

An Influence-Cost Model of Organizational Practices and Firm Boundaries

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Abstract

This paper explores organizational responses to influence activities - costly activities aimed at persuading decision makers. As Milgrom and Roberts (1988) argued, rigid practices that otherwise seem inefficient can optimally arise. If more complex decisions are more susceptible to influence activities, optimal selection may partially account for the observed correlation between firm performance and management-practice quality reported in Bloom and Van Reenen (2007). Further, a firm's boundaries can be shaped by influence-activity considerations, providing a theory of the firm based on ex-post inefficiencies. Finally, boundaries and rigid practices interact: rules under non-integration should be less restrictive than under integration. (JEL D02, D23, D73, D83)

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1 Introduction

Influence activities—costly activities aimed at persuading a decision maker—are commonplace in business relationships both between and within firms. Employees may spend their otherwise-productive time building credentials and seeking outside opportunities to convince management they should be promoted to a key position (Milgrom and Roberts (1988)). Division managers may lobby corporate headquarters for larger budgets to pursue pet projects (Wulf (2009)). Firms may lobby suppliers to provide favorable delivery slots, to give them first pick of the highest quality batches of goods, or to assign specific personnel to their case. Such influence activities are privately costly and can lower the quality of decision making, so part of the organizational design problem is to moderate them.

In order to moderate influence activities, organizations may adopt rigid, seemingly inefficient, practices. Seniority-based promotion rules may promote less-talented workers or ones who are not a good fit for a position, but they reduce the incentives for workers to waste time "buttering up the boss" (Milgrom (1988), Milgrom and Roberts (1988)). Low-powered managerial incentives may stifle motivation, but they can reduce an own-division bias in lobbying for corporate resources (Scharfstein and Stein (2000), Rajan, Servaes, and Zingales (2000)). Closed-door organizational practices that hamper communication may make it difficult to implement continuous-improvement initiatives, but a more open policy may invite lobbying.

Moreover, as Milgrom and Roberts (1990) point out, "even the very boundaries of the firm can become design variables." That is, divesting a business unit can create barriers to influence (Meyer, Milgrom, and Roberts (1992)). Influence activities are not absent between firms, however—most business relationships are on-going and involve significant relationship specificity, and hence a firm *does* care about (and thus may hope to influence) what its business partners do.

In this paper, I take moderating influence activities to be a central goal of designing a firm's organizational practices and boundaries. As in Grossman and Hart (1986) and Hart and Moore (1990), I hold technology, preferences, information, and the legal environment constant across prospective governance structures and ask, for a given transaction with given characteristics, whether the transaction is best carried out within a firm or between firms. Giving control over all aspects of the production process to one manager eliminates that manager's incentives to engage in influence activities but intensifies the other manager's. Additionally, I ask whether the transaction should be governed by rigid or flexible practices. Rigid organizational practices reduce influence activities but occasionally lead to poor decision making. Of course, difficult transactions will be difficult no matter how they are

organized (Gibbons, 2005, p. 220), but the relative importance of these considerations is determined by the transaction's characteristics. This paper thus delivers a unified account of the costs and benefits of alternative governance structures, consistent with Williamson's observation that "substantially the same factors that are ultimately responsible for market failures also explain failures of internal organization" (1973, p. 316).

To sketch the model's ingredients and results, consider two managers in a working relationship. In the course of their relationship, two decisions must be made. The rights to make these decisions are contractible *ex ante*, but neither the rights to make decisions nor the actual decisions to be made are contractible *ex post*.¹ That is, when a particular contingency arises, the managers cannot bargain over the decision that is to be taken; instead, for each decision, the manager with the control right unilaterally chooses his ideal decision given his information. Additionally, there are decision externalities—each manager cares directly about both decisions—because the managers are, at least in the short-run, locked into working with each other (whether within one firm or in a supply relationship).

The manager in control of a decision must rely on information that can be influenced by the disempowered manager. The disempowered manager may seek out additional information that favors his view, he may neglect to mention certain points that do not, or he may attempt to tell a story consistent with the facts but heavily biased in its conclusion. In any case, crafting such an argument takes time that would be better spent on more productive tasks—the direct cost of influence activities is the opportunity cost of the influencer's time. As such, these costs are convex—engaging in influence activities crowds out less productive tasks before more productive tasks. Formally, there is an informative but manipulable public signal. Prior to its realization, each manager can manipulate the distribution of this signal so that its realizations appear more favorable for his ideal decision. That is, the managers engage in a signal-jamming game under symmetric uncertainty (Holmstrom (1982/1999), Dewatripont, Jewitt, and Tirole (1999)).

As an example, two managers in a vertical chain may care about a common asset such as the reputation of the final product that emerges from their production process. The upstream manager may prefer that the reputation be geared toward showcasing the durability of the inputs. The downstream manager may prefer that it emphasize novelty. Decisions must be made regarding the direction to emphasize in a new marketing campaign. Both managers want the final product to succeed, and success largely depends on consumers' preferences,

¹Departure from *ex-post* contractibility is a common theme in recent theoretical papers on organizations: see Masten (1986), Milgrom and Roberts (1988), Dewatripont and Tirole (1994), Aghion and Tirole (1997), Rajan and Zingales (2000), Dessein (2002), Prendergast (2002), Hart and Moore (2005), Alonso, Dessein, and Matouschek (2008), Hart and Moore (2008), Rantakari (2008), Hart (2009), Hart and Holmstrom (2010), Van den Steen (2010), and Baker, Gibbons, and Murphy (2011)

which are uncertain. Depending on who is making these decisions, one or both managers may have the incentive to try to persuade the other by, say, altering the phrasing of certain questions that are asked in consumer focus groups. Time spent on crafting such arguments is time spent away from strategic planning and operations oversight.

Non-integration minimizes aggregate influence costs: divided control leads each manager to try to influence the other's decision, but these influence activities crowd out only mundane activities; in contrast, unified control leads the disempowered manager to devote a lot of time to influence activities, crowding out potentially important tasks. On the other hand, there may be benefits to unifying control: coordinating the two decisions could be important, or one manager might simply have more to lose from not having his ideal decision implemented. It may therefore be more efficient to opt for integration and to moderate influence activities using alternative instruments, such as closed-door policies or restrictions on the discretion of the decision maker. Influence costs may thus shed light on why certain puzzling management practices persist and why they are negatively correlated with performance (as documented by Bloom and Van Reenen (2007)).² Adapting a phrase from Prendergast (2003), when rigid practices perform well, flexible practices perform better; but when rigid practices perform poorly, flexible practices perform worse. Finally, organizational practices and firm boundaries interact: rigid organizational practices and integration are complementary; non-integrated relationships should be governed by less restrictive rules than relationships within integrated firms.

To summarize, this paper provides a unified set of answers to two classic questions: (a) why are all transactions not carried out in the market and (b) why are all transactions not carried out within a single large firm? Williamson (1971) identified between-firm "haggling" costs as an answer to (a) and, in later works, "bureaucratic costs of hierarchy" (Tadelis, Williamson, 2012) as an answer to (b). Here, I expand Williamson's argument from explicit disputes to inefficiencies in implicit lobbying. This influence-cost approach suggests refinements to Williamson's argument. Holding organizational practices constant, unifying control *increases* influence costs, in contrast to Williamson's claim that "fiat [under integration] is frequently a more efficient way to settle minor conflicts" (1971, p.114): modifying firm boundaries without adjusting practices does not solve the problem. However, whenever integration is being considered for influence-cost moderating purposes, it will be accom-

²As an example of the hazards of unified control, IBM's 1984 decision to disempower its PC division resulted in its PC division head regularly spending several days a week in Armonk, NY "taking care of internal political and operational issues, gaining approval for actions, leaving others in charge in Boca Raton [the site of the PC division's offices] of many details." (Bresnahan, Greenstein, Henderson (2012)) Unification of control led to an increase in influence activities. Eventually, this change was complemented with a change in the formal reporting structure of the firm, which ultimately reduced the scope for such activities, but also led to IBM's failure to maintain its initial lead in the PC industry.

panied by rigid organizational practices that appear bureaucratic in spirit. Fiat (unified control) appears effective precisely because it is coupled with bureaucracy. Though costly, bureaucracy is the lesser of two evils.

This paper is related to the literature on influence activities in organizations (Milgrom (1988), Milgrom and Roberts (1988, 1990, 1992), Schaefer (1998), Scharfstein and Stein (2000), Laux (2008), Wulf (2009), Friebe and Raith (2010), Lachowski (2011)) but is closest in spirit to Meyer, Milgrom, and Roberts (1992) who explore the idea that the boundaries of the firm can serve as design variables to mitigate influence activities. In their model, divestiture of a division amounts to the choice of a decision rule that cannot depend on the information the division possesses, whereas in my model, divestiture of a division amounts to divided control. I view informational restrictions on decision rules as an additional instrument (as in Milgrom and Roberts (1988)) and analyze the interaction between the two.

The analysis expands upon Gibbons (2005), who explores the role of the allocation of a single decision right on equilibrium influence activities. This paper goes further in that it analyzes the simultaneous choice of boundaries (unified versus divided control) and organizational practices. In doing so, it provides a theory of the firm based on ex-post inefficiencies.³ My treatment of rigid organizational practices and their observed negative correlation with performance parallels Prendergast (2003)'s argument for why observed bureaucracies appear inefficient.

Section 2 describes a simple model of influence activities and defines and characterizes the equilibrium of this influence-activity model for a given allocation of control (control structure) and set of organizational practices (practices). Section 3 analyzes the optimal control structure for a fixed set of practices, section 4 fixes the control structure and analyzes optimal practices, and section 5 examines the joint optimization over both. Section 6 concludes.

2 The Model

2.1 Description

There are two managers, denoted by L and R and two decisions that must be made, d_1 and d_2 . The payoffs to the managers for a particular decision depend on an underlying state of the world, denoted by $s \in S$. The state of the world is unobserved; however, the two managers

³For other models of firm boundaries based on ex-post inefficiencies, see Masten (1986) on rent-seeking versus bureaucracy, Matouschek (2004) and Baliga and Sjöström (2013) on residual control rights and ex-post bargaining under asymmetric information, Hart and Holmström (2010) on coordination versus aggrievement, and Dessein (2012) on motivation versus coordination.

can commonly observe an informative but manipulable signal, σ . The two managers bargain over a **control structure** $g \in G = \{I_L, I_R, NI, RNI\}$, where under I_j , manager j controls both decisions, under NI , L controls d_1 and R controls d_2 , and conversely under RNI . After the control structure has been chosen, each manager chooses a level of "influence activities," denoted by λ_i at private cost $k(\lambda_i)$, with $k', k'' > 0$. Influence activities are chosen prior to the observation of the public signal and without any private knowledge of the state of the world, and they affect the conditional distribution of σ given s . I assume that this effect is linear: $\sigma = s + \lambda_i + \lambda_j + \varepsilon$, where ε is a noise term. After the signal has been observed, the manager(s) with control of the decision rights must immediately choose a decision. Further, the managers cannot bargain over a signal-contingent decision rule ex ante.

The timing of the model is as follows:

1. L and R bargain over a control structure $g \in G$;
2. L and R simultaneously choose (unobservable) influence activities $\lambda_L, \lambda_R \in \Lambda \subset \mathbb{R}$ at cost $k(\lambda_i)$, where k is convex and symmetric around zero, with $k'(0) = k''(0) = 0$;
3. i and j publicly observe the signal σ ;
4. The manager with control of decision ℓ chooses $d_\ell \in \mathbb{R}$;
5. Payoffs are realized.

All random variables are normally distributed ($s \sim N(0, h^{-1})$, $\varepsilon \sim N(0, h_\varepsilon^{-1})$) and independent, and managers have quadratic costs of influence, $k(\lambda_i) = \frac{1}{2}(\lambda_i)^2$, and gross payoffs

$$U_i(s, d) = \sum_{\ell=1}^2 \left[-\frac{\alpha_i}{2} (d_\ell - s - \beta_i)^2 \right], \alpha_i > 0, \beta_i \in \mathbb{R}.$$

Manager i prefers $d_1 = d_2 = s + \beta_i$, and hence the two managers disagree on their ideal decision conditional on the state of the world. The problem is not interesting if $\beta_L = \beta_R$, so without loss of generality, assume $\beta_L - \beta_R \equiv \Delta > 0$. Additionally, assume that $\alpha^L \geq \alpha^R$.

Two aspects of symmetry have been assumed here. First, the amount by which manager i cares about how close the decision is to his ideal decision is assumed to be the same across decisions. That is, the α_i coefficient on the loss functions for both decisions is the same. In this model, unified control is desirable, because the manager who cares more about one decision also cares more about the other. An alternative foundation for unified control would be complementarities between the decisions. Secondly, the amount by which the two managers disagree about the ideal decision is equal across decisions. Relaxing this does not

qualitatively change any results. Allowing for different Δ 's across decisions simply adjusts the weights that are placed on each decision in the optimal control-structure choice.

Divided control will be referred to as *non-integration* (and will be denote by $g = NI$) and unified control as *integration* ($g = I$). Though there are four potential allocations of control, only two will ever be optimal: unifying control with manager L or dividing control by giving decision 1 to L and decision 2 to R . This eliminates the need for additional notation for the remaining control structures: R -control and reverse non-integration.

2.2 Equilibrium

Suppose manager i has control of a decision. Manager j cares about the decision to be taken and recognizes that this decision depends on i 's beliefs. Thus, manager j has a direct interest in what manager i believes and will do whatever is in his power to change i 's beliefs. But, as Cyert and March (1963: p. 85) argue, "We cannot reasonably introduce the concept of communication bias without introducing its obvious corollary - 'interpretive adjustment.'" That is, manager i recognizes that manager j has the incentive to influence the signal, and he will correct for this in his beliefs. As in career-concerns/signal-jamming games, this "interpretive adjustment" does not eliminate the incentives to carry out influence activities, for if the decision maker expected no influence activities, then the influencer would have a strong incentive to engage in them. Conditional on a control structure, g , the solution concept is subgame-perfect equilibrium. Denote manager i 's beliefs about the vector of influence activities by $\hat{\lambda}(i)$.

Definition 1 *Given a control structure, g , a **subgame-perfect equilibrium** of the resulting game consists of choices of influence activities, λ_L^* and λ_R^* , and a decision function $d^{*g}(\sigma; \hat{\lambda})$, such that: (1) each component of $d^{*g}(\sigma; \hat{\lambda})$ is chosen optimally by the manager who controls that decision under g , given his beliefs about the state of the world; which depend on conjectures about the level of influence activities, $s | \sigma, \hat{\lambda}(i)$; (2) influence activities are chosen optimally given the allocation of the decision right; and (3) beliefs are correct: $\hat{\lambda}(i) = \lambda^*$.*

Let us begin by solving for an equilibrium for an arbitrary control structure g . Suppose manager i has control of decision ℓ under governance structure g . Let λ^* denote the equilibrium level of influence activities. Manager i will choose d_ℓ^* to minimize his expected loss given his beliefs. Since he faces a quadratic loss function, his decision will be equal to his conditional expectation of the state of the world, given the signal and his conjecture about

influence activities, plus his bias term, β_i . That is,

$$d_\ell^{*g}(\sigma; \hat{\lambda}(i)) = E_s \left[s | \sigma, \hat{\lambda}(i) \right] + \beta_i.$$

The decision manager i chooses differs from the decision manager $j \neq i$ would choose if he had the decision right for two reasons. First, $\beta_i \neq \beta_j$, so for a given set of beliefs, manager i prefers a different level of d_ℓ than manager j does. Secondly, it may be that, out of equilibrium, beliefs are incorrect. That is, manager i knows λ_i but only has a conjecture about λ_j . The updating rule for normal distributions implies that the conditional expectation of the state of the world from the perspective of individual i is a convex combination of two estimators of the state of the world—the first is the prior mean, 0, and the second is a modified signal, $\hat{s}(i) = \sigma - \hat{\lambda}_L(i) - \hat{\lambda}_R(i)$, which must of course satisfy $\hat{\lambda}_i(i) = \lambda_i$, because this is a game of perfect recall. The weight that i 's preferred decision rule attaches to the signal is given by the signal-to-noise ratio, $\varphi = \frac{h_\varepsilon}{h+h_\varepsilon}$. That is,

$$E_s \left[s | \sigma, \hat{\lambda}(i) \right] = (1 - \varphi) \cdot 0 + \varphi \cdot \hat{s}(i).$$

Given decision rules $d_\ell^{*g}(\sigma; \lambda^*)$ for $\ell = 1, 2$, we can now compute the equilibrium level of influence activities that each manager will engage in. Influence activities for manager j are more privately beneficial (out of equilibrium) the greater is the difference between the equilibrium decision rule and manager j 's decision rule, the more manager j cares about his loss from having a privately suboptimal decision rule, and the more weight the decision maker places on the manipulable signal. Manager j 's level of influence activities will solve

$$|k'(\lambda_j^*)| = \left| E_{s,\varepsilon} \left[\sum_{\ell=1}^2 -\alpha_j (d_\ell^{*g}(\sigma; \lambda^*) - s - \beta_j) \frac{\partial d_\ell^{*g}}{\partial \sigma} \frac{\partial \sigma}{\partial \lambda^{j*}} \right] \right| = N_{-j} \alpha_j \Delta \varphi, \quad (1)$$

where N_{-j} is the number of decisions that manager j does not control under governance structure g . Further, since given any beliefs about λ_j , the unique optimal decision rule of manager i is a pure strategy, and given that manager i chooses a pure strategy decision rule, there is a unique value of λ_j^* satisfying (1). Thus, the focus on pure strategy equilibrium is without loss of generality. These results are captured in the following proposition.

Proposition 1 *For a given control structure, there exists a unique subgame-perfect equilibrium of the game that follows. Further, in that subgame-perfect equilibrium, the levels of influence activities are given by*

$$|\lambda_j^*| = N_{-j} \Delta \alpha_j \varphi,$$

where N_{-j} is the number of decisions player j does not control and $\varphi = \frac{h_\varepsilon}{h+h_\varepsilon}$ is the signal-to-noise ratio.

All else equal, manager j will choose a higher level of influence activities the more disagreement (Δ) there is, the more he cares about the decision (α_j), and the more informative the signal is (φ). This last comparative static can be decomposed further. φ is high the larger is h_ε (i.e., when the signal is more precise) and the smaller is h (i.e. when there is more ex ante uncertainty). Note that, in contrast to cheap-talk models of strategic communication in which losses depend only on relative disagreement, the losses in this model also depend on the stakes of the decision. The rest of this paper will concern itself with alternative methods of moderating these influence activities.

2.3 Discussion of Assumptions

Before proceeding to characterize the optimal choice of control structure, I will pause to discuss several of the modeling assumptions I have made. Throughout, I assume the two parties are "locked in" with each other, regardless of the allocation of control, and thus each manager directly cares about both decisions. This may be due to asset specificity, absent which, if one party found the others' decision to be unappealing, he could seek recourse by substituting to an outside party. A richer model might allow for endogenous dependence between the two players. Examining how this endogenous dependence interacts with firm boundaries is an interesting question.

I also assume that the disagreement between parties stems from private benefits, such as career-concerns motives. If the difference in ideal decisions originated from technological aspects, then one potential remedy might be for one manager to buy the other manager's firm and assets, install his own employee as the new manager of that division, and appropriate all the receipts of that division. If, on the other hand, these differences are due to private benefits, then in this proposed solution the newly installed manager has the same incentives as the manager he replaced.

Additionally, influence activities are assumed to be chosen without knowledge of the underlying state of the world. I show in Appendix B that the qualitative results of this model can also be generated as a separating equilibrium in a noisy signaling game. However, the multiplicity of equilibria in signaling games makes such an approach relatively unappealing.

Formally, influence activities occur prior to decision making and therefore influence costs are ex ante, rather than ex-post, inefficiencies. However, whereas malinvestment in the Grossman-Hart-Moore model occurs ex ante both in a formal sense (in that investments occur prior to decision making) and an informal sense (in that the gap in timing between

investment decisions such as locating a plant and decision making regarding production quantities is thought of as being large), influence activities should be thought of as occurring within the "contract execution interval." These are activities that occur very near actual decision making, and as a result, I refer throughout to these costs as being ex-post.

In equilibrium, influence activities do not negatively affect the quality of decision making. The Milgrom and Roberts (1988) observation that "when... underlying information is so complex that unscrambling is impossible, decision makers will have to rely on information they know is incomplete or inaccurate" is ruled out by the assumption that λ_L and λ_R do not affect the conditional variance of $\sigma|s$. Rather, I am focusing only on the direct private costs associated with influence activities.

Similarly, influence activities do not positively affect the quality of decision making. All else equal, an organization may like to provide incentives for information acquisition and discourage influence activities. But the two need not be separable, and thus I am ruling out potentially beneficial effects of influence activities—since an individual must be credible to be persuasive, he must gather useful information in order to influence a decision maker (see Laux (2008) for recent work along these lines). In a multitask model in which information gathering and influence activities are both unobserved to the decision maker, a manager's preferred level of information gathering increases in his choice of influence activities (i.e., the complements from the perspective of the manager) only if the two are cost substitutes. That is, if engaging in more information acquisition (which increases the precision of the public signal) makes it less costly at the margin to choose a higher level of influence activities (as might be the case if both require the manager to familiarize himself with the ins and outs of a complex problem), then he may prefer to do both in equilibrium. In such a model, there could be multiple pure-strategy equilibria. In this case, if the decision-maker believes that high (low) levels of influence activities have been chosen, he will place much (little) weight on the signal. This in turn will induce the other manager to choose high (low) levels of influence activities. This argument parallels the multiplicity of equilibrium argument in Dewatripont, Jewitt, and Tirole (1999).

Additionally, I have assumed that while the allocation of control is ex-ante contractible, it is not ex-post contractible. As we will see in Section 3, the central trade-off in the model will be between the costs of maladaptation and the costs of influence activities. After the influence activities have been sunk, it will always be desirable to reallocate control so as to reduce the costs of maladaptation. However, if renegotiation of decision rights were to occur after σ has been realized, the two managers would possess private information regarding their own influence activities and therefore about the state of the world. Bargaining over the decision-right allocation would occur under asymmetric information and therefore need not

result in an efficient allocation. Whether this renegotiation would lead to greater or smaller influence costs is an interesting question.

Finally, I do not consider the possibility of allocating control to a third party. The relative benefits of doing so would depend on the third party's preferences over decisions as well as on how effective influence activities are in affecting his decisions. If, for example, the third party is an unbiased, but uninformed person in the company's headquarters, then allocating control to him may yield good decision making but at the cost of high levels of influence activities.

3 The Coasian Program

Property Rights Theory (Grossman and Hart (1986), Hart and Moore (1990), and Hart (1995), hereafter PRT) advanced the methodology for studying the boundaries of the firm by specifying a common contractual environment across prospective control-right allocations, providing a unified description of the costs and benefits of integration. However, PRT assumes ex-post efficiency, via Coasian bargaining, instead focusing on how the allocation of control affects managers' bargaining positions and hence the sensitivity of their expected split of the surplus to their ex-ante investments. While the approach has proven fruitful in a variety of fields, ex-post inefficiencies are also viewed as important determinants of firm boundaries, and thus as Hart (2008) points out, "in order to make progress on the Coasian agenda, we must move away from Coase (1960) and back in the direction of Coase (1937). We need to bring back haggling costs!" But a unified account of Williamson (1971)'s appealing argument that non-integration may produce "haggling," so that decision-making by "fiat" under integration may be more efficient has been elusive. This section will develop a framework for analyzing a version of the "haggling" versus "fiat" trade-off, but a more complete analysis is deferred until section 5.

From the perspective of period 1, before λ_L and λ_R are chosen, the two managers bargain over a control structure, g^* , correctly anticipating its effects on equilibrium influence activities (which are unique, conditional on g) as well as on the equilibrium decision rules. I assume that the managers can freely make transfers at this stage, so that the control structure g^* will be the solution to the following program, which I refer to as the "Coasian program":

$$\max_{g \in G} \{W(g)\} = \max_{g \in G} \left\{ E_{s,\varepsilon} \left[\sum_{i \in \{L,R\}} U_i(s, d^g(\sigma; \lambda^*)) \right] - \sum_{i \in \{L,R\}} k(\lambda_i^*) \right\}.$$

Because managers' payoff functions are quadratic, we can use a mean-variance decomposition

of the first term in $W(g)$:

$$W(g) = -(ADAP + ALIGN(g) + INFL(g)).$$

That is, ex-ante expected welfare can be decomposed into the sum of three costs: (1) an adaptation cost that arises from basing decisions on a noisy signal rather than directly on the state of the world; (2) an alignment cost that is due to the fact that for each decision, one manager will not be able to implement his ideal decision rule; and (3) an influence-cost component, which can be interpreted as "haggling costs." The exact expressions for these terms are derived in proposition 5 in the appendix.

The *ADAP* term does not depend on the control structure, so g is chosen to minimize the sum of *ALIGN*(g) and *INFL*(g). Two polar cases help identify the relevant trade-off. First, let us look at a "pure adaptation" model in which $k(\lambda) = \infty$ for all $\lambda \neq 0$, so that influence activities are impossible by assumption. To minimize alignment costs, the managers want to allocate control of both decisions to the manager who has more to lose from not having his ideal decision rule implemented. Since $\alpha_L \geq \alpha_R$, the optimal control structure involves unifying control with manager L ($g^* = I$).

Next, consider a "pure influence" model in which $k(\lambda) = \frac{1}{2}\lambda^2$ and $\alpha_L = \alpha_R$. Under any control structure, each decision will be Δ away from one of the manager's ideal decisions. Since $\alpha_L = \alpha_R$, both managers care equally about the resulting loss. That is, *ALIGN*(g) does not depend on g and thus the control structure will be chosen to minimize influence costs. Here, the managers will optimally choose to divide control. To see why, notice that by proposition 1, the total amount of time wasted on influence activities ($\sum_j \lambda_j$) is independent of g . Since influence costs are convex, *INFL*(g) is minimized under divided control. That is, $g^* = NI$ is optimal. This result is true for any increasing and convex cost function k with k' log-concave. (See Proposition 7 in the appendix) This is satisfied for $k(\lambda) = c\lambda^\xi$ for all $\xi > 1$.

In the richer model in which $\Lambda = \mathbb{R}$ and $\alpha_L > \alpha_R$, these opposing forces lead to a non-trivial trade off, provided α_L is not too large relative to α_R . There is a critical value of the signal-to-noise ratio φ^* such that if $\varphi < \varphi^*$, control will optimally be unified and if $\varphi > \varphi^*$, control will optimally be divided. This leads to the following proposition.

Proposition 2 *Assume $\alpha_R < \alpha_L < \sqrt{3}\alpha_R$. Divided control is optimal if and only if*

$$\varphi^2 \geq \frac{\alpha_L - \alpha_R}{3(\alpha_R)^2 - (\alpha_L)^2}. \quad (2)$$

The condition that manager L cares more about the decision than manager R but not too

much more (i.e. $\alpha_L < \sqrt{3}\alpha_R$) is best understood by considering the case in which manager R is essentially indifferent about both decisions ($\alpha_R \approx 0$) but manager L is not. Then it is clear that control should be unified with manager L . Also, note that the level of disagreement, Δ , does not matter for the optimal control structure. The reason for this is that with quadratic preferences and quadratic influence costs, both *ALIGN* and *INFL* are proportional to Δ^2 and thus differences in Δ^2 do not affect the relative trade-off between minimizing alignment costs and influence costs. More generally, an increase in Δ makes integration relatively less appealing if $k''' > 0$ and makes integration relatively more appealing if $k''' < 0$.

When are influence costs large relative to alignment costs? Condition (2) implies that whenever the signal-to-noise ratio is large, the costs of integration exceed the costs of non-integration. Further unpacking φ (which is equal to $\frac{h_\varepsilon}{h+h_\varepsilon}$), non-integration is preferred whenever the level of ex-ante uncertainty is high (i.e. h small) or the signal is very informative (i.e. h_ε large) and thus will be relied heavily upon. Influence-activity moderation therefore provides a basis for a theory of the optimal control structure.

In Gibbons (2005)'s single decision-right model, control should always be allocated to the party who cares more, because that party has more to lose if it does have control, and it will also engage in more influence activities than the other party would. In contrast, this model captures a trade-off between alignment costs and influence costs. Incidentally, if one allows for heterogeneous costs $k_i(\lambda) = \frac{\lambda^2}{2c_i}$ in Gibbons (2005), a similar trade-off can be derived if $c_R > c_L$: $W_L - W_R \propto (1 - \chi)(\alpha_L - \alpha_R) + \chi(c_L - c_R)$ for some $\chi \in (0, 1)$. Allocating control to L reduces alignment costs but increases influence costs, because R has a lower marginal cost of engaging in influence activities. In contrast, in the present model, starting from divided control and allocating a second decision right to L reduces alignment costs but increases influence costs because doing so increases (decreases) the private marginal benefit of influence activities for R (L). Since k is convex, the cost of R 's additional influence activities exceed the gains from L 's reduced influence activities.

In what sense does the trade-off between alignment costs and influence costs resemble the classic "haggling" versus "fiat" trade-off? Interpreting the opportunity costs of influence activities as the costs of "haggling," this model generates the prediction that such costs should be *greater* under integration than under non-integration, in contrast to Williamson's claim that "fiat [under integration] is frequently a more efficient way to settle minor conflicts... than is haggling [under non-integration]" (1971, p. 114). Put differently, this model suggests that the *cost* of "fiat" (interpreted here as unified control) is an increase in haggling, and thus the current model does not deliver the Williamson (1971) trade-off. This will be resolved in section 5, which allows for integration to be coupled with organizational practices aimed at reducing "haggling."

4 Alternative Instruments to Reduce Influence Costs

4.1 Rigid Organizational Practices

The previous section emphasized the scope for allocating control to moderate influence activities (Proposition 2). However, as Milgrom and Roberts (1988, 1992) highlight, there are many other methods available for achieving this goal. Recall that under a control structure in which party i controls N_{-j} decision rights, manager j 's equilibrium influence activities are $|\lambda_j| = N_{-j}\Delta\alpha_j\varphi$ (Proposition 1). In the context of this model, therefore, any corporate policy that reduces α , Δ , or φ will reduce equilibrium influence activities. Closed-door policies in which decision makers are insulated from relevant information would result in a reduction in h_ε and hence φ . Low-powered incentive schemes and shrinking the size of operations could reduce α . Pursuit of a focused strategy in which managers agree on their ideal decisions would correspond to reducing Δ . Hiring outside consultants to acquire independent information about the state of the world might increase h , thereby reducing φ .

None of these policies is costless, however. A firm that is smaller or narrower than its technology and capabilities would dictate forgoes profitable opportunities. Low-powered incentives stifle managerial motivation. "Defensive information acquisition" by an outsider who, by definition, is not an insider and thus not privy to the relevant information, is costly. While all these policies are important in real organizations, their costs are exogenous to the present model, so I will focus on one with endogenous costs: closed-door policies.

Assume party L has both decision rights. The model is as above, except that in the first period, instead of bargaining over the control structure, L and R bargain over whether or not to carry out their relationship under an open- or closed-door policy. They may trim out personnel whose job it is to gather relevant information, they may purposefully load up their schedules and keep themselves too busy to pay attention to everything that crosses their desks, or they may limit the frequency and length of meetings with each other. Let $\theta \in \Theta = \{0, 1\}$ denote this choice. Under an open-door policy (denoted by $\theta = 0$), the rest of the game proceeds as usual. Under a closed-door policy (denoted by $\theta = 1$), no public signal is realized in period 3. Let $W(\theta)$ denote the expected ex-ante equilibrium welfare under organizational practice θ . The Coasian program is

$$\max_{\theta \in \Theta} \{W(\theta)\}.$$

If no public signal is realized, neither manager will have the incentive to exert any influence over it, and thus $\lambda_L = \lambda_R = 0$. This is potentially worthwhile if manager R would otherwise have a strong incentive to influence the signal (i.e. if φ is large). Since there is no

additional information on which to base his decisions, L will set both decisions equal to the prior mean. If the prior is very imprecise (i.e. h is small), this is potentially very costly, but if there is already a wealth of information (i.e. h is large) about the decision to be made, then it might not be very costly to have a closed door policy. This is captured in the following proposition.

Proposition 3 *There exists a function $\Phi(\Delta, \alpha_L, \alpha_R)$ that is increasing in α_L and decreasing in α_R and Δ such that when control is unified, a closed door policy ($\theta = 1$) is preferred to an open door policy ($\theta = 0$) whenever $\varphi h > \Phi(\Delta^2, \alpha_L, \alpha_R)$.*

Proposition 5 in the appendix allows for a more convex set of policies. For example, if φ denotes the signal-to-noise ratio, the players could bargain over a level of "noise" they could put into the signal, which reduces h_ε up to the point where the effective signal-to-noise ratio is given by $(1 - \theta)\varphi$. This can be interpreted as shutting off certain, but not all, lines of communication. The rest of the analysis would proceed similarly.

I assume that the managers are able to commit to these rigid practices. However, if putting these practices in place deters influence activities, the managers would always find it mutually beneficial to eliminate these practices at the last minute—the standard time-inconsistency problem of rigid rules applies here. Organizations have many ways of committing to these types of practices, however—executives may overload their schedules to make themselves scarce, decision makers might physically locate themselves away from those who seek their attention, actual decision making may be carried out by hard-headed, "by the books" types for whom it is no use to try to persuade, or decisions may be made excessively early before useful information arrives.

4.2 Empirical Implications

The logic of influence-activity moderation can help shed light on why certain rigid organizational practices persist. A recent series of papers starting with Bloom and Van Reenen (2007) documents substantial dispersion in management practices across firms, and in particular, highlights the prevalence of firms with puzzling ("bad") management practices. They conduct a survey inquiring about eighteen specific management practices of individual manufacturing plants (e.g. about whether or not the firm adopts continuous-improvement initiatives, the criteria the firm uses for promotions, and so on). Each response is scored on a 1 – 5 scale, with 1 being considered a "bad" management practice and a 5 being considered "good," and a firm's management score is a normalized average of the scores for each individual practice. Firms with higher management scores perform better (have higher sales, higher profitability,

are less likely to exit, and have greater sales growth) than firms with lower management scores.

The negative correlation between "bad" management practices and firm performance is consistent with selection, as the following figure illustrates.

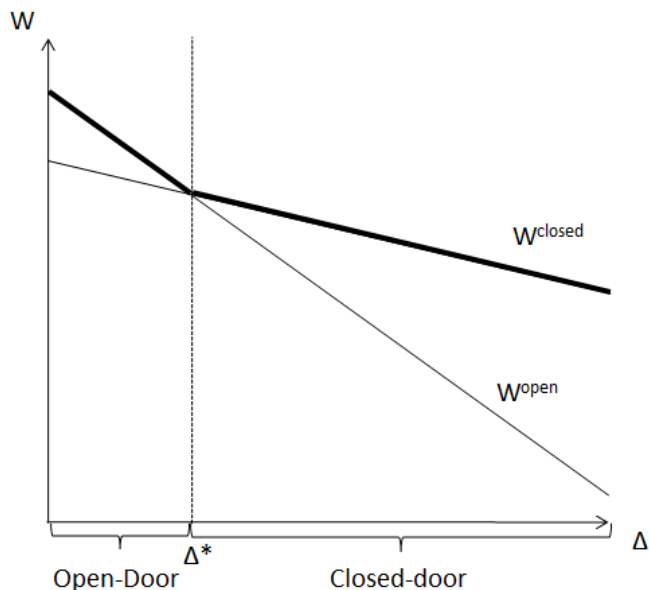


Figure 1: Endogenous Practice Selection

A firm operating in an environment with greater levels of disagreement (i.e. with a higher Δ) will, all else equal, perform worse than a firm with a lower Δ . Further, such a firm will be plagued by greater influence activities (since λ_j is increasing in Δ) and thus will find that adopting a closed-door policy is relatively more appealing. There will be some cutoff value Δ^* such that firms with $\Delta < \Delta^*$ will choose open-door policies and have better performance and firms with $\Delta > \Delta^*$ will choose closed-door policies and have worse performance. Thus, a simple selection story along these lines could account for a negative correlation between closed-door policies ("bad" management practices) and firm performance.

Further, since firms choose their management practices optimally, any outside intervention resulting in a change in management practices would lead to a decrease in firm efficiency. In particular, an intervention aimed at altering management practices for poorly performing firms would lead to a decrease in the performance of such firms. This view is consistent with the "Management as Design" perspective discussed in Bloom, Sadun, and Van Reenen (2013). The argument, of course, assumes that management practices are chosen optimally. To the extent that certain practices are not adopted due to managerial unawareness or mis-

takes, such interventions could potentially improve the performance of firms (see Bloom, et. al., 2012).

5 Practices and Control

Transactions within integrated firms appear to be governed by more bureaucratic rules than transactions across firm boundaries. Indeed, many have proposed such bureaucracy costs of integration as the solution to the question, "Why can't a large firm do everything that a collection of small firms can do and more?" (Williamson, 1985, p. 131) by replicating whatever the small firms would do, except in cases where there is potential for joint improvements. For example, Masten argues that the "[benefits] of internalizing successive transactions is limited by... bureaucratic inefficiencies..." (1984, p. 406). But, if integration is viewed as unified control bundled with inefficient bureaucracy, this naturally begs the question of why can we not unify control without the concomitant inefficient bureaucracy, perhaps through the contractual allocation of control rights?

In section 3, I argued that unifying control does in fact improve ex-post decision making. But unifying control (whether contractually or otherwise) increases the incentives for influence activities. In this section, I will argue that when both the benefits from improving ex-post decision making as well as the increased influence costs from unifying control are large, it may be optimal to supplement unified control with rigid organizational practices. Rigid organizational practices actually *improve* the efficiency of unified control: "inefficient bureaucracy" is not the problem, it is a solution to the underlying problem. The model is similar to the model in the previous section, except now L and R bargain over the control structure in addition to rigid/flexible organizational practices. That is, in the first period, L and R bargain over $(g, \theta) \in G \times \Theta = \{I, NI\} \times \{0, 1\}$. The rest of the analysis proceeds as above.

I begin by introducing some terminology. A choice of g is referred to as a **control structure**, and a choice of θ is referred to as an **organizational practice**. A **governance structure** is the joint choice of a pair (g, θ) , as it forms a complete description of how the transaction is to be governed. Only three governance structures will be chosen in equilibrium: $(I, 0)$, $(I, 1)$, and $(NI, 0)$. I refer to these, respectively, as **directed transaction**, **hierarchy**, and **market**. In a directed transaction, control is unified and there are flexible organizational practices. Markets are characterized by divided control and flexible organizational practices. The defining feature of hierarchy is that decision making is carried out by *fiat*—all relevant decisions are made by a single decision maker (control is unified), and rigid organizational practices are adopted.

Under either control structure, setting $\theta = 1$ eliminates the incentive for (and hence the presence of) influence activities. Given that the costs of influence activities is zero when $\theta = 1$ for both $g = I$ and $g = NI$, it is clear that $g = I$ will be preferred whenever $\theta = 1$. Closed-door policies are thus inconsistent with non-integration. Fixing $\theta = 0$, Proposition 2 implies that there will be some $\hat{\varphi}$ such that non-integration is preferred if and only if $\varphi > \hat{\varphi}$. Let $W(g, \theta)$ denote the expected equilibrium welfare under control structure g and organizational practice θ . It can be shown that

$$W(g, \theta) = - (ADAP(\theta) + ALIGN(g) + INFL(g, \theta)),$$

where the exact expressions for these three components are given in Appendix A. The Coasian program is therefore

$$\max_{(g, \theta) \in G \times \Theta} \{W(g, \theta)\}.$$

It is worth noting that the only term that depends on both the control structure and the organizational practices is $INFL(g, \theta)$. The intuition described above suggests that $INFL(I, \theta) - INFL(NI, \theta)$ is decreasing in θ . Let χ denote a vector of parameters of the model. The complementarity between g and θ gives us the following proposition.

Proposition 4 *Let $\alpha_R < \alpha_L < \sqrt{3}\alpha_R$. Then $W(I, \theta) - W(NI, \theta)$ is increasing in θ . Further, $\min_{\chi} \theta^*(I, \chi) \geq \max_{\chi} \theta^*(NI, \chi)$.*

This implies the empirical proposition that transactions within firms will be more rule-driven and rigid than transactions carried out in the market, which has been discussed by Williamson, "*Interorganizational conflict can be settled by fiat only rarely, if at all... intraorganizational settlements by fiat are common... .*" (1971, emphasis in the original)

The following figure describes the full solution to the model for different regions of the parameter space. There are three boundaries of note. I refer to the vertical boundary between "Directed Transaction" and "Market" as the "Meyer, Milgrom, and Roberts boundary": a firm rife with politics should perhaps disintegrate. This is consistent with recent empirical work by Forbes and Lederman (2009), which argues that the main obstacle to integration between major airlines and regional carriers in the United States is that integration invites the regional carrier's work force to lobby for higher pay, as it is comparatively less well-compensated than the major's. The diagonal boundary between "Directed Transaction" and "Hierarchy," discussed in more detail in section 4, is the "Milgrom and Roberts boundary": rigid decision-making rules should sometimes be adopted within firms. The presence of these two boundaries highlights the idea that non-integration and rigid organizational practices

are substitute mechanisms: sometimes a firm will prefer to control influence activities with the former and sometimes with the latter.

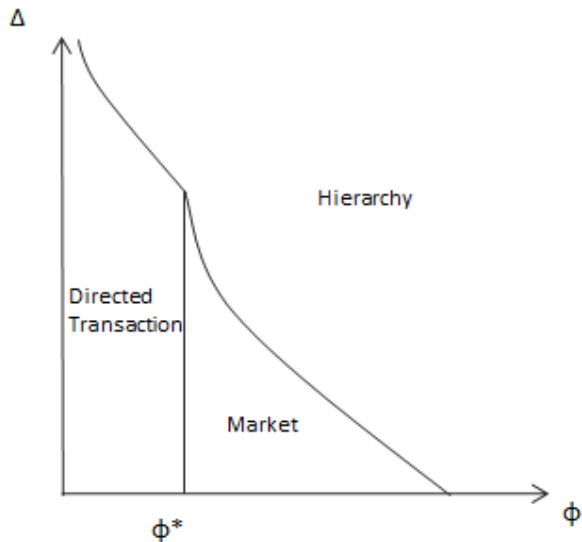


Figure 2: Optimal Governance Structures

Of primary interest is the third boundary, which I refer to as the "Williamson boundary". Sometimes, the market mechanism, with its high-powered incentives and open lines of communication invites such high levels of influence activities ("haggling") that it should be superseded by a hierarchy (unified control) *coupled* with rigid organizational practices. This becomes increasingly true the greater is the level of ex post disagreement between the parties (Δ) and the greater is the level of ex ante uncertainty (as measured by a small value of h or a large value of φ).

These predictions are consistent with the findings of many of the classic empirical papers in support of Transaction Cost Economics (see, for example, Masten (1984), Masten, Meehan, and Snyder (1991), Lieberman (1991), Hanson (1995)), which find positive correlations between a firm's vertical integration decisions and (a) measures of ex-post lock-in and (b) measures of contractual incompleteness. Since lock-in is a necessary component of ex-post disagreement, existing empirical proxies for ex-post lock-in (typically some measure of specificity) also serve as measures of ex-post disagreement. Additionally, these papers use measures of the uncertainty or complexity of the environment a firm operates in as the empirical proxy for the level of contractual incompleteness, which is the actual object of interest in TCE. These particular measures are also reasonable proxies for the scope for ex-post influence activities.

Figure 3 below depicts the relationship between the level of uncertainty surrounding a transaction and the potential "haggling" costs under each of the three potential governance structures. The bold segments depict the actual "haggling" costs under the optimal governance structure. In section 3, I argued that the cost of unified control was an increase in "haggling." Holding organizational practices fixed, this is indeed the case, as shown by the difference between the $Infl(NI, \theta = 0)$ and $Infl(I, \theta = 0)$ lines. However, changing organizational practices in addition to the control structure completely eliminates "haggling," as shown by the difference between the $Infl(NI, \theta = 0)$ and $Infl(I, \theta = 1)$ lines. A firm with $\varphi > \varphi^{**}$ that decides to integrate will adopt rigid organizational practices, opting for unresponsive decision making by "fiat" rather than responsive decision making and "haggling."

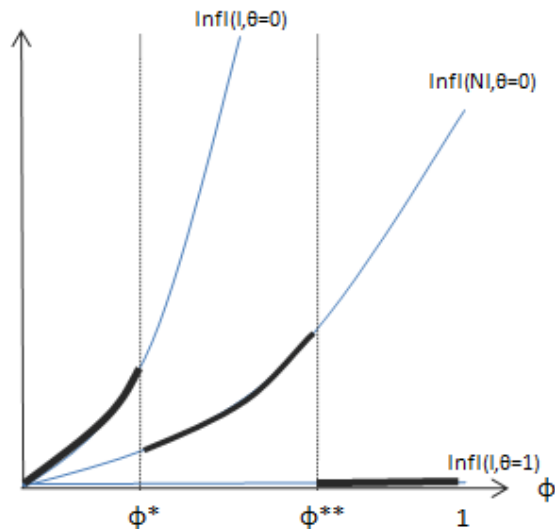


Figure 3: Equilibrium influence costs

Whereas Williamson views "bureaucratic costs of hierarchy... [as] a deterrent to integration," (Tadelis and Williamson (2012, p. 17)) this model views the bureaucratic costs of hierarchy as the lesser of two evils, the alternative to which is high levels of influence activities. By endogenizing the costs of bureaucracy, we obtain a result that is analogous to Williamson's argument that low-powered incentives complement integration, "Incentives... are adapted to the attributes of each organizational alternative. To attempt to 'hold the rules as nearly constant as possible,' on the theory that what works well in one regime ought to apply equally to another, is thus mistaken." (1985, p. 140) Rigid organizational practices, like low-powered incentives, should be chosen in conjunction with firm boundaries with the goal of aligning both to the environment in which the organization operates.

Empirically, this implies that the bureaucratic costs of hierarchy are endogenous and determined by the model's parameters. The most common interpretation of the standard regressions in the empirical TCE literature, in which a dummy for integration are regressed on a measure of specificity and a measure of uncertainty, is that the error term represents an orthogonal, unmeasurable bureaucracy cost. That such costs are unmeasurable and potentially correlated with the theory's two key variables is potentially problematic.

In this model, the costs of bureaucracy associated with integration,

$$ADAP(1) - ADAP(0) = \frac{h_\varepsilon}{h + h_\varepsilon} \frac{\alpha_L + \alpha_R}{h},$$

are independent of the level of disagreement (Δ) but are increasing in the level of uncertainty. Accordingly, in a regression of integration on uncertainty and specificity, the coefficient on uncertainty would be biased downwards (as transactions which have high levels of uncertainty will also have high levels of bureaucracy costs, making such transactions less likely to be integrated than they would be absent bureaucracy costs). If specificity and uncertainty are uncorrelated, then the coefficient on specificity would be unbiased. The inability to measure bureaucracy costs could therefore be partly responsible for David and Han's (2004) and Carter and Hodgson's (2006) observations that the TCE evidence has (a) largely supported the hypothesis that specificity drives integration but has (b) found considerably less support for the hypothesis that uncertainty drives integration.

6 Conclusion

This paper proposes a unification of Williamson's (1971, 1975, 1985) theory of "haggling costs" between firms as the central costs of market exchange with Milgrom and Roberts's (1988, 1990, 1992) view that "influence costs" are the central costs of internal organization. To counterbalance the costs of haggling between firms, Williamson introduced "costs of bureaucracy" within firms; likewise, to counterbalance influence costs within firms, Milgrom and Roberts (1990) introduced "bargaining costs" between firms. Both Williamson and Milgrom and Roberts thus depart from Williamson's observation that "substantially the same factors that are ultimately responsible for market failures also explain failures of internal organization." (1973, p. 316)

In this paper, in contrast, the costs of market exchange and the costs of internal organization have common origins and can be reduced by appropriately chosen governance structures. Organizational practices and firm boundaries are chosen to reduce the amount of time managers waste persuading decision makers within and between organizations. Williamson's

(1971) argument that "Fiat... is frequently a more efficient way to settle minor conflicts" holds here only because fiat (unified control) is coupled with rigid organizational practices ensuring ex-post inefficiency. This resulting bureaucracy is the lesser of two evils, the alternative to which is high levels of influence activities.

At this point in the literature, a proposed theory of the firm cannot stand on its own but must instead connect with existing and prospective empirical literatures. This paper does so in three ways. First, the model broadly coincides with the main empirical predictions and findings of TCE (Shelanski and Klein (2005), Lafontaine and Slade (2007), Macher and Richman (2008)). Second, in endogenizing bureaucracy, it explains how existing empirical findings may have been biased against finding support for the TCE hypothesis that uncertainty drives integration, consistent with the findings of David and Han (2004) and Carter and Hodgson (2006). Finally, the model connects to recent empirical work on topics not usually studied in TCE (e.g., Bloom and Van Reenen (2007)).

This paper explores only a narrow set of instruments available to the firm for moderating influence activities. In addition to choosing rigid organizational practices, a firm might choose to forego potentially profitable opportunities to expand its scope in order to maintain accord among its managers. Organizational focus on a narrow business strategy then arises because breadth is necessarily accompanied by influence activities. Similarly, for a given level of disagreement between managers, a firm may choose not to expand its existing operations, because doing so may raise each managers' stake in each others' decisions and therefore their incentives to engage in influence activities. Staying small may then be another way of moderating influence activities. Influence costs may therefore provide a foundation for decreasing returns to both scale and scope at the organization level.

Analyzing how repeated interaction interacts with influence activities would be an interesting avenue for future research. On the one hand, managers engaged in a long-term relationship can use the shadow of the future to better align current decision making, reducing the incentives for influence activities. On the other hand, such considerations may be insufficient for creating alignment for very important decisions. Further, the commitment power derived from long-term relationships may foster the implementation of rigid rules for such decisions. A situation may then arise in which relatively inconsequential decisions are made efficiently and are not influenced, while more substantial decisions are made via rigid rules.

Finally, in addition to providing a theory of the boundaries of the firm, the logic of influence-cost moderation also provides a theory of control structures within firms. In a related project, using the framework of the recent papers by Alonso, Dessein, and Matouschek (2008) and Rantakari (2008) emphasizing coordination versus local adaptation, I derive a

simple trade-off. Centralizing control with a third-party headquarters facilitates coordination, but it does so at the expense of high levels of influence activities. Decentralization hampers coordination but reduces influence activities. Just as integration and rigid organizational practices are complementary, centralized decision making and rigid organizational practices are also complementary, and both will be adopted when the firm is operating in a more difficult environment. These results are consistent with the Bloom, Sadun, and Van Reenen (2012) empirical findings of positive correlations between decentralization and the quality of management practices and between decentralization and firm performance.

Appendix A: Omitted Proofs and Computations

Proposition 5 *In the full model of section 5, ex ante expected equilibrium welfare as a function of the allocation of decision rights $g \in \{I, NI\}$, the organizational practices $\theta \in [0, 1]$,⁴ and a vector χ of parameters, is given by*

$$W(g, \theta, \chi) = -(ADAP(\theta, \chi) + ALIGN(g, \chi) + INFL(g, \theta, \chi)).$$

Further, these three components can be expressed as

$$\begin{aligned} ADAP(\theta, \chi) &= \frac{\alpha_L + \alpha_R}{h + h_\varepsilon} + \theta \varphi \frac{\alpha_L + \alpha_R}{h} \\ ALIGN(g, \chi) &= \begin{cases} \alpha_R \Delta^2 & g = I \\ \frac{\alpha_L + \alpha_R}{2} \Delta^2 & g = NI \end{cases} \\ INFL(g, \theta, \chi) &= \begin{cases} (1 - \theta)^2 2 (\alpha_R)^2 \Delta^2 \varphi^2 & g = I \\ (1 - \theta)^2 \frac{1}{2} ((\alpha_R)^2 + (\alpha_L)^2) \Delta^2 \varphi^2 & g = NI \end{cases} \end{aligned}$$

Proof. Suppose the managers have agreed upon a control structure g and a level of organizational practices $\theta \in [0, 1]$. The variance of the signal is then given by $\tilde{h}_\varepsilon = (1 - \theta) \frac{h_\varepsilon h}{h + \theta h_\varepsilon}$, which reduces the signal-to-noise ratio in the updating formula to $(1 - \theta) \varphi$. Condition (1) then implies that

$$\lambda_j^* = (1 - \theta) N_{-j} \alpha_j \Delta \varphi,$$

so that $INFL(g, \theta, \chi) = \sum_{j \in \{L, R\}} \frac{1}{2} (\lambda_j^*)^2$, which is equal to the expression given in the statement of the proposition. We know from section 2 that

$$d_\ell^{*g}(\sigma; \lambda^*) = E_s[s | \sigma, \lambda^*] + \beta_i = (1 - \theta) \varphi (s + \tilde{\varepsilon}) + \beta_i,$$

where $\tilde{\varepsilon} \sim N(0, \tilde{h}_\varepsilon)$. Substituting this into the definition of $W(g, \theta, \chi)$ gives us

$$W(g, \theta, \chi) = - \sum_{i \in \{L, R\}} \frac{\alpha_i}{2} E_{s, \varepsilon} \left[(d_\ell^{*g}(\sigma; \lambda^*) - s - \beta_i)^2 \right] - INFL(g, \theta, \chi).$$

The bracketed term can be decomposed into sum of the a variance and a bias term. Since the for decision ℓ is 0 if i controls ℓ under g , the bias term is equal to $ALIGN(g, \chi)$ given above. The variance term is given by

$$\begin{aligned} ADAP(\theta, \chi) &= \sum_{\ell=1}^2 \sum_{i \in \{L, R\}} \frac{\alpha_i}{2} Var(d_\ell^{*g}(\sigma; \lambda^*) - s) \\ &= (\alpha_L + \alpha_R) Var(d_\ell^{*g}(\sigma; \lambda^*) - s) = \frac{\alpha_L + \alpha_R}{h + h_\varepsilon} \left(1 + \theta \frac{h_\varepsilon}{h} \right), \end{aligned}$$

⁴A choice of θ is defined as affecting the noise of the signal such that the signal-to-noise ratio becomes $(1 - \theta) \frac{h_\varepsilon}{h + h_\varepsilon}$.

which is the desired result. ■

Proposition 6 *In this model, when control is unified, a closed door policy ($\theta = 1$) is preferred to an open door policy ($\theta = 0$) whenever $\varphi h > \Phi(\Delta^2, \alpha_L, \alpha_R)$, where $\Phi(\Delta^2, \alpha_L, \alpha_R)$ is increasing in α_L and decreasing in α_R and Δ^2 .*

Proof. Applying proposition 7, $W(I, 1, \chi) > W(I, 0, \chi)$ whenever

$$\varphi h > \frac{1}{2} \frac{(\alpha_L + \alpha_R)}{(\alpha_R)^2 \Delta^2} \equiv \Phi(\Delta^2, \alpha_L, \alpha_R),$$

and Φ clearly satisfies the described comparative statics. ■

Proposition 7 *For a general increasing, convex cost function k , in the pure influence model in which $\alpha_L = \alpha_R = \alpha$, divided control is optimal if k' is log-concave. This condition is satisfied for $k(\lambda) = c\lambda^\xi$ for all $\xi > 1$.*

Proof. Under non-integration, $|k'(\lambda_j)| = |\Delta| \alpha \varphi$ and under integration, $\lambda_L = 0$ and $k'(\lambda_R) = 2|\Delta| \alpha \varphi$. Total influence costs are $2k(k'^{-1}(|\Delta| \alpha \varphi))$ under non-integration and $k(k'^{-1}(2|\Delta| \alpha \varphi))$ under integration. A sufficient condition for the latter to be larger is that the function $k(k'^{-1}(x))$ is convex in x . Let $h(x) = k'^{-1}(x)$. Then

$$\frac{d^2 k(h(x))}{dx^2} = k''(h')^2 + k'h'' = -\frac{d^2 \log k'}{d\lambda^2} \frac{1}{k''} \left(\frac{k'}{k''}\right)^2.$$

Finally, note that $-\frac{d^2 \log k'}{d\lambda^2} = (\xi - 1) \frac{1}{\lambda^2} > 0$ whenever $\xi > 1$. ■

Appendix B: Interim Signaling Version

Suppose there are two decision rights. Consider the game with the following timing:

1. L and R bargain over a control structure $g \in G$;
2. $s_L \in S$ is drawn and observed by L (but not R) and $s_R \in S$ is drawn and observed by R (but not L);
3. L and R simultaneously choose influence activities λ_L, λ_R at costs $\frac{1}{2}\lambda^2$. Public signals $\sigma_i = s_i + \lambda_i$ are publicly observed;
4. Whoever has control chooses decisions d ;
5. Parties receive gross payoffs (letting $s = s_L + s_R$)

$$U_i(s, d) = -\sum_{\ell=1}^2 \frac{\alpha_i}{2} (d_\ell - s - \beta_i)^2.$$

Suppose L has control of N_{-R} decisions, and suppose L conjectures the equilibrium strategy $\lambda_R^*(s_R)$ of R . He chooses each decision d to solve

$$\max_d E_s \left[-\frac{\alpha_L}{2} (d - s - \beta_L)^2 \middle| s_L, \sigma_R \right]$$

or

$$d^*(s_L, \sigma_R) = E[s | s_L, \sigma_R] + \beta_L = s_L + (\sigma_R - E[\lambda_R^*(s_R) | \sigma_R]) + \beta_L.$$

Given this decision rule, R chooses $\lambda_R^*(s_R)$ to solve

$$\max_{\lambda_R} N_{-R} E_s \left[-\frac{\alpha_R}{2} (d^*(s_L, \sigma_R) - s - \beta_R)^2 \middle| s_R \right] - \frac{1}{2} (\lambda_R)^2$$

Taking first-order conditions (and imposing the equilibrium restriction that $\lambda_L^*(s_L) = 0$)

$$\lambda_R^*(s_R) = N_{-R} \alpha_R (\Delta + E[\lambda_R^*(s_R) | \sigma_R] - \lambda_R^*(s_R)).$$

Taking expectations of both sides, $E[\lambda_R^*(s_R) | \sigma_R] = N_{-R} \alpha_R \Delta$, and therefore $\lambda_R^*(s_R) = N_{-R} \alpha_R \Delta$. The incentives to influence the signal are thus the same in this model as in the baseline model with $\varphi = 1$.

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