"Vision and Firm Scope"

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Abstract

The existing literature on firms, based on incomplete contracts and property rights, emphasizes that the ownership of assets--and thereby firm boundaries-- is determined in such a way as to encourage relationship-specific investments by the appropriate parties. It is generally accepted that this approach describes owner-managed firms better than large companies. The purpose of the current paper is to broaden the scope of the property rights literature. A model is developed that emphasizes that (a) firm bosses take non-contractible decisions; (b) these decisions affect the utilities of firm workers, which in turn affects worker wages and hence firm profits; (c) the decisions of bosses will depend on bosses' preferences, and different bosses will typically have different preferences (moreover, their preferences may depend on the scope of the firm they run). The implication of these assumptions is that firm boundaries matter: a merger between two firms will not be neutral since the new boss will not have--and in general cannot have--the same preferences as the two previous bosses. We use the model to study the optimal scope of a firm, and the optimal assignment of different types of bosses to different types of firms and activities. We show that this framework can be used to analyze the optimal delegation of authority inside a firm--the idea is that certain decisions should be put in the hands of someone with different preferences from the boss. We apply our analysis to understand two kinds of non-contractible decisions: the adoption of standards and the decision to specialize.

1. Introduction

In the last ten to fifteen years, a theoretical literature has developed that argues that the

boundaries of firms--and allocation of asset ownership--can be understood in terms of incomplete

contracts and property rights.[1] The basic idea behind the literature is that firm boundaries define

the allocation of residual control rights and, in a world of incomplete contracts, these matter. In

the simplest model, parties write contracts that are ex ante incomplete, but that can be completed

ex post; the ability to exercise residual control rights improves the ex post bargaining position of

an asset owner and thereby increases her incentive, and the incentive of those who enjoy

significant gains from trade with her, to make relationship-specific investments; and as a

consequence it is optimal to assign asset ownership to those who have the most important

relationship-specific investments, or who have indispensable human capital.[2]

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[1]See Grossman and Hart (1986), Hart and Moore (1990), and Hart (1995). This literature builds on the earlier transaction cost literature of Williamson (1975, 1985) and Klein, Crawford and Alchian (1978).

[2]Extensions of the model show that it is sometimes optimal to take assets _away_ from someone to improve their incentives to make relationship-specific investments (e.g., to discourage rent-seeking behavior). On this, see Baker, Gibbons and Murphy (2002), Chiu (1998), de Meza and Lockwood (1998), and Rajan and Zingales (1998). For some recent empirical work supporting the property rights approach, see Baker and Hubbard (2001) and

Woodruff (2001).

Although the property rights approach provides a clear explanation of the costs and benefits of integration, as a number of people have argued, the theory seems to describe owner-managed firms better than large companies.[3] There are several ways to see this. First, according to the theory, the major impact of a change in ownership is on those who gain or lose ownership rights; however, in a merger between two large companies it is often the case that the key decision-makers (the CEOs, for example) do not have substantial ownership rights before or after the merger. Second, the relationship-specific investments analyzed are made by individuals rather than by firms; this again resonates more with the case of small firms than large companies. Third, and perhaps most important, the approach envisions a situation of "autarchy," in which all the relevant parties meet and bargain ex post over the gains from trade, and the only issue is who has the right to walk away with which assets. The model as it stands has no room for "organizational structure," "hierarchy" or "delegation";[4] in an important sense, the model continues to describe a pure market economy, although one enriched by the idea that individuals can be empowered through the ownership of key nonhuman assets.

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[3]For a discussion of this and related points, see Holmstrom and Roberts (1998) and Holmstrom (1999a).

[4]But see Aghion and Tirole (1997), Dessein (2001), and Hart and Moore (2000).

The purpose of the current paper is to broaden the property rights theory, and to allow for the analysis of issues such as delegation. Our approach has several ingredients. First, we view a firm as consisting of workers and assets. Each worker has a utility function whose arguments are money and the firm's activity or action; that is, workers care about the kind of jobs they do--they receive job "satisfaction" and this depends on the firm's action (we refer to job satisfaction as a "private benefit"). For simplicity, we assume that all workers are identical ex ante, but this could easily be relaxed. Second, each firm has a boss (a manager rather than an owner) who determines which activities the firm is engaged in or which actions it undertakes. The boss also cares about the firm's action, as well as the firm's profit. We will suppose a commonality of interest between the boss and workers concerning the choice of firm action; that is, it is as if the boss puts weight on each worker's preferences. An implication of this assumption is that the boss will pursue an agenda that reflects the interests of the firm's workers as well as the shareholders.[5]

There are several reasons why a boss might be biased towards its workforce. On a human level, it is more pleasant for a boss to have a good relationship with her workers. Sustained contact with workers fosters friendship and empathy. Wrestling with the same problems, sharing the same information and having a similar professional background are all conducive to a common vision that aligns interests, particularly on issues such as the strategic direction of the

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[5]Of course, shareholder value maximization will respect worker preferences to the extent that market alternatives force firms to internalize (ex post) the effects their decisions have on their workforce. Here we are talking about decisions whose effects have not been fully internalized.

firm (Shleifer and Summers (1987)).[6] Frequent interactions also give workers the opportunity to articulate their views and influence the minds of their bosses (Milgrom and Roberts, 1988). These tendencies get reinforced through selection: workers stay with firms that pursue agendas they find appealing and firms retain and promote workers that match their vision and objectives.

It is supposed that in each firm some noncontractible actions must be taken, e.g., an adoption of a standard, a shift in the firm's strategic direction, a decision to reallocate financial or human resources, and so on. These are taken by the relevant boss (or someone appointed by the boss). Because the decision is noncontractible and the workers care about what the boss decides, the boss's preferences become an important consideration in designing the organization. A key premise of our analysis is that shareholders can indirectly make a commitment to a (contingent) future course of action by choosing (irrevocably) a boss with a particular set of preferences. An alternative interpretation is that the shareholders, by approving the scope of the firm's activities and its organization, can influence the boss's preferences. We will assume that the boss of a firm with a broad scope will put less weight on worker preferences than a boss with a narrow scope. This is a central assumption. The reasons given above for why bosses care about workers in the

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[6]In fact, Shleifer and Summers (1987) argue that it may be an efficient long-run strategy for a firm to bring up or train prospective bosses to be committed to workers and other stakeholders. On this, see also Blair and Stout (1999).

first place provide an informal rationale for it. With a broader range of activities the firm's workforce will be more heterogenous, making the boss less biased towards any given group. Also, the intensity of contact with different groups will go down, reducing the workers' ability to influence the boss.

To be a bit more formal, we will assume a population of bosses with varying preferences. Some are *professionals* who care less (or not at all) about worker preferences and put correspondingly more emphasis on profits. Others are *enthusiasts* who are biased towards particular lines of business and hence care about the direction of the firm in addition to its profits. Enthusiasts will have an affinity to workers with interests similar to theirs; professionals will not. We view the optimal matching of bosses and firms (or decisions) as an important part of organizational design. In a firm that incorporates several lines of business, enthusiasts will typically be too narrowly focused on their favorite ideas. It will therefore be better to choose a professional to run such businesses. Professionals will choose actions that take into account the total level of profits of the firm without particular biases towards one unit or the other. On the other hand, units may be set up as separate firms to take advantage of enthusiasts. Because the actions of an enthusiast partly reflect the private benefits of like-minded workers, workers will be willing to work for a lower wage in such firms.[7] These considerations lead to a simple trade-off concerning integration. The benefit of integration is that the professional boss of an integrated firm will coordinate better / internalize externalities / and avoid hold-up problems. The cost of

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[7]There is some evidence consistent with this. Schoar (2001), in a study of the effects of corporate diversification on plant level productivity, finds that diversified firms have on average 7% more productive plants but pay their workers on average 8% more than comparable stand alone firms.

integration is that the boss's preferences are distorted in favor of profit: she puts too little weight on worker preferences when she takes noncontractible decisions.

We will present two simple models/examples of these ideas. The first concerns the case where two units may want to coordinate an action such as a common standard. This is a familiar problem in high-tech industries where the choice of a technological platform is of critical importance. We suppose that the standard is noncontractible so there will be no ex post bargaining using side-payments.[8] Under nonintegration a common standard will be adopted only if it is in each firm's interest to do so; both sides can veto adoption and choose a private standard. Workers in both firms are assumed to prefer this option. In contrast, under integration one single decision-maker chooses whether to impose the standard. The basic trade-off is that under nonintegration there will be too little adoption of the standard since a unanimity rule imposes a very high hurdle; while under integration there will be too much adoption since the single decision-maker emphasizes aggregate profit at the expense of the interests of individual units.

The second model is concerned with a seller who supplies several buyers with an input (the set-up is similar to Bolton and Whinston (1993)). The buyers' demands are stochastic, which implies that the seller does not need to have the capacity to supply all of them: some

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[8]One might think that it would be easy to contract on standards, but in practice this is not the case.

savings in capacity are possible. However, saving on capacity requires coordination and specialization: the limited capacity must be dedicated or directed to the buyers with the greatest needs. We compare two organizational forms: one where the supplier is an independent firm ("outsourcing of supply"); and the other where all the buyers and sellers merge into one firm ("complete integration"). We show that in some cases potential savings in capacity can be exploited only under complete integration; the reason is that under other organizational forms the supplier will be unwilling to specialize to any one buyer. We argue that this model captures the idea of "integrating for synergy." Note that in this model bargaining plays an important role since prices have to be negotiated for the input.

Having presented both models, we use the first to analyze the optimal delegation of authority within a firm. There are two decision making units. In each unit there are two types of decisions. For instance, the units might be hotels that could be independent or be integrated into a single chain. One decision could be about the scope and nature of advertising, the other about the choice of food at each establishment. Neither decision is contractible. The units can coordinate on one or both decisions, or they can decide not to coordinate. The right to decide belongs to the boss in charge of the unit in question, unless she delegates the decision to a local boss. There is no issue with reneging: the boss can delegate a decision irrevocably. If the units are not integrated, each has a separate boss, while if they are integrated they have a common boss. There are four possible decisions that can be made (coordinate advertising and food menus, coordinate advertising only, coordinate food only, do not coordinate either). Unit profits and private benefits are general functions of these four alternatives.

There are many organizational forms, but we focus on the leading ones. Our main

objective is to show that delegation may sometimes, but not always, be a preferred compromise between full integration (a single boss who makes all decisions) and nonintegration (two separate bosses). In addition, we provide some basic theorems about the benefits and costs of delegation that suggest that this way of modeling delegation may be both tractable and rich enough to be economically interesting.

Our paper is related to a number of ideas that have appeared elsewhere in the literature. First, there is an overlap with the recent literature on internal capital markets; see particularly Stein (1997, 2001), Scharfstein and Stein (2000), Rajan, Servaes and Zingales (2000), Brusco and Panunzi (2000), and Inderst and Laux (2000). This literature emphasizes the idea that the boss of a conglomerate firm, even if she is an empire builder, is interested in the overall profit of the conglomerate, rather than the profits of any particular division. As a result, the conglomerate boss will do a good job of allocating capital to the most profitable project ("winner-picking"). Our idea that the boss of an integrated firm has balanced preferences is similar to this; the main differences are that the internal capital markets literature does not stress the same cost of integration as we do--the insufficient emphasis on worker private benefits--or allow for the possibility that the allocation of capital can be done through the market (in our models, the market is always an alternative to centralized decision-making), or consider general coordination decisions, such as agreements on standards. Second, the idea that it may be efficient for the firm to have narrow scope and choose a boss that is biased is familiar from the work of Rotemberg and Saloner (1994, 2000) and Van den Steen (2001). These papers emphasize the effect of narrow scope and bias on worker effort rather than on private benefits or wages, but the underlying premise, that workers care about the boss's preferences, is the same. However, none

of these papers analyzes firm boundaries. Third, there are several recent papers that like this one

use the idea that some actions are noncontractible but transferable; see, e.g., Aghion,

Dewatripont and Rey (2002), Hart and Moore (2000), Bolton and Dewatripont (2001), and

Mailath et al. (2002). Finally, there is an emerging incomplete contracting literature on

delegation; see Aghion and Tirole (1997) and Dessein (2001). So far this literature has

emphasized the incentive/informational benefits of delegation, and has had little to say about the

costs of delegation--in terms of reduced coordination--that are a major focus of the current paper.

2. Standards

In this model/example, we consider the case of several firms or units, in the same

industry, say, which may benefit from adopting a common standard or coordinating a decision.

To make matters very simple, suppose that there are just two units and that there are two

dates. At date 0 an organizational form is chosen--specifically whether the units should be

separate firms (nonintegration) or should merge into one firm (integration). At date 1 the

decision whether or not to coordinate is made.

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Organizational   Decision to
form chosen   coordinate?

Figure 1

Assume that the decision to coordinate is made by the boss of each unit, i.e., two separate bosses

make this decision if the units are nonintegrated, and one boss makes it if the units are integrated.

 Also think of coordination as consisting of pressing an "on" button; if both on buttons are

pressed, coordination occurs, i.e., this corresponds to a common standard being adopted, while if

either "off" button is pressed, coordination does not occur (i.e., it is as if both off buttons are

pressed).[9]

Finally, we suppose that coordination (i.e., adopting a standard) is noncontractible at both

dates 0 and 1. This implies that contracts in which one party agrees to coordinate in return for a

side-payment cannot be enforced.

We represent the date 1 payoffs from the different outcomes in the following matrix.

While there may be ex ante uncertainty about payoffs this uncertainty is resolved at date 1 and

there is symmetric information throughout (that is, the payoffs are observable; however, they may

 not be verifiable).

	Unit 1	Unit 2
N (no coordination)	(v_N^1, β_N^1)	(v_N^2, β_N^2)
Y (yes coordination)	(v_Y^1, β_Y^1)	(v_Y^2, β_Y^2)

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[9]In a more general model, the outcome if one button is on and the other is off might differ from the outcome if both buttons are off. This would not significantly change the analysis in the two-unit case.

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Figure 2

Here the first coordinate v refers to profit and the second coordinate β refers to the workers' on the job consumption, i.e., their private benefits (represented in dollars). Superscripts refer to units and subscripts to the decision to coordinate.

We will focus on the case where workers value independence or autonomy as opposed to standardization, and where private benefits are therefore lower under coordination:

(2.1) $\beta_Y^1 \leq \beta_N^1, \beta_Y^2 \leq \beta_N^2.$

Continuing with the example in the introduction, imagine that units 1 and 2 are hotels. Each hotel can have its own distinctive style--decor, service, food, entertainment--or the two hotels can standardize some or all of these things (they become a "chain"). It is plausible that it is more interesting for people to work in a hotel with unique features, which is why worker private benefits are higher in stand-alone hotels.

We come now to the preferences of the bosses. We will suppose that a boss's preferences can be represented by a linear combination of profit and worker private benefits, where the weights depend on whether the units are integrated or not. If unit i is separate, the preferences of its boss (a "narrow" boss) are given by

(2.2) $v^i + \lambda^i \beta^i ,$

while if units 1 and 2 are merged in one firm, the preferences of the single boss (a "broad" boss)
are given by

(2.3) $v^1 + v^2 + \mu^1 \beta^1 + \mu^2 \beta^2.$

The important assumption we will make is that

(2.4) $\mu^i \leq \lambda^i$, $i = 1, 2;$

that is, a broad boss puts less weight on worker private benefits than a narrow boss.

We have mentioned several possible justifications for (2.2) - (2.4) in the introduction: a
narrow boss may have a background in a particular firm and share some of the goals of its
workers; or a boss may care about the workers directly, but be less concerned about any
particular worker when she runs a larger firm and deals with more of them (she has limited total
empathy); or a boss may simply feel as part of her mission that she should maximize a weighted
sum of workers' utilities and profit.

To make the analysis as tight as possible, we focus on the first of these justifications. We
suppose that there is a population of bosses with different preferences, determined by their
backgrounds. Specifically, we assume that there are three types of bosses: a unit 1 "enthusiast," a
unit 2 "enthusiast," and a professional manager. A unit 1 enthusiast is someone with a
background in unit 1 (a particular hotel, say), who therefore has similar preferences to the unit 1
workers; similarly for a unit 2 enthusiast; and a professional manager is someone with no prior

connection to units 1 and 2, who therefore puts less weight on worker private benefits–for simplicity we suppose <u>no</u> weight.

We represent the preferences of a unit i enthusiast as $m + k^i\beta^i$, where m is money and k^i reflects the congruence between the boss's and workers' tastes.

As mentioned in the introduction, the key assumption we will make is that there is no-one in the population who is a unit 1 <u>and</u> unit 2 enthusiast, i.e., whose preferences are represented by $m + k^1\beta^1 + k^2\beta^2$. The idea is that to have these preferences one would have to have a strong background in both unit 1 and unit 2 and this is impossible.

We also suppose that any boss, through her position of power, i.e., her ability to press buttons, can divert a fraction θ of total profit toward herself (or toward perks that benefit her alone--fancy offices, secretaries, pet projects, etc.). Denote profit by Π. Then a unit i enthusiast will maximize $\theta\Pi + k^i\beta^i$, i.e., $\Pi + \lambda^i\beta^i$, where $\lambda^i = k^i/\theta$; and a professional manager will maximize Π.[10]

The assignment of bosses to firms is part of the choice of an optimal organizational form at date 0. For simplicity we will <u>suppose</u> initially that a unit 1 enthusiast is assigned to unit 1 if unit 1 is an independent firm; a unit 2 enthusiast to unit 2 if unit 2 is an independent firm; and a professional manager to units 1 and 2 if they are merged. It follows that a narrow boss will maximize

(2.5) $$v^i + \lambda^i\beta^i,$$

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[10]A boss may also care about total profit Π for career concern reasons; that is, future employers will observe the performance (profit) of activities under her control, and her future wages will be based on this (along the lines of Holmstrom (1999b)).

and a broad boss will maximize

(2.6) $$v^1 + v^2.$$

This assignment is natural since, if a unit 1 enthusiast were assigned to run a merged firm, she would maximize

$$v^1 + v^2 + \lambda^1 \beta^1,$$

which would put too much weight on unit 1's goals relative to unit 2's. However, we will periodically revisit the question of whether the above assignment of bosses is optimal.

Note that (2.5) - (2.6) is a special case of (2.2) - (2.3), where $\mu^1 = \mu^2 = 0$. In fact we will also suppose $\lambda^1 = \lambda^2 = 1$. That is,

(2.7) $$\lambda^i = 1, \mu^i = 0, i = 1, 2.$$

Assumption (2.7) captures in a simple way the costs and benefits of integration: a narrow boss has the "right" preferences for her unit (total profit plus worker private benefits, i.e., total surplus), but does not care at all about the other unit; while a broad boss has "balanced" preferences across units, but does not respect worker private benefits in any one unit.

Another simplifying feature of (2.7) is that it avoids the need to consider (simple) incentive schemes. Clearly there is no role for an incentive scheme, based on unit i profit, in the

case of a narrow boss since she has the "right" preferences. An incentive scheme only makes

things worse in the case of a broad boss since she already cares too much about profit.[11]

At date 0 the parties have a choice about organizational form; they can choose

nonintegration or integration. We think of this as a strategic choice about the set of activities that

the firm is engaged in rather than the assets it owns (of course, the two may be strongly

correlated). This decision cannot be altered at date 1 (more on this below). We assume that the

choice of organizational form is made by the initial owner/owners of units 1 and 2 (under

symmetric information) and that side-payments are possible between them; we also suppose that

their only interest is to maximize the combined date 0 value of the two units (they wish to sell

out and retire). Everyone is risk neutral and, for simplicity, the discount rate is zero. It follows

that an optimal organizational form is one that maximizes total expected profit net of wages.

Concerning wages, we suppose that there is a competitive market for (identical, risk

neutral) workers at date 0 with a reservation utility level of   , i.e., in equilibrium the wage plus

a worker's expected private benefit equals   . It follows that maximizing expected profit net of

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[11]It might be desirable to reward unit i's boss according to unit j's profits in order to
encourage coordination. Note, however, that this will not "solve" the coordination problem
unless unit j's workers' private benefits can also be made part of this incentive scheme (which is
impossible if these benefits are not verifiable).

wages is equivalent to maximizing expected profit plus worker private benefits, i.e., expected

surplus.[12] The conclusion is that the parties will choose an organizational form at date 0 that

maximizes total expected net surplus (subject to the equilibrium behavior of the bosses).

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[12]We assume that the private benefit and remuneration of bosses are so small that they can be ignored in the total surplus calculation.

An immediate implication of (2.7) is that wages will be lower in independent firms, because independent firms are run by enthusiasts who look out for workers' private benefits. Professional bosses, running the integrated firms, would also like to convince workers ex ante that they will take actions ex post that are in the workers' interest. Unfortunately, such promises will not be believed; there is no way for a boss to make a contractual commitment, because we have assumed that ex post actions are noncontractible.[13]

Let us now return to the coordination decision (see Figure 2). Consider first

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[13]Note that we have emphasized a particular cost of integration resulting from the fact that a professional boss puts too little weight on worker preferences: the cost of integration is an increase in wages. However, other related costs may also be important: (1) valuable workers may quit because they don't like the work environment under a professional boss; (2) workers may become less motivated, and less willing to make relationship-specific investments, because a professional boss is less likely to reward such motivation or investments (on this, see Shleifer and Summers (1987), and Blair and Stout (1999)).

In an extension of the model, one can imagine indirect instruments for making ex ante commitments to respect worker preferences. For instance, a firm might invest in equipment that is complementary to its workers' skills or train workers internally in particular ways that make it more costly to choose decisions workers dislike. The role of job design for these purposes has been emphasized by Rajan and Zingales (1998).

nonintegration. Under nonintegration each boss has a veto since she can press the off button.

Thus coordination will occur if and only if both bosses are better off (a unanimity rule). (Recall

that there is no role for side-payments given that coordination is noncontractible.) Since each

narrow boss is concerned with profit plus private benefits, it follows that coordination will occur

under nonintegration if and only if

(2.8) $v_Y^i + \beta_Y^i \geq v_N^i + \beta_N^i$, i = 1, 2. [14]

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[14]Even if (2.8) holds, there is a (Nash) equilibrium where each boss presses the off button
and coordination does not occur. This equilibrium is dominated and so we ignore it.

Consider next integration. Now there is a single boss who makes the coordination decision (she presses both buttons).[15] However, the boss has the wrong preferences: she maximizes total profit rather than total surplus. It follows that coordination will occur under integration if and only if

(2.9) $v_Y^1 + v_Y^2 \geq v_N^1 + v_N^2$.

Finally, in the first-best, coordination will occur if and only if total surplus rises, i.e.,

(2.10) $v_Y^1 + \beta_Y^1 + v_Y^2 + \beta_Y^2 \geq v_N^1 + \beta_N^1 + v_N^2 + \beta_N^2$.

The basic trade-off between nonintegration and integration is now clear. Inequality (2.8) implies (2.10), but not conversely; and (2.10) implies (2.9) (given (2.1)), but not conversely. In other words, nonintegration implies too little coordination (coordination never occurs when it shouldn't, but sometimes doesn't occur when it should), while integration implies too much (coordination always occurs when it should, but sometimes occurs when it shouldn't).

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[15]Another interpretation is that the boss chooses a trusted subordinate (with the same tastes as hers) to press a button on her behalf.

In the case of perfect certainty about the payoffs, it is easy to see which organizational form is better. If (2.10) holds, then integration is optimal since coordination is efficient and integration errs on the side of too much coordination, but never too little. If (2.10) does not hold, then nonintegration is optimal since coordination is inefficient and nonintegration errs on the side of too little coordination, but never too much.

If there is uncertainty, the analysis gets substantially more complicated. But the equations above still convey some simple messages. An important one is that a more uneven distribution of profits across the units, keeping all else equal (the sum of profits and the sum of private benefits), tends to make integration more attractive. We formalize this in the following proposition.

<u>Proposition 1</u>. Let $Dv_i \equiv v_Y^i - v_N^i$, $D\beta_i \equiv \beta_Y^i - \beta_N^i$, $i = 1,2$. Consider a change in payoffs in some state of the world from $(v_N^1, \beta_N^1, v_N^2, \beta_N^2, v_Y^1, \beta_Y^1, v_Y^2, \beta_Y^2)$ to $(v'_N^1, \beta'_N^1, v'_N^2, \beta'_N^2, v'_Y^1, \beta'_Y^1, v'_Y^2, \beta'_Y^2)$ such that

(a) $Dv_1 + Dv_2 = Dv'_1 + Dv'_2$

(b) $D\beta_1 + D\beta_2 = D\beta'_1 + D\beta'_2$.

Assume further that

(c) if $(Dv_1 + D\beta_1) - (Dv_2 + D\beta_2) \geq 0$, then

   $(Dv'_1 + D\beta'_1) - (Dv'_2 + D\beta'_2) \geq (Dv_1 + D\beta_1) - (Dv_2 + D\beta_2)$, and

(d) if $(Dv_1 + D\beta_1) - (Dv_2 + D\beta_2) \leq 0$, then

   $(Dv'_1 + D\beta'_1) - (Dv'_2 + D\beta'_2) \leq (Dv_1 + D\beta_1) - (Dv_2 + D\beta_2)$.

Then the expected surplus from non-integration (NI) becomes (weakly) lower, while the expected

surplus from integration (I) as well as the first-best expected surplus stay the same.

Proof: Given (a) and (b), the decisions to coordinate as well as the expected payoffs are unaltered both in first-best and under integration (I). So the issue is only what happens under non-integration.

Assume case (c) applies, that is, $(Dv_1 + D\beta_1) - (Dv_2 + D\beta_2) \geq 0$. Together with (a) and (b), assumption (c) implies

(2.11) $(Dv'_1 + D\beta'_1) \geq (Dv_1 + D\beta_1)$ and

$(Dv'_2 + D\beta'_2) \leq (Dv_2 + D\beta_2)$.

Suppose $(Dv_1 + D\beta_1) \geq (Dv_2 + D\beta_2) > 0$. Then coordination is first-best both for the original and the new payoffs (because of (a) and (b)). Under non-integration, coordination will occur with the original payoffs, but not necessarily with the new payoffs (because of (2.11)). If $(Dv_1 + D\beta_1) \geq 0 > (Dv_2 + D\beta_2)$ or if $0 > (Dv_1 + D\beta_1) \geq (Dv_2 + D\beta_2)$, there will be no coordination under non-integration either with the old or the new payoffs. Since there is always too little coordination under non-integration, we conclude that payoff changes that satisfy (a)-(c) will result in a (weakly) worse decision rule under non-integration. By symmetry, the same is true for payoff changes that satisfy (a), (b) and (d). Q.E.D.

Assumptions (a) and (b) ensure that nothing changes under integration or first-best. Assumptions (c) and (d) describe the sense in which the interests of the two units should grow

further apart in order to make non-integration worse. Proposition 1 is stated in terms of a change

in a single state of the world, but it applies of course equally when there are changes in several

states of the world, all satisfying conditions (a)-(d).

As an example of poor alignment, consider the case of technology standards. There the

deeper the individual firms become entrenched in their own idiosyncratic technologies, the

harder it gets to reach a common standard. If such problems can be seen in advance, it may be

strategically wise not to specialize too much, but rather take a more diversified approach to the

development of technology. Note that our analysis says nothing about the value of ex post

integration as a way of making it easier to adopt a common technological platform. In reality,

such moves tend to be difficult, because merging two firms with different technological legacies

(and cultures) faces much the same objections as agreeing on a common standard: workers will

not like it.

A second simple, but important, message from the basic formulation is that when workers

suffer more from coordination, keeping the total surpluses unchanged, this will make integration

relatively less attractive.

<u>Proposition 2.</u>. Let $Dv_i \equiv v_Y^i - v_N^i$, $D\beta_i \equiv \beta_Y^i - \beta_N^i$, $i = 1,2$. Consider a change in payoffs in some

state of the world from $(v_N^1, \beta_N^1, v_N^2, \beta_N^2, v_Y^1, \beta_Y^1, v_Y^2, \beta_Y^2)$ to $(v'_N^1, \beta'_N^1, v'_N^2, \beta'_N^2, v'_Y^1, \beta'_Y^1,$

$v'_Y^2, \beta'_Y^2)$ such that for $i = 1,2$

(a) $Dv_i + D\beta_i = Dv'_i + D\beta'_i$,

(b) $D\beta_i \geq D\beta'_i$.

Then the value of integration is (weakly) lower with the new payoffs, while the value of non-

integration as well as total social surplus is unchanged.

Proof. Given (a), condition (b) is equivalent to $Dv'_i \geq Dv_i$. Therefore, under integration, the new payoffs may cause a switch from no coordination (N) to coordination (Y), but never the other way around. Since there is already too much coordination under integration, this reduces the expected surplus from integration. Because of (a), nothing changes under non-integration or under first-best.   Q.E.D.

One implication of Proposition 2 is that if private benefits from no coordination are sufficiently large, it pays to set up independent firms. A new venture would be a good example. A new firm, in which an overly enthusiastic entrepreneur is paired up with equally enthusiastic workers who share the entrepreneur's vision, can often be run at a much lower financial cost as a free-standing unit than within a larger firm. As a free-standing unit the entrepreneur and the workers can be paid in "dreams" – the expectation of a success in the future – while in a larger firm their projects may be terminated by bosses that do not share the same vision, because there are many other activities and interests to consider.

We have assumed dichotomous decisions: either actions are coordinated or they are not. In the certainty case (as well as in some simple uncertainty settings) one can extend the range of this simple model by interpreting the payoffs as resulting from a sub-optimization. For instance, the payoffs under coordination can be assumed to stem from the optimal choice of a variety of endogenous variables (workers, technology, etc) such that the highest total surplus is achieved

subject to coordination being accepted by all parties.[16] One could interpret the payoffs from not

coordinating on a standard in a similar way and then proceed to compare which of the two forms

of organization are better. The point of interpreting the model in this manner is that when non-

integration ends up being optimal, the endogenous variables will be chosen to take advantage of

enthusiasm and single-mindedness (as illustrated by the discussion above), while when

integration is optimal they will be chosen to take advantage of coordination.[17]

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[16]By doing this, we may be stretching the ex ante bargaining assumption beyond the plausible.

[17]To analyze these issues in more detail, one can explicitly introduce a more general decision framework as follows. Each firm i controls a decision $x_i \in X_i$. Profits and private benefits depend on the full vector of decisions $x = (x_1, x_2, ..., x_n)$. Bosses have preferences $v_i(x) + \lambda_i \beta_i(x)$, where $v_i(x)$ represents firm i's profits (the sum of profits from the basic production units under the control of firm i) and $\beta_i(x)$ is a weighted average of the private benefits of workers working in firm i. This kind of formulation would also be helpful in studying how technological platforms emerge. In reality, firms end up making compromises by choosing a standard that is not ideal from a surplus maximizing point of view, but is chosen because it is acceptable to everyone (or a sufficient majority). Compromises allow parties to redistribute surplus in a credible or acceptable manner. Monetary transfers are problematic if standards are hard to enforce other than by self-interest (as we have assumed). Money can also invite rent-seeking

There are several other ways in which this simple model can be extended. One is to allow for different kinds of coordination decisions, and to study the desirability of delegating some decisions to specialized (narrow) bosses while allowing a general (broad) boss to take others. We will study the delegation issue in Section 4.

Another extension is to stick to a single coordination/standardization decision, but suppose that n units must make the decision rather than just two. Although we will not carry out the analysis here, one general result is immediate. The more units there are, the harder it becomes to agree on a common standard. Every new unit adds a potential veto and unless the gains from coordination are distributed in just the right way, it becomes increasingly unlikely that everyone will be a winner. This assumes that everyone has to agree on a standard. In most cases that is not realistic. Often a few different technological platforms develop with each firm joining one of them. Of course, once a firm no longer has veto power, it is quite possible that it will choose to adopt a standard even though it may be worse off than if no common standard had been agreed on (in fact, it is conceivable that *all* firms are made worse off by the adoption of the standard).

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behavior (something we have not assumed).

Finally, it would be important to study what happens when the form of organization (and its boss) can be changed ex post. Firms may merge if they find it difficult to coordinate decisions, for instance. Or they may merge precisely because both firms decide to go in the same direction in a given set of circumstances. It is clear that sufficiently big changes in the environment will call for an industrial restructuring of some kind. How much commitment can be, and should be, built in at an ex ante stage is one of the key issues in the debate on corporate governance.[18] It appears that our approach may be well suited also for this kind of extension.

3. Synergies

In the previous section we analyzed a model in which production units may want to pick a common standard. In that model there was no role for bargaining since the standard was noncontractible. We now show that similar ideas concerning the relationship between a firm's scope and a boss's preferences can be used to understand the trade-off between supplying a specialized and possibly scarce input internally (insourcing) and doing so through the market (outsourcing). Our analysis will throw light on the idea that firms may sometimes merge

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[18]For instance, Shleifer and Summers (1988) argue that takeover legislation may have been too permissive in the 1980s, because it led to a breached implicit contracts with workers.

horizontally to exploit synergies. In the model of this section bargaining plays a significant role since under nonintegration (outsourcing) the input must be paid for.

The set-up is similar to Bolton and Whinston (1993). We will consider a small number of buyers who are perfect competitors in their respective output markets (they may or may not operate in the same output market). These buyers can be supplied input by a small number of sellers. These sellers may be independent firms or divisions of the buyers.

The economy lasts for three dates, $t = 0,1,2$. We start with the simplest case of one buyer and one seller, B and S. B requires one unit of specialized input, one widget, say, at date 2. S has one unit of capacity, costing k, which can be used to supply one widget at date 2 (S's variable costs are zero). This widget can be supplied either to B or to the outside market, which is assumed to be competitive; the competitive market price is R.

S must make a choice at date 1. To supply B at date 2, S must specialize to B; but then S can't supply the outside market at date 2. Alternatively, S can choose to "remain flexible" and supply the outside market at date 2; but then S cannot supply B.

The value to B of a (specialized) widget is v; in addition B's workers receive a private benefit β if the widget is supplied. (We ignore any private benefits of S's workers.) The variables v, β, R are uncertain as of date 0, but the uncertainty is resolved at date 1; moreover, these variables are observable to B and S (but are not verifiable). The time line is as follows:
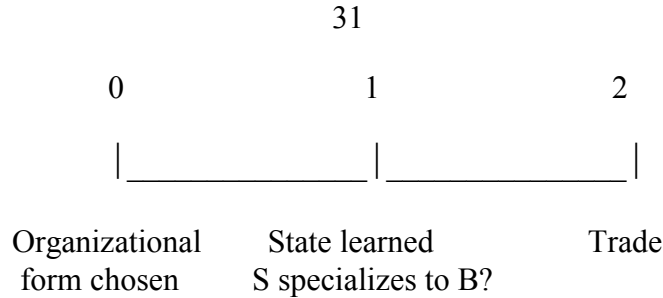
```
        0                    1                    2
        |_____|_____|

    Organizational      State learned         Trade
    form chosen        S specializes to B?
```

Figure 3

It is worth giving some motivation for the private benefit β. One can imagine that B is a publisher of academic books and that S provides specialized printing/marketing/PR or legal services to B. With these services, B's books will be of higher quality and more successful; this makes B's workers happy.

In this model, the key decision is whether to specialize at date 1. As in Section 2, we assume that this decision is made by S's boss. We also suppose that no long-term contracts can be written at dates 0 or 1 about the date 2 widget price; but short-term contracts at date 2 are possible. Also, no contract can ever be written about the date 1 specialization decision (since this is ex post noncontractible).

As in Section 2, we suppose that there are two types of boss. There is an enthusiastic boss (someone who has spent her career working in B), who maximizes profit plus private benefits β. And there is a professional boss, who maximizes solely profit. Which kind of boss any particular firm has is a choice variable for the initial owner at date 0.

We will begin by making an analogous assumption to that of Section 2. We will assume that an independent buyer B is always assigned an enthusiastic boss, as is a vertically integrated buyer-seller pair, B-S. (This means that the boss of these firms has the correct social objective.)

In contrast we will suppose that the boss of an independent seller is a professional. (This is not unreasonable since S's workers do not receive any private benefits.) Later on we will check that these assignments are optimal.

Assume first that B and S are nonintegrated. Suppose S specializes to B at date 1. Then at date 2 S and B will bargain about the price of the input. Assume that they divide the gains from trade 50 : 50. Since B's boss values the widget at $v + \beta$ and S's (variable) costs are zero, this means that S will receive $\frac{1}{2}(v + \beta)$. (Recall that the uncertainty is resolved at date 1, so S knows this value at date 1.) In contrast, if S does not specialize at date 1 and sells on the open market, S will receive R. It follows that S will specialize to B if and only if

$$(3.1) \qquad\qquad \frac{1}{2}(v + \beta) > R.$$

(In other words, we have a classic holdup problem.)

Now suppose B and S are integrated. Then the date 1 specialization decision is made by the boss of the integrated firm, who maximizes total profit plus worker private benefits. So specialization will occur at date 1 if and only

$$(3.2) \qquad\qquad v + \beta > R.$$

Of course, this is also the first-best rule.

We can conclude that in the simple case where there is only one buyer and one seller integration is superior to nonintegration.

Let us consider next what happens if we have two buyers: call them B1, B2. Suppose that B1 and B2 have the same β ($\beta_1 = \beta_2 = \beta$), and independent and identically distributed v's. Moreover, assume that at date 1 a supplier can specialize to only one B at a time, i.e., the choice is now to specialize to B1, B2, or to remain flexible.

There are now two types of "enthusiastic" boss: a B1 enthusiast and a B2 enthusiast. We will continue to suppose that a single buyer B or a single vertically integrated buyer-seller pair, B-S, is assigned an "enthusiastic" boss; while any other firm (e.g., consisting of two buyers, or just a seller) is assigned a professional boss. (Recall that there is no boss who is an enthusiast for B1 and B2.)

When there are two buyers the key question is whether there should be two units of capacity in the upstream market or just one (in which case supply is obviously available ex post to only one buyer). We already know that conditional on two units of capacity being available the first-best can be achieved by having B1, B2 each vertically integrate with a supplier. This is illustrated in Figure 4(i). On the other hand, if there is only one unit of capacity, then there are two leading organizational forms, also illustrated in Figure 4.

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Figure 4 here
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In (ii), B1, B2 and a single S all merge. In (iii), B1, B2 and a single S all stay separate.[19]

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[19]There are two other cases. First, B1 and B2 may merge horizontally, with S staying

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independent. Second, B1 and S may merge vertically with B2 staying independent. It can be shown that, given our assumptions, both of these are dominated.

To understand the trade-offs between (i) - (iii), it is useful to work with the following example. Suppose β and R are constants, while v can take on two values: $v = v_H$ with probability π and v_L with probability $(1 - \pi)$. Assume also that $v_L + \beta > R$, so that it is always efficient to supply B1, B2 rather than the outside market. Then, with two units of capacity, first-best (expected) surplus is

$$(3.3) \qquad W^{**} = 2\{\pi(v_H + \beta) + (1 - \pi)(v_L + \beta) - k\}$$

since each buyer will always receive a widget (whose value may be v_L or v_H). On the other hand, with one unit of capacity, first-best (expected) surplus is

$$(3.4) \qquad W^* = (2\pi - \pi^2)(v_H + \beta) + (1 - \pi)^2 (v_L + \beta) - k,$$

since the single widget will be supplied to the buyer with value v_H if there is one, and the probability that at least one B has $v = v_H$ is $1 - (1 - \pi)^2 = 2\pi - \pi^2$.

The first thing to notice is that

$$(3.5) \quad W^{**} - W^* = 2\{\pi(v_H + \beta) + (1 - \pi)(v_L + \beta)\} - \{(2\pi - \pi^2)(v_H + \beta) + (1 - \pi)^2 (v_L + \beta)\} - k$$

$$< (2\pi - \pi^2)(v_H + \beta) + (1 - \pi)^2 (v_L + \beta) - k = W^*,$$

i.e., there are diminishing returns to capacity. The right-hand side (RHS) represents the marginal net gain from the first unit of capital and the left-hand side (LHS) the marginal net gain from the

second unit. The reason for the diminishing returns is that with one unit of capital winner-

picking is possible (cf. Stein (1997)): the scarce input can be directed to where it is most needed;

moreover, it is unlikely that B1 and B2 both have strong needs at the same time. It follows that,

if $W^{**} - W^* > 0$, two units of capital are efficient, and the first-best can be achieved through

symmetric vertical integration. On the other hand, if $W^* > 0$, $W^{**} - W^* < 0$, then it is first-best

optimal to have one unit of capital. In this case it turns out that, depending on the parameters,

any one of (i) - (iii) can be second-best optimal; or it may be second-best optimal to close down,

i.e., have no units of capital. ((i) can be optimal since it may be better to achieve the first-best

level of surplus with two units of capital than the second-best level of surplus with one unit.)

Finally, if $W^* > 0$, then it is first- and second-best optimal to close down.

The situation is illustrated in Figure 5, where $a \equiv 2\{\pi (v_H + \beta) + (1 - \pi) (v_L + \beta)\}$ -

$\{(2\pi - \pi^2) (v_H + \beta) + (1 - \pi)^2 (v_L + \beta)\}$, $b \equiv (2\pi - \pi^2) (v_H + \beta) + (1 - \pi)^2 (v_L + \beta)$.
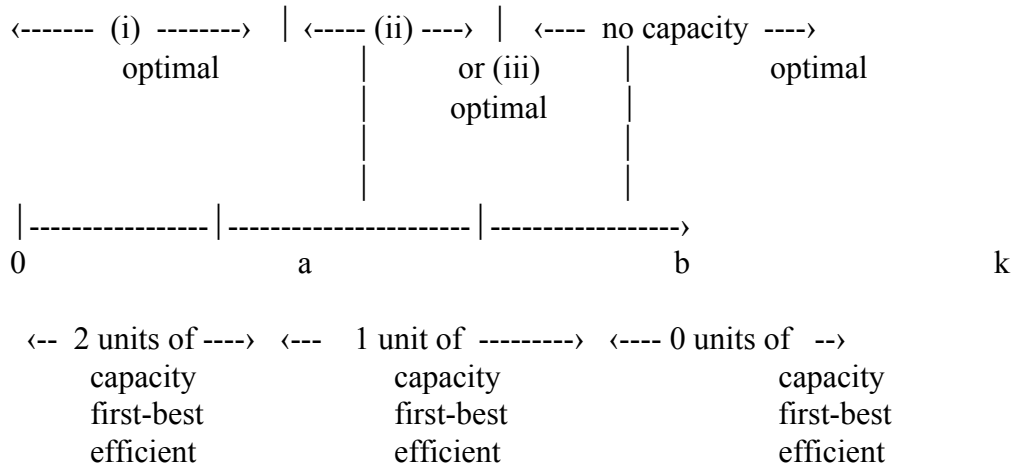

```
    ‹------- (i) --------›  | ‹----- (ii) ----› |  ‹---- no capacity ----›
          optimal          |      or (iii)     |           optimal
                           |      optimal       |
                           |                    |
                           |                    |
                           |                    |
    |----------------|----------------------|-----------------›
    0                a                      b                      k

      ‹-- 2 units of ----›  ‹---   1 unit of ---------›  ‹---- 0 units of  --›
            capacity                  capacity                   capacity
            first-best                first-best                 first-best
            efficient                 efficient                  efficient
```

Figure 5

We now provide some examples.

Example 1: $v_H = 12$, $v_L = 8$, $\pi = \frac{1}{2}$, $\beta = 4$, $R = 10$

It can be checked that a = 13, and b = 15. Hence in the first-best two units of capital are optimal if k < 13, one if 13 < k < 15, and none if k > 15.

Denote the second-best surplus under the three organizational forms by W_1, W_2, W_3, respectively.

Form (i)

Recall that (i) achieves the first-best with two units of capital. Hence

$$W_1 = W** = 28 - 2k.$$

Form (ii)

The only thing to notice here is that, since the boss is a professional, she maximizes profit, ignoring β. Hence she supplies the widget to the outside market when B1 and B2 both have v = 8 (since 8 < R). Thus compared to W^* the formula for W_2 has 10 in it instead of 12, i.e.,

$$W_2 = \frac{3}{4} \, 16 + 1/4 \, 10 - k = 14 \, \frac{1}{2} - k.$$

Form (iii)

Under nonintegration, S never specializes to either buyer since $\frac{1}{2}(v_H + \beta) < 10$, i.e., S always

supplies the open market. Hence

$$W_3 = 10 - k.$$

We see that in this example (iii) is dominated by (ii), and so the choice is between (i) and (ii). Form (i) is optimal if $k < 13 \frac{1}{2}$, form (ii) is optimal if $13 \frac{1}{2} < k < 14 \frac{1}{2}$, and zero capacity is optimal if $k > 14 \frac{1}{2}$.

Example 1 also illustrates the idea that it may pay two buyers to merge with each other and their supplier (complete integration) to exploit a synergy. Here the synergy is the cost saving from having one unit of capital rather than two. When $13 \frac{1}{2} < k < 14 \frac{1}{2}$, it is optimal to have one unit of capital, and allocate the scarce input to whichever of the B's has a high value of v. This is possible under complete integration, but not under outsourcing, given the parameter values in Example 1.

Of course, complete integration is not always a good idea--in fact in the above example it is not first-best efficient, conditional on one unit of capital, since the boss supplies the outside market when both v's are low. Given this, it is not surprising that sometimes form (iii) can be superior to complete integration.

Example 2: $v_H = 9, v_L = 4, \pi = \frac{1}{2}, \beta = 7, R = 5$

Now, conditional on unit of capital being used, outsourcing (form (iii)) is superior to (ii). The reason is that since $\frac{1}{2} (v_L + \beta) > R$, an independent supplier will be prepared to specialize to either buyer, and will obviously prefer to specialize to the buyer with the higher v, i.e., (iii)

achieves efficiency. In contrast, complete integration is inefficient because the boss will direct input to the outside market when both buyers have low v's (since $v_L < R$).

To summarize, we have shown that each of the forms (i) - (iii) can be optimal in some circumstances. We still have one important matter to check: we have made particular assumptions about the assignment of "enthusiastic" and "professional" bosses to different types of firms. What happens if we endogenize this? The answer is that in the examples we have analyzed nothing significant changes. For instance, in Example 1, it is easy to see that it is suboptimal to make the boss of B1 - B2 - S an enthusiast. The reason is the following: if the boss respects the private benefits of B1 workers but not B2 workers, then when B1 has a low v and B2 a high v, the boss will direct input to B1 rather than B2, which is inefficient. (Actually she is indifferent since $v_L + \beta = v_H$, but if v_L is slightly above 8, the indifference is broken.) The fact that when B1 and B2 both have low v's, the boss will direct input efficiently to B1 rather than inefficiently to the open market does not offset this. Specifically, with an enthusiastic boss, surplus under complete integration equals

$$W_2' = \tfrac{1}{2}\,16 + \tfrac{1}{2}\,12 - k = 14 - k < W_2.$$

In example 2, outsourcing continues to dominate complete integration but now the argument is slightly different when B1 - B2 - S's boss is an enthusiast. The problem is no longer that the boss will direct input to the outside market when both buyers have low v's; rather it is that an enthusiastic boss will direct input to B1 when B1 has a low v and B2 has a high v (since $v_L + \beta > v_H$).

To conclude this section, note that we have explored a particular kind of synergy that arises from the fact that it is unlikely that two (or more) buyers have high valuations for input at the same time. It would be easy to consider other synergies. For example, suppose that B1 and B2 ideally want different types of input. It could be that a single supplier can supply two units of input by incurring a fixed cost K, where K < 2k. However, the units will then have to be homogeneous (i.e., have the same quality). The alternative is for two suppliers to set up at cost k each, and supply heterogeneous input. Assume that it is efficient to save on capital costs and put up with homogeneity (where the characteristics of the homogeneous input are chosen optimally to be intermediate between what B1 and B2 would individually want). Then to achieve this it may be necessary for B1, B2 and S to merge, since an independent S might not be willing to compromise appropriately on the characteristics of the homogenous input.

We leave the analysis of this situation to another paper.

4. Delegation

In this section we explore the issue of the delegation of authority inside a firm, using the "standards" or "coordination" model of Section 2.

The simplest way to capture delegation is to allow for two coordination decisions A and B in each of the two units (each decision might be associated with a different standard). That is, each unit has an A button and a B button, and coordination of the A decision requires that both A buttons are "on," while coordination of the B decision requires that both B buttons are "on." Thus there are now four possible outcomes, (YA, YB), (YA, NB), (NA, YB), (NA, NB), where (YA, YB) means that A and B are both coordinated, (YA, NB) means that A is coordinated and

B is not, etc. (As in Section 2, Y stands for yes and N for no.)

We suppose that organizational form is chosen at date 0 and coordination decisions are made at date 1. The date 1 payoff matrix is now as follows.

	Unit 1	Unit 2
(NA, NB)	(v^1, β^1)	(v^2, β^2)
(YA, NB)	(v_A^1, β_A^1)	(v_A^2, β_A^2)
(NA, YB)	(v_B^1, β_B^1)	(v_B^2, β_B^2)
(YA, YB)	(v_{AB}^1, β_{AB}^1)	(v_{AB}^2, β_{AB}^2)

Figure 6

As before, the first component v represents profit, and the second component β represents private benefits. However, we have simplified the notation a bit. We have left off the N, Y subscripts and put in a subscript if and only if that particular decision is coordinated. (So v_{AB}^1 represents unit 1 profit if the A and B decisions are both coordinated.)

The payoff matrix in Figure 6 is quite general. For example, imposing a standard can increase or decrease profit, and the standards A and B can be complements or substitutes. However, one assumption we will continue to make is that coordination reduces private benefits:

(4.1) $\qquad \beta_{AB}^i \leq \text{Min} (\beta_A^i, \beta_B^i) \leq \text{Max} (\beta_A^i, \beta_B^i) \leq \beta^i$ for i = 1, 2.

In section 2, there was one coordination decision (or standard) and the question was whether this should be made by one boss (integration) or two (nonintegration). Now there are two coordination decisions and each one can be made by one boss or two. This means that there are four (leading) organizational forms, as illustrated in Figure 7. (In Figure 7, rows represent decisions and columns units.)

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Figure 7 here
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In (i), unit 1 has one boss, who presses one pair of A and B buttons (the left pair, say), and unit 2 has another boss, who presses the other pair of buttons (the right pair, say). In (ii) the A decision is in the hands of one boss at headquarters, that is, one boss presses both A buttons; while the B decision is in the hands of two local bosses, that is, each B button is pressed by a different boss. In (iii) the roles of A and B are reversed. Finally, in (iv), both decisions are in the hands of a single boss at headquarters, that is, one boss presses all four buttons.[20]

It may be useful to have an example in mind. One can imagine, as in Section 2, that each unit is a hotel, and the hotel has to make marketing decisions (A) and food decisions (B). In each case some sort of standard might be desirable. If the two hotels are separate both decisions are

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[20]We have ignored some organizational forms; for instance, decision A could be controlled by headquarters, who would also make decision B in unit 1; while a local boss would make decision B in unit 2. Or there could be complete decentralization where each individual decision is controlled by a local boss.

made locally. In a decentralized hotel one decision is made at headquarters and the other by local (hotel) bosses. Finally, in a centralized hotel, marketing and food decisions are both made at headquarters.

We continue to assume that there are three kinds of bosses: unit 1 "enthusiasts," unit 2 "enthusiasts," and "professionals." We also initially make the simplifying assumption that unit i enthusiasts are assigned to make "local" unit i decisions (i.e., to press a single A or a single B button), and professionals are assigned to make "global" decisions (i.e., to press two A buttons or two B buttons or all four buttons).

A major issue that we will ignore is the extent to which a choice to decentralize is credible. That is, it could be the case that a hotel chain announces that food decisions will be made locally, but then headquarters changes its mind and makes these decisions anyway. For the moment we will simply assume that all organizational choices made at date 0 are binding; however, we will return to this issue at the end of this section.

As in Section 2, organizational structure (i.e., one of the forms (i) - (iv)) is chosen at date 0 to maximize the expected value of surplus (profit plus worker private benefits), taking into account the equilibrium behavior of bosses at date 1. If there are multiple (Nash) equilibria at date 1, we assume that the one that maximizes total surplus is chosen.

The date 1 equilibria arising from forms (i) and (iv) are fairly simple. In (i), there are two bosses, each pressing one A and one B button. In effect, each boss has a veto over each coordination decision. (NA, NB) is always a Nash equilibrium of this game (both parties exercise their veto), but there may be other (pure strategy) equilibria. (YA, NB) is an equilibrium if

$$v_A^i + \beta_A^i \geq v^i + \beta^i \quad \text{for } i = 1, 2;$$

(NA, YB) is an equilibrium if

$$v_B^i + \beta_B^i \geq v^i + \beta^i \quad \text{for } i = 1, 2;$$

(YA, YB) is an equilibrium if

$$v_{AB}^i + \beta_{AB}^i \geq \text{Max} \, (v_A^i + \beta_A^i, \; v_B^i + \beta_B^i, \; v^i + \beta^i) \text{ for } i = 1, 2.$$

In (iv), the single boss picks the outcome that maximizes total profit. Let $V^* = \text{Max}$ $\{v^1 + v^2, \; v_A^1 + v_A^2, \; v_B^1 + v_B^2, \; v_{AB}^1 + v_{AB}^2\}$. Then she picks (NA, NB) if $v^1 + v^2 = V^*$; (YA, NB) if $v_A^1 + v_A^2 = V^*$; (NA, YB) if $v_B^1 + v_B^2 = V^*$; and (YA, YB) if $v_{AB}^1 + v_{AB}^2 = V^*$.

Forms (ii) and (iii) are more complicated since there are now three players: a "global" boss and two "local" bosses. Take (ii), for example. It is always an equilibrium for the two local bosses to veto coordination of B and for the global boss to choose to coordinate A if this increases total profit and not to coordinate A otherwise, i.e., (YA, NB) is an equilibrium outcome if $v_A^1 + v_A^2 \geq v^1 + v^2$ and (NA, NB) is an equilibrium outcome if $v_A^1 + v_A^2 \leq v^1 + v^2$. However, there may be other equilibria. (NA, YB) is an equilibrium outcome if

$$v_B^1 + v_B^2 \geq v_{AB}^1 + v_{AB}^2,$$

$$v_B^1 + \beta_B^1 \geq v^1 + \beta^1,$$

$$v_B^2 + \beta_B^2 \geq v^2 + \beta^2.$$

The first inequality guarantees that the global boss does not want to coordinate A given that the local bosses are coordinating B; and the second and third inequalities guarantee that each local boss wants to coordinate B given that the global boss is not coordinating A.

By the same argument, (YA, YB) is an equilibrium outcome in (ii) if

$$v_{AB}^1 + v_{AB}^2 \geq v_B^1 + v_B^2,$$

(4.2) $$v_{AB}^1 + \beta_{AB}^1 \geq v_A^1 + \beta_A^1,$$

$$v_{AB}^2 + \beta_{AB}^2 \geq v_A^2 + \beta_A^2.$$

A similar analysis applies to organizational form (iii).[21]

In general, the analysis of an optimal organizational form is quite complicated. In a rough sense, the trade-offs are similar to those in Section 2. Specifically, taking as given the B coordination decision, putting the A decision in the hands of a single boss will lead to too much coordination (since the boss ignores her effect on private benefits), while putting the A decision in the hands of two bosses will lead to too little coordination since coordination occurs only if both bosses gain from it. What complicates matters, of course, is that the B decision isn't given: the two decisions interact.

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[21]Note in (4.2) that the boss in charge of A and the boss in charge of B1 are assumed to value Unit 1's profit the same. Why? Going back to the derivation of a boss's preferences, we can check that it is possible to normalize utilities so that the values placed on profits v_{AB}^1 coincide.

Progress can be made in particular cases. Proposition 1 deals with a situation where, even though the payoffs are uncertain ex ante, the ex post efficient outcome is always the same.

Proposition 3: (1) Suppose (NA, NB) is always ex post efficient. Then NI (form (i)) is optimal.

(2) Suppose (YA, NB) is always ex post efficient. Then DF (form (ii)) is optimal.

(3) Suppose (NA, YB) is always ex post efficient. Then DF′ (form (iii))

is optimal.

(4) Suppose (YA, YB) is always ex post efficient. Then CF (form (iv)) is optimal.

Proof: Suppose (NA, NB) is ex post efficient. Under NI, (NA, NB) is always an equilibrium outcome, and so NI achieves the optimum. This proves (1).

Suppose (YA, NB) is ex post efficient. Given (4.1), it follows that $v_A^1 + v_A^2 \geq v^1 + v^2$, and so (YA, NB) is an equilibrium outcome under DF. This proves (2).

(3) follows similarly. Finally, suppose (YA, YB) is ex post efficient. Given (4.1), it follows that $v_{AB}^1 + v_{AB}^2 = \text{Max} \{v^1 + v^2, v_A^1 + v_A^2, v_B^1 + v_B^2, v_{AB}^1 + v_{AB}^2\}$, and so (YA, YB) is an equilibrium outcome under CF. This proves (4).   Q.E.D.

An example may be useful.

Example 3

	Unit 1	Unit 2	Surplus
(NA, NB)	$(v^1 = 6, \beta^1 = 1)$	$(v^2 = 6, \beta^2 = 1)$	14

(YA, NB) $\qquad$ $(v^1 = 8, \beta^1 = 1)$ $\qquad$ $(v^2 = 5, \beta^2 = 1)$ $\qquad$ 15

(NA, YB) $\qquad$ $(v^1 = 6.1, \beta^1 = 0)$ $\qquad$ $(v^2 = 6.1, \beta^2 = 0)$ $\qquad$ 12.2

(YA, YB) $\qquad$ $(v^1 = 8.1, \beta^1 = 0)$ $\qquad$ $(v^2 = 5.1, \beta^2 = 0)$ $\qquad$ 13.2

The right-hand side column gives total surplus, which is maximized at (YA, NB). Under NI the unique equilibrium outcome is (NA, NB) (any move away from (NA, NB) reduces $v^2 + \beta^2$, and is therefore vetoed by the boss of unit 2). Under DF the unique equilibrium outcome is (YA, NB) (coordinating A is a dominant strategy for a professional boss since this maximizes total profit, while both local bosses veto coordination of B). Under DF′ the unique equilibrium outcome is (NA, YB) (coordinating B is a dominant strategy for a professional boss since this maximizes total profit, while the local boss of unit 1 vetoes coordination of A). Finally, under CF, the unique equilibrium outcome is (YA, YB) since this maximizes total profit. So only DF achieves the optimum, consistent with Proposition 3.

Propositions 4 and 5 deal (respectively) with cases where a particular decision will be made efficiently by a local (respectively, a global) boss, and where the way this decision is made does not affect the decision of anyone else.

Proposition 4. Suppose

$$v_{AB}^1 + \beta_{AB}^1 + v_{AB}^2 + \beta_{AB}^2 > (\text{resp.}, =) v_A^1 + \beta_A^1 + v_A^2 + \beta_A^2$$

$$\Leftrightarrow \quad v_{AB}^i + \beta_{AB}^i > (\text{resp.}, =) v_A^i + \beta_A^i \quad \text{for } i = 1, 2;$$

$$v_B^1 + \beta_B^1 + v_B^2 + \beta_B^2 > (\text{resp.}, =) v^1 + \beta^1 + v^2 + \beta^2$$

$$\Leftrightarrow \quad v_B^i + \beta_B^i > (\text{resp.}, =) v^i + \beta^i \quad \text{for } i = 1, 2;$$

$$v_{AB}^1 + v_{AB}^2 > (\text{resp.,} =) \ v_B^1 + v_B^2 \Leftrightarrow v_A^1 + v_A^2 > (\text{resp.,} =) v^1 + v^2;$$

$$v_{AB}^i + \beta_{AB}^i > (\text{resp.,} =) v_B^i + \beta_B^i \Leftrightarrow v_A^i + \beta_A^i > (\text{resp.,} =) v^i + \beta^i, \text{ for } i = 1, 2.$$

Then DF or NI is optimal.

The first two conditions say that local bosses will coordinate B efficiently, regardless of how decision A is made. The last two conditions say that a global (resp., local) boss's choice of whether to coordinate A is independent of how decision B is made.

Proof: We show that CF is dominated by DF and DF′ is dominated by NI, which establishes the proposition.

Consider CF. Suppose the equilibrium outcome is (NA, NB) or (NA, YB). Then under DF the global boss will continue not to coordinate A, whatever happens with regard to decision B (given the penultimate condition of the proposition). This means that the equilibrium outcome under DF is either (NA, NB) or (NA, YB). Since the local bosses coordinate B efficiently (given the first two conditions of the proposition), whichever outcome occurs generates at least as much surplus as the outcome under CF. The same argument applies if the equilibrium outcome under CF is (YA, NB) or (YA, YB). Hence DF dominates CF.

Consider next DF′. Suppose the equilibrium outcome is (NA, NB) or (NA, YB). Then under NI the local bosses will continue not to coordinate A (given the last condition of the proposition). This means that the equilibrium outcome under DF′ is either (NA, NB) or (NA, YB). Since the local bosses coordinate B efficiently (given the first two conditions of the

proposition), whichever outcome occurs generates at least as much surplus as the outcome under

DF′. The same argument applies if the equilibrium outcome under DF′ is (YA, NB) or (YA,

YB). Hence NI dominates DF′. Q.E.D.

Among other things, the proposition says that if decision B matters to local units but not

to headquarters (its effect on private benefits is large relative to its effect on profit), then decision

B should be left to local units.

Proposition 5. Suppose

$$v_{AB}^1 + \beta_{AB}^1 + v_{AB}^2 + \beta_{AB}^2 > (\text{resp.}, =) \ v_B^1 + \beta_B^1 + v_B^2 + \beta_B^2$$

$$\Leftrightarrow \quad v_{AB}^1 + v_{AB}^2 > (\text{resp.}, =) \ v_B^1 + v_B^2;$$

$$v_A^1 + \beta_A^1 + v_A^2 + \beta_A^2 > (\text{resp.}, =) \ v^1 + \beta^1 + v^2 + \beta^2$$

$$\Leftrightarrow \quad v_A^1 + v_A^2 > (\text{resp.}, =) \ v^1 + v^2;$$

$$v_{AB}^i + \beta_{AB}^i > (\text{resp.}, =) \ v_A^i + \beta_A^i \ \Leftrightarrow v_B^i + \beta_B^i > (\text{resp.}, =) \ v^i + \beta^i, \ i = 1, 2;$$

$$v_{AB}^1 + v_{AB}^2 > (\text{resp.}, =) \ v_A^1 + v_A^2 \ \Leftrightarrow v_B^1 + v_B^2 > (\text{resp.}, =) \ v^1 + v^2.$$

Then CF or DF is optimal.

The first two conditions say that a global boss will coordinate A efficiently, regardless of

how decision B is made. The last two conditions say that a local (resp., global) boss's choice of

whether to coordinate B is independent of how decision A is made.

<u>Proof</u>: We show that DF′ is dominated by CF and NI is dominated by CF, which establishes the proposition.

Consider DF′. Suppose the equilibrium outcome is (NA, NB) or (YA, NB). Then under CF the global boss will continue not to coordinate B (given the last condition of the proposition). This means that the equilibrium outcome under CF is either (NA, NB) or (YA, NB). Since the global boss coordinates A efficiently (given the first two conditions of the proposition), whichever outcome occurs generates at least as much surplus as the outcome under DF′. The same argument applies if the equilibrium outcome under DF′ is (NA, YB) or (YA, YB). Hence CF dominates DF′.

Consider next NI. Suppose the equilibrium outcome is (NA, NB) or (YA, NB). Then under DF the local bosses will continue not to coordinate B (given the penultimate condition of the proposition). This means that the equilibrium outcome under DF is either (NA, NB) or (YA, NB). Since the global boss coordinates A efficiently (given the first two conditions of the proposition), whichever outcome occurs generates at least as much surplus as the outcome under NI. The same argument applies if the equilibrium outcome under NI is (NA, YB) or (YA, YB). Hence DF dominates NI.   Q.E.D.

In rough terms, the proposition says that if decision A does not matter much to local units (its effect on private benefits is small relative to its effect on profit), then decision A should be left to headquarters.

It is straightforward to combine the proofs of Propositions 4 and 5 to show that if the conditions of *both* propositions hold, then DF is optimal.

<u>Corollary</u>. If the conditions of both Propositions 4 and 5 hold, then DF is optimal.

The analysis in this section is obviously quite preliminary, and there are several directions in which it could be taken. One issue we have left open is what kinds of decisions should be grouped within the same unit. We have implicitly taken the view that the decisions within the unit come as a package. An alternative view is that all decisions (buttons) can be freely moved around and allowed to form whatever clusters are efficient. One could rationalize our structure by assuming that there are critical (unmodeled) decisions that require marketing and food activities to be under the formal control of the same owner under all circumstances (this is akin to assuming that two assets are complementary as defined in Hart and Moore (1990)). The interesting extension would then be to study several units and several decisions. This would allow us to investigate whether a particular decision should be in the hands of headquarters, local units, or maybe an intermediate level. For example, hotels could be organized by region as well as nationally and locally, and some decisions could be allocated to regional headquarters.

When there are more than two units, one can also analyze how units are bundled together for the purpose of making a decision, e.g., decision A could be coordinated across units 1 and 2, units 2 and 3, or units 1 and 2 (as well, of course, as all three units). An analysis of this might throw light on the choice between the M form and the U form.

We believe that a similar analysis to the one of this section could be carried out for the synergy model of Section 3. In that model we considered whether two buyers should merge to take advantage of a cost saving on input: the allocation of this input would then be determined by

a headquarters that had "balanced" preferences. Suppose now that there are several inputs.

Then, centralized allocation may be efficient for some inputs, but for others it may be better to

leave the allocation decision to local units, given that local bosses will respect private benefits.

Thus the issue of optimal delegation can be studied in this model too. The analysis is likely to be

richer, as well as more complicated, since outsourcing is also a feasible option. (In the standards

model there is nothing corresponding to outsourcing since there is no physical input to be

traded.)

Finally, let us remark on the credibility of delegation. It is unrealistic to assume that

decisions can be delegated irrevocably to local bosses. A key distinction between ownership and

delegated authority is that control by virtue of ownership cannot be taken away without the

owner's (or an owner representative's such as the CEO's) consent. In contrast, delegated

authority can be revoked on short, or no notice. That does not mean that it will be revoked as

soon as there are gains from doing so. In a repeated game, Baker et al (1999) have nicely

demonstrated that bosses are able to make limited commitments that keep them from intervening

every time it would pay to do so in the short run. This, of course, is also ex ante desirable. One

could interpret our model as one without discounting, because in that case full commitments of

the kind we have assumed would be both feasible and optimal. When there is discounting,

interventions will occur when the short run benefits become sufficiently big. It would seem both

possible and desirable to analyze delegation in this more interesting setting.

5. Concluding remarks.

One of the main objectives of this research project has been to come up with a model that

is so simple, tractable and flexible that it can be used to address a much richer set of

organizational issues than has been possible so far, at the same time as it focuses on a trade-off

central to the issues at hand. There is no question that the key assumptions concerning the boss's

preferences are ad hoc, if plausible. The hope is that the insights of the model and the empirical

relevance of it will provide sufficient payback to offset the costs of making such strong

simplifications. Needless to say, this preliminary paper is no proof. But we think that many of the

proposed extensions are both tractable and interesting and we intend to research some of them

more systematically.

Our second objective has been to move the focus of attention away from assets towards

activities. Asset ownership is at the core of the property rights theory and it will remain important

for understanding boundaries. At the same time it is remarkable how few practitioners,

organizational consultants and researchers studying organizations within other disciplines than

economics (e.g., sociology and organizational behavior) ever talk about firms in terms of

ownership. For most of them a firm is defined by the things it does and the knowledge and

capabilities it possesses. Coase (1988), in his article "Industrial Organization: A Proposal for

Research," makes clear that he too is looking for "a theory which concerns itself with the

optimum distribution of activities, or functions, among firms" (p. 64). He further notes that the

key issue is how different activities fit together: "The costs of organizing an activity within any

given firm depend on what other activities the firm is engaged in. A given set of activities will

facilitate the carrying out of some activities but hinder the performance of others."
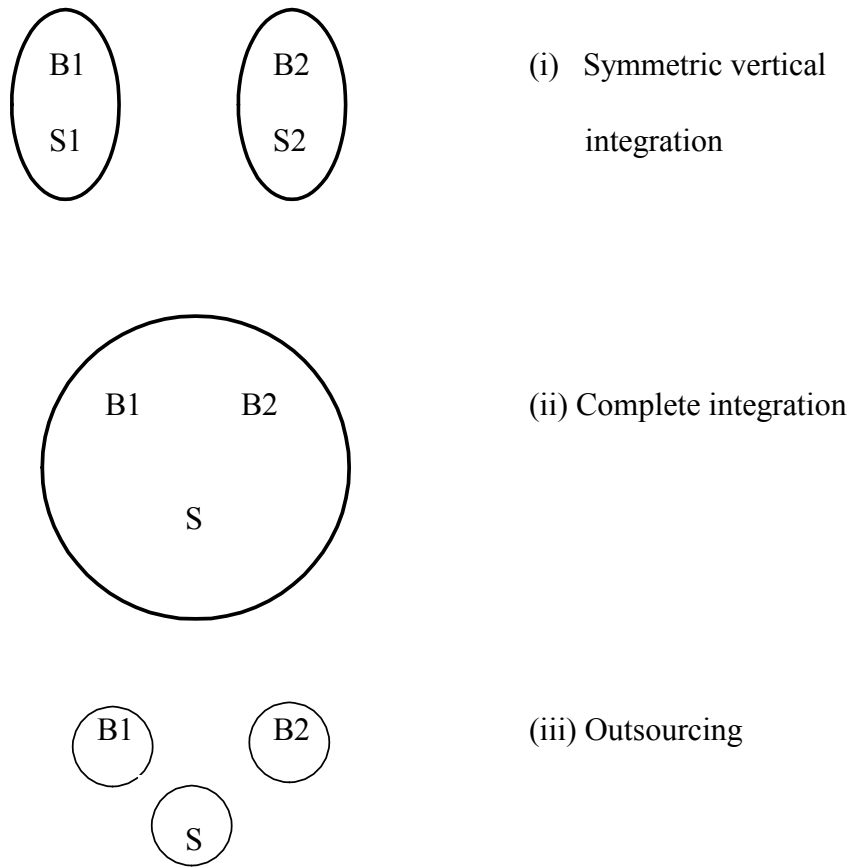
The model we have proposed is in this spirit.

FIGURES

B1

S1

B2

S2

(i) Symmetric vertical

integration

B1   B2

S

(ii) Complete integration

B1   B2

S

(iii) Outsourcing

Figure 4

A   (i) Two separate firms (NI)

B

A   (ii) Decentralized firm (DF)

B

A   (iii) Decentralized firm′ (DF′)
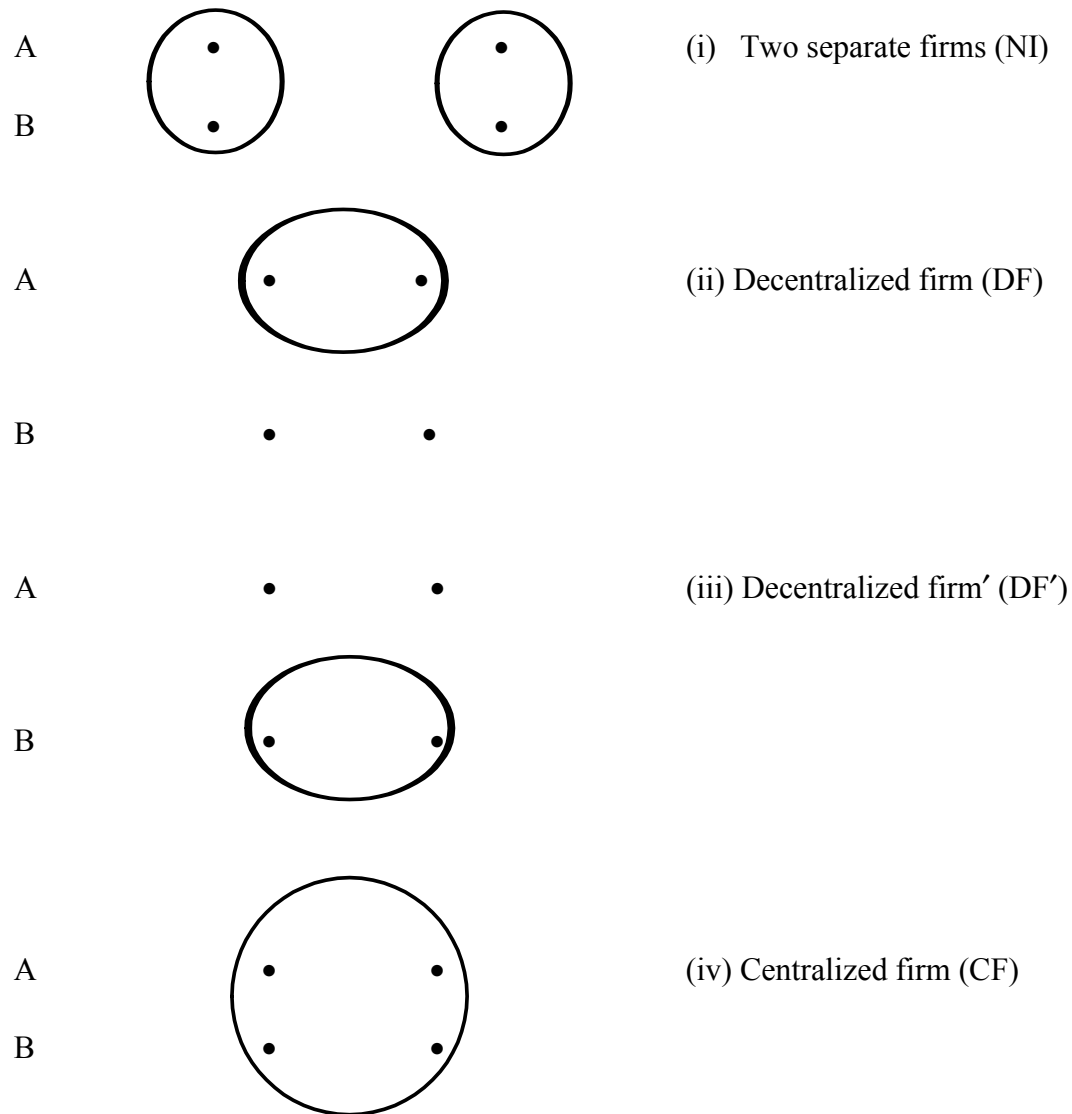
B

A   (iv) Centralized firm (CF)

B

Figure 7

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