previous works that investigate this topic, I hope the model presented here may encourage more tailored theories, and related empirical research.

6. Conclusion

This paper has developed a relational contracting model to explain why fiat—a principal's ability to dictate her agent's performance—abounds in integrated firms. The proposed explanation is that vertical integration, by making the agent indifferent towards her unit's profits, reduces her temptation to renege on demanding relational contracts, which require substantially greater performance than a profit-maximizing agent would be willing to supply. This result has several implications for the theory of the firm. First, relational contracts and integration should be seen as complements, rather than substitutes;

second, inter-firm spillovers should encourage vertical integration; third, monitoring costs should discourage vertical integration. In addition, the model provides a formal explanation for Williamson's idea that, as inter-firm conflicts increase, governance structures should evolve from spot markets into hybrids, and from hybrids into hierarchies. Finally, the model can be applied to study the choice between integration and regulation in the provision of public services. Some of the model's results, such as the link between integration, spillovers and monitoring costs, shed new light on existing empirical evidence. Some others, such as the complementarity between integration and relational contracts, and the application to regulation, call for empirical investigation, which I hope to pursue in future works on this topic.

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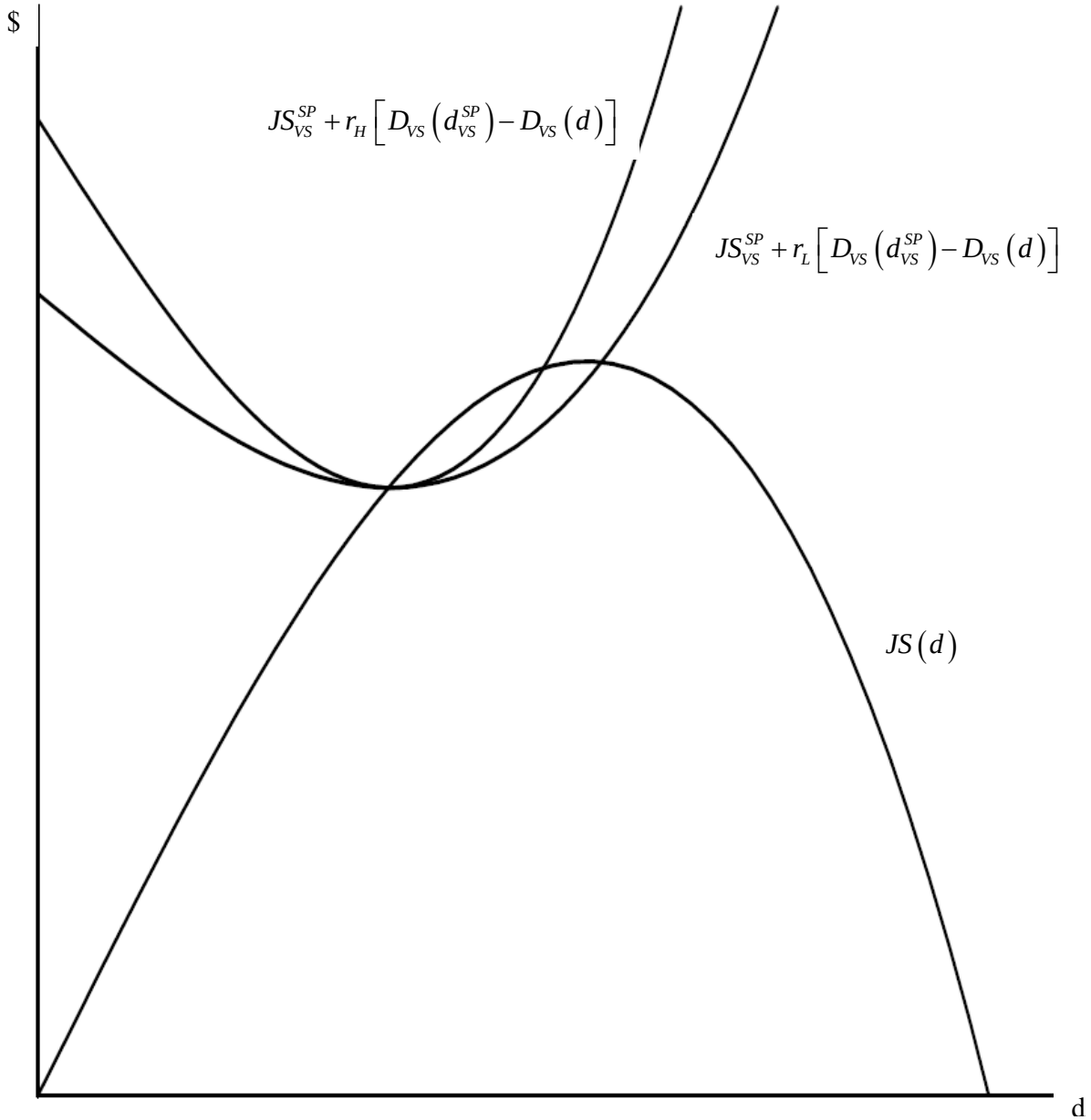
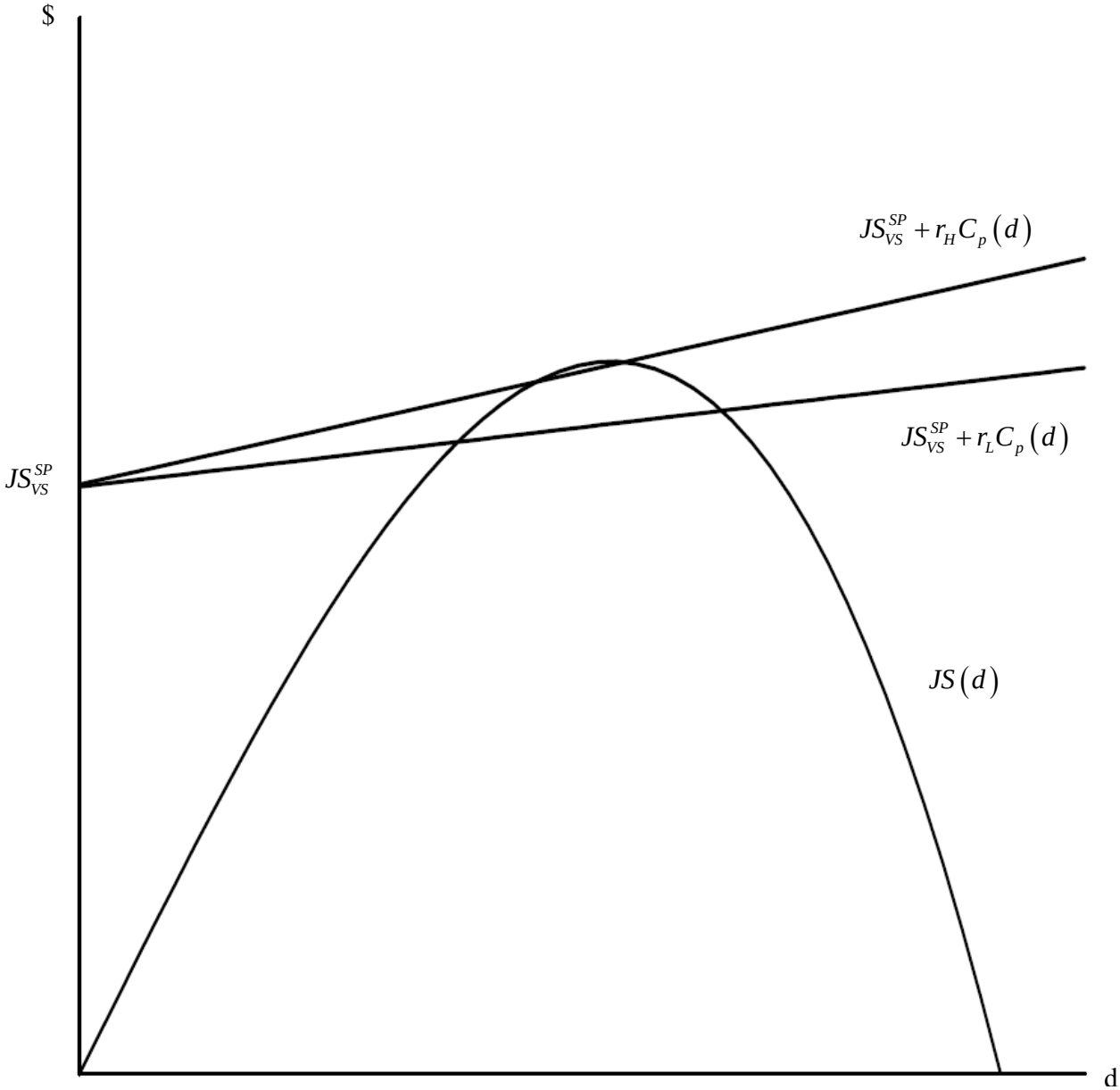
Figure 2: Optimal relational contracts under vertical separation, for high (r_H) and low (r_L) interest rates



The figure assumes $B(d) = 10d$, $V(d) = 8d$, $C_a(d) = d^3$, and $C_p(d) = d$. Note that the reneging temptation is always minimized at d_{VS}^{SP} .

Figure 1: Optimal relational contracts under vertical integration, for high (r_H) and low (r_L) interest rates



The figure assumes $B(d) = 10d$, $V(d) = 8d$, $C_a(d) = d^3$, and $C_p(d) = d$.

Table 1. Recent evidence: the effect of spillovers, repeated interaction, and monitoring costs on vertical integration

Empirical study	Year	Industry	Agent's task	Observed variations	Change in model's parameters			Effect on vertical integration
					Spillover	*Interest rate*	*Monitoring cost*	
Nickerson & Silverman	2003	Trucking	Drive safely	Less-than-truckload	+			+
Yeap	2006	Chain restaurants	Control service quality	In-house production; dine-in service; high price	+			+
Forbes & Lederman	2009	Air transportation	Reschedule flights	Bad weather airport	+			+
Corts & Singh	2004	Oil drilling	Drill and maintain oil rigs	Repeated interaction		–		+
Lafontaine & Shaw	2005	Retailing	Manage outlet	Franchisor operates in more states			+	–