Organizing for Synergies

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Abstract

Large companies are usually organized into business units, yet some functions are almost always centralized at the corporate level in order to identify and implement standardization opportunities. We first show that organizations create endogenously an incentive conflict between corporate managers (who desire excessive standardization) and business unit managers (who desire excessive local adaptation.) We then study how the allocation of authority and tasks to corporate and business unit managers interacts with this endogenous incentive conflict. Our analysis generates testable implications for the likely success of mergers and for the organizational structure and incentives inside multidivisional firms.

Keywords: coordination, incentives, task allocation, incomplete contracts, merger implementation, scope of the firm, organizational design, multidivisional firms.

JEL Classifications: D2, D8, L2.

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1 Introduction

Large companies are generally organized into business units, yet some functions are almost always centralized at the corporate level. These organizations are neither pure M-form business-unit organizations nor pure U-form functional organizations; they are "hybrid" organizations. The typical organization design problem is not whether to choose an M-form or a U-form but which activities should be centralized at the corporate level and which should remain at the business-unit level.\(^1\) For example, Procter and Gamble centralizes product development, accounting, and finance, but regional business units are responsible for sales, distribution, manufacturing, and procurement while GE centralizes sourcing at a global level, but keeps sales, distribution and manufacturing at product level business unit. Daimler-Chrysler’s Commercial Vehicles Division created the Truck Product Creation organization in 2004, a unit responsible for centralized product development and purchasing across the various divisions while other functions remained at a local level.\(^2\)

Hybrid structures require business-unit managers and corporate managers to coordinate their activities when each unit’s activities impact and complement other units’ activities. Corporate managers attempt to create value by standardizing activities that impact many business units while business-unit managers benefit from tailoring activities to increase profits in their units. Coordinated decision-making about which activities to standardize is difficult when managers have divergent interests arising from narrow incentives. A key organizational design problem is then to provide incentives for managers and determine the authority structure so that synergies from standardization can be captured.

The challenges of which activities to centralize in a company-wide functional unit, which activities to leave decentralized at the business units, and how to design the supporting managerial incentives, are perhaps most vividly on display when two companies merge. Merged companies typically do not leave the old pre-merger units untouched as independent business units, as synergies would then not be captured. However, they also do not restructure completely along functional lines, as this would reduce the ability of decentralized business units to adapt to local information and enhance performance with high-powered incentives for their managers. Instead, in an effort to extract some synergies, acquirers consolidate functions where they expect to achieve economies of scale and leave the rest within the business units.

\(^{1}\)Note that we study when to centralize activities, rather than decisions. While centralized decisions can be made by the principal (e.g. see Aghion and Tirole, 1997), centralized activities must be carried by an agent who needs to be motivated. For example, even though GE centralizes sourcing globally, the GE CEO does not make the individual sourcing decisions; these are delegated to a functional manager. See Simons (2005), Chapter 3, for these and many other examples of centralized functions along these lines.

\(^{2}\)The purpose was to capture some economies of scope: "The second cornerstone of [our strategy for Commercial Vehicles] consists of deriving appropriate cost advantages from the large volumes that DaimlerChrysler realizes as the world’s leading producer of commercial vehicles. The core of this strategy is to use as many identical parts and shared components as possible, and to use existing vehicle concepts for the maximum possible production volumes while protecting the identity of our brands and products.” 2004 Management Report., http://www.daimlerchrysler.com/Projects/e2e/channel/documents/629779_management_report.pdf
Failure to implement effective organizational strategies is common in many of the most spectacular merger disasters.\(^3\) A claimed source of increased value in the merger between AOL and Time Warner was to be synergies from selling advertising packages that included all media encompassed by the merged company’s divisions. But centralized ad-selling was thwarted by divisional advertising executives who felt they could get better deals than the shared revenue from centralized sales. An outside advertising executive was quoted by the Wall Street Journal, stating, "[t]he individual operations at AOL Time Warner have no interest in working with each other and no one in management has the power to make them work with each other."\(^4\) AOL Time Warner could have chosen to provide greater control to the centralized advertising unit, but this too is not without cost and significant peril. Taking control away from business units over such an important source of revenue could reduce the sensitivity of decisions to local information, reduce the coordination among the different activities of a business unit, and blunt incentives.

We study the design and use of hybrid structures to achieve synergies. We model a firm organized around two product units – one can think of two distinct products or locations, although we will refer to the them as products. Each product requires two activities such as manufacturing and marketing. We assume that the optimal organizational structure requires that one activity, say marketing, be organized by products because business-unit managers must make decisions based on local information. But there may be benefits from standardizing the second activity, say manufacturing, across products. Synergies can only be realized if the manufacturing activities for each product are integrated (e.g. in a single manufacturing plant), and a corporate manager specialized in that activity is put in charge. Once the organizational structure and incentives are set, managers obtain information that determines whether or not standardization is efficient. In an integrated structure, the corporate manager obtains information about the cost savings that may be attained through standardization and business-unit level managers learn about the cost of standardization to their business units – the lost value of local adaptation to the needs of the individual market.

Furthermore, managers need to be motivated to carry out their activities, so compensation must be linked to performance.\(^5\) Since managers are risk-averse, this is best achieved by making incentives narrowly targeted to the performance of their (corporate or business) unit. However, and this is key, motivating managers in this way makes them care about their own output, thereby biasing decision-making away from joint objectives and making communication strategic. A corporate manager who is given a stake in low-cost production

\(^3\)The anecdotal evidence of failed synergy implementation is also consistent with the broader empirical literature on merger performance in corporate finance. See Andrade, Mitchell, and Stafford (2001).


\(^5\)We assume that only the task allocation is contractible. In contrast, the way the task is carried out (which includes the effort provided, and whether or not to limit local adaptation) can only be indirectly influenced through output incentives.
will be biased in favor of standardization, while business-unit managers will be biased in favor of adaptation to local market conditions.

Integrating two business units and putting the manufacturing activities under the control of a corporate manager then results in a trade-off between motivation and coordination. Improved decision-making requires that managerial incentives are muted and made broader, so that managers’ pay depends both on the performance of their own and other units. An integrated organization then must trade off lower-powered compensation that is more broadly targeted (and thus often riskier) with less biased standardization decisions. In particular, we find that integration has three costs. First, corporate managers are endogenously biased in favor of their own unit’s performance and, as a result, implement too much standardization. Second, in order to reduce these decision-making distortions, effort incentives are reduced in an integrated organization. Third, for the same reason, incentives must be broadened, so that the corporate manager is also accountable for business unit performance. This increases risk exposure for a given level of effort. In fact, as we show, risk exposure may actually be higher in an integrated organization even though effort is lower. The benefits of integration are, obviously, that some (standardization) synergies are captured.

As we show, integration may therefore be suboptimal if motivating managers is important. Intuitively, muting and broadening effort incentives is then too costly and an integrated organization engages in excessive standardization. In contrast, integrating and centralizing an activity becomes more attractive when the performance measures of that activity are more noisy (and even non-integrated organizations provide low-powered effort incentives) or the expected value of synergies increases (and standardization is likely to be optimal).

For certain activities, it may be possible to allocate the implementation of standardization decisions to the business units, effectively giving them veto power. In section 4, we study how the allocation of authority over standardization decisions interacts with the above trade-off between motivation and coordination. On the one hand, business unit control is a safeguard against excessive standardization, and thus removes the need to mute and broaden the incentives of the corporate manager. On the other hand, business unit control is ineffective at realizing win-lose synergies where standardization is value-increasing, but reduces the revenues of one of the business units. It is only effective at implementing win-win synergies, where both business-units face low adaptation costs.

As we show, when effort incentives are not too important or business unit performance measures are not too noisy, the organization prefers to make standardization decisions which fully reflect the associated cost savings and revenue losses. This is done most efficiently by having corporate control over standardization, and providing the corporate manager with broad but low-powered incentives. In contrast, if incentive alignment is costly, for example because motivation is important, business-unit control may be optimal. Managers are

\[ \text{While this may be hard to do for manufacturing, it maybe easier to do in other functions such as purchasing. See e.g the Daimler example in Footnote 2.} \]
then provided with high-powered, narrow incentives, and standardization only occurs if both business-units face low adaptation costs, regardless of the associated cost savings. We further show that business-unit control is more attractive if either the correlation or the variance in adaptation costs is higher, as win-lose synergies matter less then.

In Section 5 we extend the analysis in two ways. First, we make communication strategic, so that a narrowly motivated business-unit manager (one with high-powered effort incentives) does not credibly communicate how costly standardization is to him, as he always prefers to adapt his products to the local market. The need to induce credible communication sharpens the trade-off between coordination and incentives – when incentives are more narrowly targeted, credible communication becomes more difficult, as a business-unit manager may choose to misrepresent local market information to limit standardization. Thus providing effort incentives under integration has two costs – distorted decision-making and distorted (not credible) communication. Making communication possible requires softening the power of the effort incentives of the business-unit manager and giving him a stake in the standardization decision. As we show, this implies that non-integration becomes more attractive than when communication is non-strategic.

In a second extension, we allow for managers to bargain with each other. Specifically, we allow for the possibility that business-unit managers influence the standardization decision by making transfers to the corporate managers that are contingent on the standardization choice. An alternative interpretation is that managers bargain over who controls standardization decisions. We find that incentive alignment and bargaining are substitutes. If incentive alignment is costly, then managers make transfers in equilibrium; implementation decisions are still quite distorted, but effort incentives are first-best. If, however, incentive alignment is relatively cheap to obtain in terms of effort cost, then no bargaining takes place in equilibrium, and no transfers between the units are observed (consistent with the outcome usually observed in practice). This result provides a new rationale for why organizations (in Coase’s famous words ‘islands of conscious power’) make little use of the price system and substitute market transactions by authority and incentive alignment.

Our paper is the first one to study formally the endogenous conflict that appears in organizations between corporate and business unit managers as organizations try to capture synergies. It contributes to a recent literature that studies together the incentive problems and the coordination problems in organizational design; however, unlike those papers, we endogenize the source of the incentive conflict. Hart and Moore (2006) and Hart and Holmstrom (2002) study organizational structures in which a coordinator is needed to extracts synergies, but she is (exogenously) biased.7 Alonso, Dessein and Matouschek (2008) and

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7Hart and Moore (2006) study how to allocate authority over the use of assets when agents with several assets (coordinators) can have ideas involving the common use of several of these assets, and when agents are motivated by their own interest rather than that of the organization. Hart and Holmstrom (2002), in a framework centering on the managers’ private benefits of control, show that independent firms coordinate their activities insufficiently, while integrated firms have a tendency to realize too many synergies, neglecting private benefits of managers and workers.
Rantakari (2008) analyze the role of a coordinator who is unbiased, but who depends for his decision on the information provided by (exogenously) biased managers. If incentives are endogenous one may expect that low powered incentives may be optimal, as the multitasking literature (Holmstrom and Milgrom (1991, 1994), Holmstrom (1999)) has shown in a reduced form setting. This literature however is not explicit about the coordination issue underlying the multiple tasks, and thus cannot illuminate how the allocation of authority and of tasks to (corporate and business unit) managers interact with the need to provide low powered incentives. Endogenizing the trade-off between capturing synergies and preserving adaptation, we give specific content to the broad multitasking intuition on the motivation-coordination trade-off and show, in particular, that the power of incentives depends on the integration decision and on who has authority over the standardization decisions. Athey and Roberts (2001) are the only precedent to our work in this respect, as they also give content to the multitasking intuition by focusing on the conflict between high-powered incentives to induce effort and biased decision-making. However, task allocation and decision-making authority are endogenous in our framework and exogenous in theirs. These features, together with the more tractable framework we develop, distinguish our paper from theirs. They also allow us to generate new empirical implications. 8

Specifically, we obtain new testable implications concerning centralization and mergers and the design of incentives in multidivisional organizations. For example, consider a company that is undertaking a merger. Which activities should it centralize? Trivially, those with high synergy potential. Less obviously, activities that are hard to measure or provide high-powered incentives for, such as R&D or HR, since in those activities the loss from lower powered incentives will be less important. For the same reasons, we expect the merger to be more likely to fail when pre-merger the two firms had high powered incentives and when the synergies to be obtained come from many small distinct decisions, rather than one big source. When synergies come from many separate decisions, contingent decision-making is more important, and thus incentives must be more muted. Finally, concerning the design of incentives in multidivisional organizations, we expect corporate managers to be motivated with broad, but lowered powered incentives and business unit managers with targeted but higher powered incentives.

8 A related strand of literature, under the broad heading of team theory (Marshack and Radner, 1972), studies coordination problems absent incentive issues. For example, Cremer (1980), Genakoplos and Milgrom (1991) and Vayanos (2002) study the optimal grouping of subunits into units in the presence of interdependencies; Harris and Raviv (2002) study the organizational structure that best appropriates synergies when managers are expensive; Qian, Roland and Xu (2006) study how the grouping of units (M-form versus U-form) affects how organizations coordinate changes; Dessein and Santos (2006) study the trade-off between ex ante coordination, through rules, and ex post coordination, through communication; Cremer, Garicano and Prat (2007) study the limits to firm scope due to the loss of specificity in organizational languages as firm scope grows. A polar approach is taken by Maskin, Qian and Xu (2000) who abstract from any coordination problems, and study the optimal grouping of tasks (M-form versus U-form) purely based on incentive and measurability considerations. Outside of economics an old literature (e.g. Chandler’s 1962 and and Lawrence and Lorsch’s 1967) studies coordination and integration mechanisms in organizations.
2 The model

2.1 An illustrative example

A fictional example helps illustrate our model. Wonka Inc. produces and markets two lines of candy: Bitter and Sweet. Each line of candy has its own brand image, distinctive packaging, ingredients, and loyal customer base. Initially Bitter and Sweet are organized as independent businesses, each with its own manufacturing facility and marketing organization, perhaps because Wonka has recently acquired Bitter. Wonka management identifies potential economies of scope from integrating production between the two units in a single plant. Integration requires the firm to reallocate some activities from each business unit to a "corporate manager" who, from time to time, identifies opportunities to save costs by sharing inputs, consolidating production, or standardizing packaging.

Any of these standardization activities may reduce revenues, however, as each candy line becomes less tailored to the unique tastes and preferences of its customer base. We assume that any potential economies of scope in the other activity, marketing, are small relative to the losses from removing these activities from business-unit managers with specialized skills and rich knowledge of their customers.

Wonka faces the following organizational design choices:

- **Non-integration**: Bitter and Sweet are kept fully independent. Both Bitter and Sweet have their own (business-unit level) manufacturing and marketing managers. Opportunities for scope economies can neither be identified nor exploited.

- **Integration**: Marketing of Bitter and Sweet is still assigned to two different business-unit level managers, but manufacturing is consolidated into a single factory managed by a central, company-wide manufacturing manager who identifies potential cost savings from standardizing activities. We initially assume (Section 3) that these activities are inalienable from the manufacturing manager, so he has control over whether or not to standardize activities.

Managers learn about the benefits of standardization and local adaptation on some particular decision only after the organizational structure is in place. That is, the designer only knows the probability distribution of future synergies, not their realization, and chooses a structure that shapes how decisions to standardize are made once managers learn the specific costs and benefits. We aim to capture the fact that the organizational design decision has a level of permanence – organizations cannot be changed with every decision that must be taken. The standardization decision may be whether or not this year’s products for the domestic and foreign markets will have the same packaging or not. Thus we assume that first the organizational design decision is taken (including who has authority and on what basis they are rewarded) and only then are decisions on what to standardize made. In effect, we
assume that in each period there is an opportunity for standardization drawn from the same underlying probability distributions.

Manufacturing and marketing of Bitter and Sweet require that the managers (to whom the activities are allocated) exert unobservable effort; this leads the firm to tie wages to output. The company observes the output from each activity; we assume that effort in manufacturing reduces costs while effort in marketing increases revenues. The impact of effort is additive, it does not interfere with standardization decisions, but the output measures are noisy and managers are risk-averse. The risk-incentives trade-off, therefore, is minimized by only rewarding managers for the task under their control, that is the marketing manager is rewarded based on his product’s revenues, the manufacturing manager based on production costs. It may, however, also be optimal to give the manufacturing manager a stake in revenues so he makes better standardization decisions (as these affect both costs and revenues).

In Section 5, we extend the model to incorporate the possibility that incentives affect the ability to communicate private information credibly. We assume that the cost savings from standardizing activities are private information of the corporate manager and the revenue losses for each business unit are private information of the respective business-unit level managers. We allow for cheap talk communication, so decisions can reflect other managers’ information. This creates an additional role for providing pay based on the performance of other units which increases alignment of interests, thereby improving communication.

2.2 The formal model

We now lay out the formal details of the model.

Tasks and Task Allocation: We model a company or organization that produces two goods; each one requires two tasks or activities. Potential benefits from standardization exist in one of the activities – say manufacturing; the other activity, say marketing, requires adaptation to local conditions, so standardization of these activities is never profitable. Under non-integration, each of these four tasks are allocated to a different business-unit level manager. Under integration, the manufacturing activities are integrated and allocated to a corporate manager. The marketing activities remain assigned to two business-unit level managers.

Costs, Revenues and Standardization. Production generates four value streams: two cost streams (generated by the manufacturing activities) and two revenue streams (generated by the marketing activities). The costs to produce each product depend on the effort of the manager who is allocated the manufacturing activity of good . The privately-incurred cost of effort level equals . In addition, under an integrated structure, the corporate manager in charge of both manufacturing activities may standardize his activities in order to further reduce costs. Under standardization, the organization saves costs on these activities, where

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9The key feature is that output from each activity is observable and contractible. Although imperfect performance measurement may result from task reallocation, we choose to focus on incentive-coordination tradeoff that exists even without these measurement problems.
Figure 1: Non-Integrated structure Integrated structure

$k$ is a random variable drawn from a uniform distribution $k \sim U[0, K]$. No cost savings can be achieved if the two production efforts are undertaken by different managers. The total costs of product $i$ are

$$C_i = C - \nu c_i - \frac{k}{2}I + \varepsilon c_i,$$

where $\varepsilon c_i$ is an i.i.d. shock to the costs, $\varepsilon c_i \sim N(0, \sigma^2 c)$, and

$$I = \begin{cases} 
0 & \text{under non-integration;} \\
0 & \text{under integration and no standardization;} \\
1 & \text{under integration and standardization.} 
\end{cases}$$

The revenues of each product $i$ depend on the effort $e r_i$ of the manager who is allocated the marketing activity of good $i$. As in manufacturing, the marginal (and average) product of effort is $\nu$, the privately-incurred cost of effort $e$ equals $e^2/2$. Standardization not only reduces costs, it also results in revenue losses $\Delta_i$, $i = 1, 2$, where $\Delta_i$ equals $\Delta$ with probability $p$ and 0 otherwise. These revenue losses are the costs of not being adapted to the local environment, that is of producing a good $i$ that is not ideal for local market conditions. Total revenues of product $i$ are thus

$$R_i = \nu e r_i - \Delta_i I + \varepsilon r_i,$$

for $i = 1, 2$, where $\varepsilon r_i$ is an i.i.d. shock to the revenues, $\varepsilon r_i \sim N(0, \sigma^2 r)$. Synergies are positive whenever $k - (\Delta_1 + \Delta_2) > 0$. We assume that $K - 2\Delta > 0$, so that it is sometimes optimal to standardize ex post regardless of $\Delta_i$. This assumption reduces the number of cases to consider, thereby simplifying the analysis without affecting the results. While the first-best standardization decision is contingent on the realization of $k, \Delta_1$ and $\Delta_2$, we assume that managers learn this information only after the organization is set-up and the integration decision is made.

Contracts and Information: Total revenues and costs are contractible, but both effort and standardization are non-verifiable. Non-verifiable effort is a completely standard assumption;
non-verifiable standardization merits discussion. We use the word standardization as shorthand for the myriad of tasks that must be undertaken to capture synergies. For an outsider, it is impossible to tell whether two widgets are customized in a meaningful way (hence, allowing the business-unit managers to benefit from local adaptation) or only in appearance. In other words, a judge will always observe that products are in fact different without knowing the extent to which their designs or production processes have been harmonized to produce cost savings.\footnote{Formally, we assume that the functional manager exerts two types of non-contractible efforts, }\footnote{Other papers which emphasize the importance of organizations as governance structures when actions are ex post non-contractible are Hart and Holmstrom (2002), Aghion, Dewatripont and Rey (2004), Hart and Moore (2006) and Baker, Gibbons and Murphy (2006).} Second, we have in mind that corporate managers periodically make choices which trade off adaptation and standardization. These specific choices are surely hard to anticipate, so contracting on standardization will be infeasible. The organization is thus a governance structure which manages standardization decisions ex post.\footnote{Note that this implies that the linear shares in }\footnote{This assumption can be formally justified if one considers the variant of our model outlined in Appendix A, which yields the same expected profit function, but where the cost and revenue stream of each division is affected by an infinite number of small independent standardization choices.} Incentive contracts are further restricted to be linear in costs and revenues and, consistent with our view of the organization as a governance structure, managers learn about the cost-savings and revenue losses of a specific standardization opportunity only after the organizational structure (incentive contracts, task allocation) is in place.\footnote{9}

It does not matter for most of our analysis whether $\Delta_1$, $\Delta_2$ and $k$ are observable to all managers, or only to those in charge of the related activities (where the corporate manager observes $k$ and business-unit manager $i$ observes $\Delta_i$). Only in in section 5, where we consider a number of extensions, will strategic communication between managers play a role.

### Profits and Managers’ Effort Choices
Managers are risk averse with CARA utility, so they maximize a linear combination of expected income and its variance. The organization can set positive or negative fixed payments to keep managers’ utility at their individual rationality constraint, so we can focus entirely on the surplus-maximizing shares of costs and revenues. Throughout the analysis, we will ignore the impact that uncertainty over the costs and benefits of standardization has on the risk-averse managers’ utility. This simplifies the analysis without affecting the qualitative results. Moreover, as shown in Appendix A, this assumption can be formally justified by assuming that there are an infinite number of small, independent standardization choices rather than one big standardization decision.

Under Non-Integration, there are four managers, who respectively choose efforts $e_{c1}$, $e_{c2}$, $e_{r1}$ and $e_{r2}$. The Manufacturing manager of good $i$ is given a share $\alpha$ in $C_i$ as incentives, the
Marketing manager of good $i$ is given a share $\beta$ in $R_i$ as incentives. Given that the privately-incurred cost of effort equals $e^2/2$ for effort $e$, this yields $e_{ci} = v\alpha$ and $e_{ri} = v\beta$. Normalizing the reservation utilities of managers to 0, expected profits under non-integration can be written as

$$\pi^{NI} = \sum_{i=1,2} \left( E[R_i - C_i] - \frac{1}{2} e_{ci}^2 - \frac{1}{2} e_{ri}^2 - \frac{1}{2} r(\sigma_c \alpha)^2 - \frac{1}{2} r(\sigma_r \beta)^2 \right),$$

where $r$ is the coefficient of absolute risk aversion. Setting $r = 1$ and substituting optimized efforts, this yields

$$\pi^{NI} = v^2 \alpha(2 - \alpha) + v^2 \beta(2 - \beta) - (\sigma_c \alpha)^2 - (\sigma_r \beta)^2 \tag{3}$$

Under Integration, there are two marketing managers but only one manufacturing manager, who chooses both $e_{c1}$ and $e_{c2}$, and is given a share $\alpha$ in the cost savings of his own activities, $C_i$, $i = 1, 2$ as incentives. There is no benefit, but there is a cost, from giving a risk-averse manager a share in the risky output from decisions he does not affect. Marketing manager $i$’s contract therefore only consists of a share $\beta$ in the revenues of his own activity, $R_i$ and a fixed (positive or negative) payment which we can ignore. Exactly as under non-integration, this yields efforts $e_{ci} = v\alpha$ and $e_{ri} = v\beta$. Finally, the organization must give the manufacturing manager incentives for making efficient standardization decisions. In addition to $\alpha$ it may thus also be optimal to give him a share $\gamma$ in the revenue streams. We analyze the standardization decision below. Normalizing the reservation utilities of managers to 0, expected profits under integration can then be written as

$$\pi^I = \sum_{i} \left( E[R_i - C_i] - \frac{1}{2} e_{ci}^2 - \frac{1}{2} e_{ri}^2 - \frac{1}{2} (\sigma_c \alpha)^2 - \frac{1}{2} (\sigma_r \beta)^2 - \frac{1}{2} (\sigma_r \gamma)^2 \right), \tag{4}$$

or substituting optimized efforts,

$$\pi^I = E[(k - \Delta_1 - \Delta_2) | I = 1] \times \Pr[I = 1] + \frac{1}{2} \alpha(2 - \alpha) + v^2 \beta(2 - \beta) - (\sigma_c \alpha)^2 - (\sigma_r \beta)^2 - (\sigma_r \gamma)^2. \tag{6}$$

Profits under integration differ from profits under non-integration on two dimensions. First, there is the decision-making component of profits, line (5) in $\pi^I$ which is missing in $\pi^{NI}$. Under integration, the organization may realize some gains of standardization and some adaptation losses which are both absent under non-integration. Second, there is the effort component of profits, line (6) under integration and the full profit expression (3) under non-integration. Note that there is no ‘mechanical’ effect of the number of agents (that is profits do not vary because there is one manager less under integration), except through the incentives. The only difference between (6) and (3) is that there is an extra share $\gamma$ (as the corporate manager may get a share of the revenues even though they are under the business-unit managers’ control), but that is a choice; the designer could chose to set that
share at $\gamma = 0$. In other words, only the total amount of effort involved matters, rather than who undertakes it.\footnote{In particular, this means that, holding effort fixed, profits are the same under integration without implementing standardization and non-integration. There are no losses in local adaptation from shifting control, just from implementing standardization. If employing a functional manager increases wage costs, our results are unchanged, since it would result in a fixed reduction of integration profits.} The objective function of the designer is to set up the organizational structure and incentives to maximize these profits.\footnote{The non-integrated organizational form corresponds to a pure M-form organization where no functions are centralized. One can think of a pure functional or U-form organization as one where standardization is always implemented. In our model, this structure is dominated by integration with functional control.}

2.3 Non-integration benchmark

Under non-integration, the strength of incentives $\alpha$ and $\beta$ reflect the classic trade-off between risk and incentives. In particular, the designer maximizes

$$\max_{\alpha, \beta} \pi^{NI} = v^2 \alpha(2 - \alpha) + v^2 \beta(2 - \beta) - (\sigma_c \alpha)^2 - (\sigma_r \beta)^2 - (\sigma_r \gamma)^2,$$

yielding

$$\alpha = \alpha^{**} = \frac{v^2}{v^2 + \sigma_c^2} \quad \text{and} \quad \beta = \beta^{**} = \frac{v^3}{v^2 + \sigma_r^2}.$$

We will refer to $e^{**}_{ci} = v\alpha^{**}$ and $e^{**}_{ri} = v\beta^{**}$ as the second-best effort levels, and to $\alpha^{**}$ and $\beta^{**}$ as the second-best cost and revenue shares.

3 Integration with corporate control

In this section, we analyze the integrated organization structure, where both production activities are assigned to a corporate manager who can identify potential cost savings from standardization and has the authority to implement them.

3.1 Effort and cooperation incentives

Efficiency requires that the standardization decision is contingent on the cost savings of standardization $k$, and the revenue losses due to lost adaptation, $\Delta_1$ and $\Delta_2$. As long as one allows for (cheap talk) communication, however, it does not matter whether the corporate manager observes $k$, $\Delta_1$ and $\Delta_2$ or only $k$ (with $\Delta_i$ being privately observed by business-unit manager $i$). Indeed, it is credible for the business-unit managers to communicate their private information in a cheap talk game. A business-unit manager with $\Delta_i = 0$ does not care about the implementation decision, so he is willing to reveal his information. In contrast, a business-unit manager with $\Delta_i > 0$ does not desire standardization, so he wants the corporate manager to believe that $\Delta_i$ is as high as possible. Thus, he will not want to pretend $\Delta_i = 0$. Thus, whether or not $\Delta_1$ and $\Delta_2$ are private information of the business-units, the corporate
manager will base his decision on complete information.\(^{15}\)

Recall that the corporate manager obtains a share \(\alpha\) of the cost savings from standardization, and suffers a share \(\gamma\) of the revenue losses for each product. In choosing effort \(e_{c_1}\) and \(e_{c_2}\) and deciding whether or not to standardize, he then maximizes:

\[
\sum_i \left( \gamma E[R_i] - \alpha E[C_i] - \frac{1}{2} e_{c_i}^2 \right) = \sum_i \left( \gamma (ve_{ri} - \Delta_i I) - \alpha (C - ve_{ci} - \frac{k}{2} I) - \frac{1}{2} e_{c_i}^2 \right). \tag{7}
\]

Hence, the corporate manager chooses efforts \(e_{c_i} = v\alpha, \ i = 1, 2\), and standardizes if \(\alpha k - \gamma(\Delta_1 + \Delta_2) > 0\). This condition determines a decision rule with three cutoff points, \(k_{LL}, k_{LH}\) and \(k_{HH}\), with

\[
k_{ij} = \frac{\gamma}{\alpha} (\Delta_i + \Delta_j) \quad i, j = L, H. \tag{8}
\]

If adaptation costs are \(\Delta_i\) and \(\Delta_j\), standardization takes place if \(k > k_{ij}\). Note that the first best standardization cut-off is \(k_{ij}^{fb} = (\Delta_i + \Delta_j)\). Thus the extent to which we have too much or too little standardization depends on whether \(\gamma/\alpha \gtrless 1\). We define

\[
A \equiv \frac{\gamma}{\alpha}, \tag{9}
\]

which is a measure of incentive alignment. If:

- \(A = 0\) the corporate manager cares only about cost savings and always standardizes;
- \(0 < A < 1, k_{ij} < k_{ij}^{fb}\), the corporate manager standardizes too often;
- \(A = 1\) the standardization decision is first-best.

Standardization decisions that are sensitive to the size of cost savings relative to the benefits of adaptation require some alignment of incentives, \(A > 0\). Narrowly-focused incentives are thus an obstacle to the organization’s ability to implement trade-offs between standardization and adaptation. This problem is mitigated only if the corporate manager’s compensation depends on business-unit revenues, thereby making him bear some of the costs of lost adaptation from standardization. A corporate manager that shares in revenues from the local adaptation will give up on standardization (when \(k\) is low) and allow local adaptation by the business-unit managers. However, this increases the risk the corporate manager bears.

The incentive design problem of the organization can be written as an optimization over

\(^{15}\)In section 5, we analyze the case where \(\Delta_i\) is always strictly positive and, hence, a narrowly motivated business-unit manager (one with high-powered effort incentives) does not credibly communicate how costly standardization is to him. As we show, making communication possible then requires softening the power of the effort incentives of the business-unit manager and giving him a stake in the cost savings from standardization.
incentive alignment, \( A = \gamma / \alpha \), and output incentives \( \alpha \)\(^{16}\):

\[
\max_{A, \alpha} \pi = \frac{(1-p)^2}{K} \int_{K_{LL}}^{K} k dk + \frac{2p(1-p)}{K} \int_{K_{LH}}^{K} (k-\Delta) dk + \frac{p^2}{K} \int_{K_{HH}}^{K} (k-2\Delta) dk
\]

\[
+ [\alpha(2-\alpha) + \beta^{**}(2-\beta^{**})] v^2 - [(\alpha \sigma_c)^2 + (\beta^{**} \sigma_r)^2 + (\alpha A \sigma_r)^2].
\]

where the revenue share of the business-unit manager is set at its second-best level, \( \beta^{**} \) (the optimization over \( \beta \) is identical as in the non-integration benchmark above). Integrating over \( k \) and simplifying,

\[
\max_{A, \alpha} \pi = E\left[k - \Delta_1 - \Delta_2\right] + A(2-A) \frac{1}{2K} E\left[(\Delta_1 + \Delta_2)^2\right] +
\]

\[
[\alpha(2-\alpha) + \beta^{**}(2-\beta^{**})] v^2 - [(\alpha \sigma_c)^2 + (\beta^{**} \sigma_r)^2 + (\alpha A \sigma_r)^2].
\]

(10) The first-order conditions with respect to \( \alpha \) and \( A \) yield

\[
\pi_\alpha = 2(1-\alpha)v^2 - 2\alpha(\sigma_c^2 + (A)^2 \sigma_r^2) = 0,
\]

(11) and

\[
\pi_A = \frac{1}{2K} E\left[(\Delta_1 + \Delta_2)^2\right]2(1-A) - 2A(\alpha \sigma_r)^2 = 0.
\]

First-order condition (13) yields a cost share \( \alpha \) that is strictly below the second-best level \( \alpha^{**} \) whenever the corporate manager is not completely biased \( (A > 0) \). Thus, in order to reduce decision-making distortions, effort incentives are muted in an integrated organization relative to the second-best level: \( e_{ci} < e_c^{**} \). Integrating and coordinating business-units thus comes at the expense of the motivation of managers.

First-order condition (14) implies that decision-making incentives are always partially aligned, that is \( 0 < A < 1 \). The fact that \( A < 1 \) implies that the corporate manager is endogenously biased in favor of his own unit’s performance. There is excessive standardization: the corporate manager sometimes standardizes even though expected synergies are negative. His share of business-unit revenues is not high enough to compensate him completely for foregoing standardization benefits. The fact that \( A > 0 \) implies that the corporate manager is partially rewarded on firm-wide performance in order to align his decision-making. This increases risk exposure for a given level of effort. In fact, it is easy to construct examples where the risk exposure under integration is higher than in the non-integration benchmark, even though actual effort provision is always lower under integration.

One can further check that profits are supermodular in the endogenous variable \( \alpha \), \( -A \) and the exogenous variable \( t \in \left\{ -\frac{\psi}{K}, v, 1/\sigma_c^2 \right\} \) for \( A \in [0,1] \) and \( \alpha \in [0,1] \) where \( \psi \equiv E\left[(\Delta_1 + \Delta_2)^2\right], \) yielding unambiguous comparative statics regarding the power of incentives \( \alpha \) and alignment of decision-making \( A \). Since effort incentives \( \alpha \) and alignment of decision-making,

\(^{16}\)To simplify notation, we drop the superscript \( I \) in this section and write \( \pi \) for profits under integration.
A, always move in opposite directions, this illustrates again the trade-off between motivation (effort incentives) and coordination (efficient standardization decisions). We summarize in the following proposition.

**Proposition 1** The optimal choice of incentives in the integrated firm are as follows:

1. Effort provision is below the second-best level provided under non-integration: \( e_{ci} < e_{ci}^{**} \). Cost-reducing incentives \( \alpha \) are further increasing in the value of effort \( v \), the precision of the corporate performance measure \( 1/\sigma_c^2 \), and the expected value of synergies \( K/2 \), but decreasing in the expected value of local adaptation \( p\Delta \).

2. The corporate manager is partially rewarded on firm-wide performance, \( \gamma > 0 \). As a result, the risk-premium to be paid to managers in the integrated firm can be higher than in the non-integration benchmark, even though effort provision is strictly lower, \( e_{ci} < e_{ci}^{**} \).

3. Corporate managers are biased towards their own unit, \( A = \gamma/\alpha < 1 \), and engage in excessive standardization. Alignment \( A \) is decreasing in \( v, 1/\sigma_c^2 \) and \( K \), but increasing in \( p\Delta \).

**Coordination incentives.** Similar comparative statics hold for coordination incentives \( \gamma \) whenever \( A > 1/2 \) (which will be the case for \( v \) sufficiently small), as \( \gamma \) and \( \alpha \) are then supermodular. Opposite comparative statics hold for \( \gamma \) whenever \( A < 1/2 \) (which will be the case for \( v \) sufficiently large), as then \( \gamma \) and \( (-\alpha) \) are supermodular.\(^{17}\) Coordination incentives \( \gamma \) are further always decreasing in \( \sigma_r^2 \), whereas effort incentives \( \alpha \) are decreasing \( \sigma_r^2 \) if and only if \( A > 1/2 \).

**Discussion:** Previous models of organizational decision-making generally treat managerial biases as exogenous (Hart and Moore (2005), Alonso, Dessein, Matouschek (2008), Rantakari (2008)); our model allows decision-making biases to be the endogenous outcome of a trade-off between effort incentives, decision-making/coordination incentives and risk. At the optimum, the organization then (1) biases the corporate manager towards his own unit’s performance, (2) mutes effort incentives (relative to the standard second-best risk-incentives trade-off) and, for a given level of effort, (3) loads some extra risk on the corporate manager by giving him a share in business-unit revenues and, hence, broadening his incentives. In equilibrium, decision-making incentives are always partially aligned, that is \( 0 < A < 1 \) and effort incentives and decision-making alignment move in opposite directions as a response to changes in external variables.

\(^{17}\) If one writes profits as a function of \( \alpha^c_\cdot \) and \( \alpha^F \), rather than \( \alpha_\cdot^c \) and \( A^F \), one can verify that

\[
\pi_{\alpha^c_\cdot, \alpha^F} = \frac{E[(\Delta_1 + \Delta_2)^2]}{K} \frac{1}{(\alpha^F)^2} (2A^F - 1).
\]
3.2 The costs and benefits of integration

An organization can realize synergies by employing a corporate manager to combine activities as well as identify and implement these synergies. As we have shown, such a manager will be endogenously biased in favor of standardization. Typically, however, the expected value of a standardization decision (though not all standardization decisions) will be positive. In other words, the benefit of integration is that synergies may be captured. There are two costs. First, effort incentives on the centralized activities will be muted relative to non-integration in order to reduce decision-making distortions. Second, for the same reason, incentives must be broadened. This increases risk exposure for a given effort level. As we show next, a firm may therefore strictly prefer to forego any potential synergies and choose a non-integrated organization.

When is integration preferred? The following proposition states that integration is only useful if expected cost savings from standardization, measured by $K$, are sufficiently large. The threshold value for $K$, $K^*$, depends on the importance of effort, the noise in the performance measures, and the measurability of revenues and costs.

**Proposition 2** If $K/2 < 2p\Delta$, there exist values of $v, \sigma_c^2$ and $\sigma_r^2$ such that non-integration is strictly preferred to integration. Integration is more likely to be optimal if:

- Motivating managers is less important ($v$ is smaller);
- Corporate performance measures are less precise ($\sigma_c^2$ is larger) or business-unit performance measures are more precise ($1/\sigma_r^2$ is larger);
- Standardization is more valuable ($K$ is larger)
- Expected adaptation costs $2p\Delta$ are smaller.

**Proof.** See Appendix.

Figure 2 illustrates the incentive costs of integration and the move towards non-integration when motivation becomes more important. When $v < v^*$, integration is optimal, but effort incentives (solid line) are lower than those that would be provided in a non-integrated organization (dotted line). Still, because the corporate manager is also partially rewarded on firm-wide performance, total variable compensation of the corporate manager is actually larger than in the second-best benchmark (where incentives only trade-off risk and effort). Finally, there is excessive standardization as the corporate manager is endogenously biased in favor of his own unit’s performance. Indeed, his share in business-unit revenues (solid bold line) is between $1/2$ and $3/5$th of his share in his own functional unit, $1/2 < A < 3/5$. Since an increase in $v$ increases the wedge between $\alpha$ and $\gamma$, his decision-making becomes increasingly distorted as motivation becomes more important. When $v > v^*$, the organization then

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18 That is, the following changes in exogenous variables may result in a shift from non-integration to integration, but never the other way around.
optimally adopts a non-integrated structure which foregoes any synergies, but provides managers with high-powered incentives that are focused purely on their areas of responsibility (their task allocations).

One implication of Proposition 2 is that a merger between two firms may not increase value despite anticipated synergies, because the incentive costs from integration (the need to mute and broaden incentives) may exceed the benefits (implementing value-increasing standardization). Thus, there is a gap between the expected benefits from a first-best exploitation of synergies (ignoring incentive issues) and the change in surplus from a merger. This gap is an ‘organizational discount’ that should be incorporated in valuing a merger. The analysis in the propositions above provides some insights into the size of this organizational discount. First, the higher the synergies, the lower the ‘organizational discount’ that must be applied to a merger, all else constant. The reason is that, as positive synergies become sufficiently likely, contingent decision-making is less important and so are balanced incentives. For sufficiently high synergies, providing the corporate managers with targeted incentives does not lead to much inefficient decision-making. Second, the organizational discount increases with the importance of incentives and integration decisions are less likely to be undertaken where effort incentives are important.
4 Corporate control versus business-unit control

In this section, we study the extent to which decentralized control over standardization decisions may be preferred, where managers at the business-unit level have the power to block standardization decisions.

4.1 Wonka Inc revisited

To illustrate the differences between integration with corporate and business-unit control, we return to our fictional example, and suppose Wonka’s opportunity for economies of scope arises not in production, but in purchasing. Wonka still requires a corporate-level purchasing unit with its own manager if it wants to identify and implement standardization opportunities. However, the company has the option to keep sufficient purchasing activities in the business units, so that each business-unit manager can refuse to cooperate with the purchasing manager’s suggestions for standardization and effectively veto the initiative.

- **Integration with corporate control**: Purchasing is consolidated, and assigned to a purchasing manager. All decision regarding purchasing, including choices regarding standardization in supplier choice, products sourced, terms offered to suppliers, quality standards, etc. are then inalienable from this functional manager. Standardization in purchasing has the same (independently realized) costs and benefits as in manufacturing, and are subject to the same asymmetric information.

- **Integration with business-unit control**: While key elements of the Purchasing function are consolidated and assigned to a purchasing manager, each business-unit manager retains an individual purchasing department responsible for implementation of purchasing policies. By refusing to implement the corporate purchasing manager’s suggestions, business-unit managers can then block any undesired standardization initiative.

The key difference between Manufacturing and Purchasing at Wonka is that realizing economies of scope in Production requires taking away authority from the business units, while this is not the case for purchasing decisions. Giving business-unit managers the power to block undesired standardization initiatives in purchasing does not rule out standardization (if approved by both business-unit managers). More generally, in some settings, it is necessary to consolidate all relevant assets into a single division in order to implement synergies. Integration with business-unit control is then not feasible. In other settings, however, it may be possible to keep some assets required for standardization within business units. It is the latter case we study now.

4.2 Analysis

We need to modify the extensive form of the game slightly in order to analyze business-unit control. The corporate manager still exerts the cost-reducing efforts for each product,
but control over the decision to standardize is now with the business-unit level managers accountable for the revenues (see figure 3). We therefore add a second stage in which each business-unit manager decides whether or not to block standardization. The preceding stages are as before. First, the managers learn about the costs and benefits of the particular standardization opportunity. Second, the corporate manager decides if he wants to standardize. If he does, each business-unit manager then decides whether or not to block standardization. Note that it may now also be optimal to give the business-unit managers a stake in cost savings in order to increase cooperation in standardization initiatives by the corporate manager.

We will show that the incentive costs (that is, the need to mute and broaden incentives) of implementing win-lose synergies – where one business unit suffers from standardization ($\Delta > 0$) and the other not ($\Delta = 0$) – are high unless the corporate manager has control. In contrast, implementing only win-win synergies – where none of the business units suffer from adaptation costs ($\Delta_1 = \Delta_2 = 0$) – can be achieved at no incentive costs. As a result, when effort incentives are not important, it is desirable to implement win-lose synergies and, as we show, corporate control is preferred. As effort incentives become more important, however, it may be optimal to decentralize control to the business-unit level and standardize only if both business-unit managers face no adaptation costs and are willing to go along with standardization. This allows the organization to provide managers with narrowly-targeted incentives (hence reducing manager’s risk exposure), and may generate more surplus than simply letting the corporate manager impose standardization unilaterally.

**Implementing synergies under business-unit control**  Let $\alpha$ and $\gamma$ be the shares the corporate manager receives in respectively costs and revenues of product $i$, $i = 1, 2$, and $\zeta$ and $\beta$ the shares that each business-unit manager receives in respectively cost and revenues of product $i$. We further allow business unit manager $i$, $i = 1, 2$, to get a share $\beta^-$ in the
revenues of business unit $j \neq i$. Given shares $\alpha, \gamma, \beta, \beta^-$ and $\zeta$, the corporate manager initiates standardization if and only if

$$\alpha k > \gamma (\Delta_1 + \Delta_2)$$

and business-unit manager $i$ cooperates with such a standardization initiative if and only if

$$\zeta k/2 > \beta \Delta_i + \beta^- \Delta_j$$

If both managers face low adaptation costs ($\Delta_1 = \Delta_2 = 0$), standardization is always implemented. If only one business unit faces low adaptation costs, standardization is implemented if and only if

$$k > k_{LH} = \max \{2\beta \Delta / \zeta, \gamma \Delta / \alpha\}$$

If both business-unit managers face high adaptation costs ($\Delta_1 = \Delta_2 = \Delta$), standardization is implemented if and only if

$$k > k_{HH} = \max \{2(\beta + \beta^-) \Delta / \zeta, 2\gamma \Delta / \alpha\}$$

Let $\alpha^*, \gamma^*, \beta^*, \beta^-*$ and $\zeta^*$ be the profit maximizing shares under business-unit control. We distinguish two cases:

1) **Only win-win synergies:** If $2\beta^* \Delta / \zeta^* \geq K$, then standardization is implemented only if both managers face low adaptation costs. Profits are given by

$$\pi = (1 - p)^2 K/2 + \frac{v^2 \alpha (2 - \alpha) + v^2 \beta (2 - \beta) - (\alpha^2 + \zeta^2) \sigma_c^2 - (\gamma^2 + \beta^2 + \beta^-)^2 \sigma_r^2}{\Delta}$$

Optimization yields $\alpha^* = \alpha^{**}$, $\beta^* = \beta^{**}$ and $\zeta^* = \gamma^* = \beta^-* = 0$. We refer to this corner-solution as business-unit control with "win-win" synergies.

2) **Business-unit control with win-lose synergies:** If $2\beta^* \Delta / \zeta^* < K$, then $k_{LH} < K$ at the optimum (otherwise $\zeta^* > 0$ cannot be optimal) and, hence, sometimes standardization is implemented even though only one manager faces low adaptation costs. We refer to such standardization as "win-lose" synergies. Expected profits are then given by

$$\pi = (1 - p)^2 K/2 + \frac{2p(1-p)}{K} \int_{k_{LH}}^{K} (k - \Delta) dk + p^2 \int_{k_{HH}}^{K} (k - 2\Delta) dk$$

$$+ v^2 \alpha (2 - \alpha) + v^2 \beta (2 - \beta) - (\alpha^2 + \zeta^2) \sigma_c^2 - (\gamma^2 + \beta^2 + \beta^-)^2 \sigma_r^2$$

In what follows, we will limit attention to the case where $\sigma_c^2 \geq \sigma_r^2 - \epsilon$, with $\epsilon > 0$ but small. In other words, costs/corporate performance measures are at least comparable in terms of

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19 As in the previous section, we restrict attention to symmetric organizations.
noise to revenues/business-unit performance measures. Under this condition, we show that business-unit control with "win-lose" synergies is always dominated by corporate control.

**Proposition 3** If \( \sigma^2_c \geq \sigma^2_r - \varepsilon \) with \( \varepsilon > 0 \) but small, corporate control dominates business-unit control with win-lose synergies.

**Proof:** See Appendix.

The intuition for the above result is that business-unit control typically applies the same threshold for the implementation of "win-lose" standardization (where only one unit has high adaptation costs) as for the implementation "lose-lose" standardization (where both units face high adaptation costs). Indeed, if \( \gamma = \beta^- = 0 \) (which is often satisfied at the optimum) then \( k_{LH} = k_{HH} \). In contrast, under corporate control, \( k_{HH} = 2k_{LH} \). Corporate control is therefore more effective at implementing win-lose standardization.

To see this intuition more formally, let \( \sigma^2_c = \sigma^2_r = 0 \), and assume that \( \beta^* > \gamma^* \) at the optimum (the Appendix provides a complete proof). Since business-unit managers then block standardization too often, that is \( k_{LH} \) and \( k_{HH} \) are above first-best levels, it is optimal to set \( \gamma^* = \beta^- = 0 \). Expected profits under business-unit control are therefore given by

\[
\pi^{BU} = (1 - p)^2 K/2 + \frac{2p(1 - p)}{K} \int_{2\beta^* \Delta/\zeta^*}^{K} (k - \Delta) dk + \frac{p^2}{2} \int_{2\beta^* \Delta/\zeta^*}^{K} (k - 2\Delta) dk
\]

Consider now re-allocating control over standardization decisions to the corporate manager, and let \( \alpha, \gamma, \beta \) and \( \zeta \) be the cost and revenue shares under corporate control, where we set \( \alpha = \beta^*, \gamma = \zeta^*, \beta = \alpha^* \) and \( \zeta = 0 \). Then profits under corporate control are given by

\[
\pi^C = (1 - p)^2 K/2 + \frac{2p(1 - p)}{K} \int_{\beta^* \Delta/\zeta^*}^{K} (k - \Delta) dk + \frac{p^2}{2} \int_{\beta^* \Delta/\zeta^*}^{K} (k - 2\Delta) dk
\]

Inspection of the profit functions \( \pi^{BU} \) and \( \pi^C \) reveals that they are identical, except for the term in \( 2p(1 - p) \), which deals with win-lose synergies. Under business-unit control, win-lose standardization is implemented if and only if

\[
k > 2\beta^* \Delta/\zeta^*
\]

whereas under corporate control, win-lose standardization is implemented if and only if

\[
k > \beta^* \Delta/\zeta^*
\]

Since the first-best rule is \( k > \Delta \) and since \( \beta^*/\zeta^* > 1 \) it follows that corporate control results
in better (win-lose) standardization decisions. Since effort provision and risk-exposure is equivalent under the two structures, corporate control is strictly thus preferred.

By imposing \( \sigma_c^2 \geq \sigma_r^2 - \varepsilon \), we created a level-playing field between business-unit control and corporate control, without restricting ourselves to the knife-edge case where \( \sigma_c^2 = \sigma_r^2 \). In contrast, if say, \( \sigma_c^2 = 0 \) and \( \sigma_r^2 >> 0 \), then, trivially, business-unit control may be preferred over functional control. Indeed, business-unit managers then can be aligned with corporate performance at no incentive cost, whereas aligning corporate managers with overall performance is very expensive. Business-unit control then often results in better decision-making.

**Business-unit control with win-win synergies.** In what follows, we will maintain the assumption \( \sigma_c^2 \geq \sigma_r^2 - \varepsilon \), with \( \varepsilon \) small. A direct consequence of proposition 3 is then that we can then restrict our analysis to organizations that set incentives so only business-unit managers with no standardization costs \( \Delta_i = 0 \), cooperate. While many synergies go unrealized, this organizational structure has the advantage that both business-unit managers and the corporate manager in charge of purchasing can be provided with narrowly-targeted and high-powered incentives that only trade off effort and risk exposure. In particular, the corporate manager only receives a share \( \alpha \) in cost savings and business-unit managers only receive a share \( \beta \) in business-unit revenues, where these shares are set at the second-best level, as in the non-integrated structure:

\[
\alpha^{**} = \frac{v^2}{v^2 + \sigma_c^2}, \quad \beta^{**} = \frac{v^2}{v^2 + \sigma_r^2}.
\]

Standardization occurs with probability \( (1 - p)^2 \), yielding expected synergies of \( (1 - p)^2 K/2 \). Hence, expected profits under business-unit control with win-win synergies equal

\[
\pi = (1 - p)^2 K/2 + v^2 \alpha^{**}(2 - \alpha^{**}) + v^2 \beta^{**}(2 - \beta^{**}) - \alpha^{**2} \sigma_c^2 - \beta^{**2} \sigma_r^2
\]

\[
= \pi^{NI} + (1 - p)^2 K/2.
\]

where \( \pi^{NI} \) are the profits under non-integration.

**Comparative Statics.** Business-unit control with win-win synergies is always strictly preferred over non-integration. The comparative statics of when business-unit control dominates corporate control are very similar to those of when non-integration dominates functional control, the only difference is the impact of an increase in the variance in adaptation cost.

**Proposition 4** If \( (1 - (1 - p)^2)K < 2p\Delta \), there exists values of \( v \), \( \sigma_c^2 \) and \( \sigma_r^2 \) such that business-unit control is strictly preferred over corporate control. Assume \( \sigma_c^2 \geq \sigma_r^2 - \varepsilon \) with \( \varepsilon > 0 \) but small, then corporate control is more likely to be optimal if:

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20 Of course, this is because we have abstracted away from any costs from hiring a functional manager.

21 That is, the following changes in exogenous variables may result in a shift from business-unit control to corporate control, but never the other way around.
• Motivating managers is less important ($v$ is smaller);

• Corporate performance measures are less precise ($\sigma_c^2$ is larger) or business-unit performance measures are more precise ($\sigma_r^2$ is smaller).

• Standardization is more valuable ($K$ is larger)

• Expected adaptation costs $2p\Delta$ are smaller;

• The variance in adaptation costs decreases, keeping average adaptation costs $2p\Delta$ constant.

**Proof:** See Appendix.

In Section 3, we showed that a mean-preserving spread in adaptation costs makes integration (through corporate control) more attractive to non-integration as contingent decision-making is then more valuable. When the choice is between integration through corporate control versus business-unit control, however, the above proposition shows that increasing the variance in adaptation costs favors business-unit control, hence making corporate control less likely to be optimal.

Intuitively, unlike non-integration, business-unit control allows for some contingent decision-making, namely standardization is implemented if both units face low adaptation costs. Moreover, an increase in the variance in adaptation cost now implies that, conditionally on at least one business-unit manager opposing standardization, the (expected) adaptation costs of standardization are larger. Hence, an increase in the variance of adaptation costs reduces the expected value of synergies that are foregone under business-unit control, and therefore makes business-unit control more attractive.

We next show that not only an increase in variance but also in correlation of adaptation costs favors business-unit control.

*Correlation of adaptation costs.* So far, we have assumed that $\Delta_1$ and $\Delta_2$ are independent. In many settings, one would expect the costs of standardization to be correlated across divisions because the impact of a standardization initiative on the business units may be similar. For example, standardization may involve a common product design in one dimension that is a compromise between the ideal product for each business unit. The sensitivity of consumer demand to these changes may be similar across markets and private information of the business-unit managers. Then $\Delta_1$ and $\Delta_2$ will be positively correlated. Let

$$\rho = \Pr(\Delta_i = \Delta | \Delta_j = \Delta),$$

where $\rho \geq p$. Then profits under business-unit control with win-win synergies become

$$\pi = \pi^{NI} + K/2 \left[ (1 - p)^2 + p(\rho - p) \right].$$
The next proposition shows that not only an increase in the variance of adaptation costs (Proposition 4) but also an increase in the correlation of adaptation costs across business units makes business-unit control more attractive.

**Proposition 5** An increase in the correlation of adaptation costs $\rho$ may result in a shift from Corporate Control to Business-Unit Control, but never the other way around.

**Proof.** See Appendix.

To understand this result in more detail, note first that a higher correlation of adaptation costs across business units reduces the incidence of win-lose synergies, where standardization is value-increasing but reduces the profits of one of the business units. Business-unit control is unable to implement such win-lose synergies. Secondly, a higher correlation increases the probability that both business-units are opposed to standardization. Corporate control then often implements standardization even though no (or negative) synergies are present. Business-unit control prevents such value-reducing standardization. Finally, business-unit control and corporate control are equally efficient at implementing win-win synergies, where none of the business-units face adaptation costs. Such win-win synergies are more frequent when the correlation is higher.

5 Extensions

5.1 Strategic Communication

In the main body of the analysis, business-unit managers truthfully report their privately-observed adaptation costs, $\Delta_i$. For a manager who observes $\Delta_i = 0$, it is actually privately optimal to agree to adaptation, as he does not incur any cost from it. In what follows, we study the case in which both the high and low adaptation costs are strictly positive, so that the business-unit manager must be given incentives to be truthful. We extend the model to the case where $\Delta_i = \Delta_H$ with probability $p$ and $\Delta_i = \Delta_L > 0$ with probability $(1 - p)$, for $i = 1, 2$. The need to induce truth-telling requires the business-unit manager to be given a stake $\zeta > 0$ in the cost savings $C_i$ attained through standardization. We focus the analysis for conciseness on the Corporate Control case, although it can similarly be extended to the business-unit control case.

Consider the constraint of a business-unit manager who decides whether or not to truthfully report the cost of lost local adaptation from standardization. When the business-unit manager sends a message to the corporate manager, he does not know the value of cost savings $k$; he must decide what to say based on the distribution of $k$. The business-unit manager who is tempted to lie is $\Delta_L$ because the business-unit manager wants less standardization than the corporate manager whenever incentives are not completely balanced. Figure 4 below shows the value of truth-telling versus lying graphically, conditional on the other manager having drawn $\Delta_L$ as well. By lying, the manager shifts the implementation rule from $k_{LL}$ to
Report $\Delta_L$ truthfully:

\[
\begin{array}{c}
\text{k}_{LL} \\
\text{implement} \\
\text{k}_{LH} \\
\text{implement} \\
\text{k}_{HH}
\end{array}
\]

Lie, pretend $\Delta_H$:

\[
\begin{array}{c}
\text{k}_{LL} \\
\text{implement} \\
\text{k}_{LH} \\
\text{k}_{HH}
\end{array}
\]

Figure 4: Communication choice of a business unit manager who draws $\Delta_L$ when the other manager draws $\Delta_L$. By lying, the manager shifts upwards the threshold value of the standardization savings $k$.

$k_{LH}$ if the other manager is $\Delta_L$ and from $k_{LH}$ to $k_{HH}$ if the other manager is $\Delta_H$. (Recall that $k_{LL} = 2A\Delta_L$ etc.) Truthfully reporting $\Delta_L$ is preferred if:

\[
\begin{align*}
(1-p) \int_{k_{LL}}^{K} \left( \frac{\zeta k}{2} - \beta \Delta_L \right) dk + p \int_{k_{LH}}^{K} \left( \frac{\zeta k}{2} - \beta \Delta_L \right) dk \\
\geq (1-p) \int_{k_{LH}}^{K} \left( \frac{\zeta k}{2} - \beta \Delta_L \right) dk + p \int_{k_{HH}}^{K} \left( \frac{\zeta k}{2} - \beta \Delta_L \right) dk.
\end{align*}
\]

The left-hand side of this inequality is the payoff of correctly communicating $\Delta_L$. In this case, with probability $(1 - p)$ the other agent also reports $\Delta_L$ (the upper choice in Figure 4), in which case the probability of synergies being implemented is the probability that $k > k_{LL}$; while with probability $p$ the other agent reports $\Delta_H$, in which case the probability of synergies being implemented is the probability that $k > k_{LH}$. On the other hand, if the agent lies, the integral is taken over a smaller set of $k$s: in the first case (if, the other agent draws $\Delta_L$) for values $k > k_{LH}$,(the lower ‘pretend’ choice in Figure 4) in the second (when, with probability $p$, the other agent draws $\Delta_H$) over $k > k_{HH}$.

That is, the value of lying is in the increase in the value of $k$ that the corporate manager has to observe before he decides about implementing synergies. For transparency, we focus on the case where $p = \frac{1}{2}$. Then the integrals simplify in the obvious way, and the IC constraint becomes

\[
\int_{k_{LL}}^{k_{HH}} \left( \frac{\zeta k}{2} - \beta \Delta_L \right) dk \geq 0.
\]

or equivalently

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We have two cases. Either $\zeta = 0$, in which case trivially communication is not incentive-compatible, and we have a pooling equilibrium, where no informative communication takes place; or alternatively, $\zeta > 0$ and $\beta$ is such that (18) holds at equality, and communication is incentive-compatible.

Consider first the pooling case. If $\zeta = 0$, there exists only one cutoff $k^{nc}$ such that if $k < k^{nc}$, the corporate manager does not standardize and the business-unit managers can adapt locally, while if the cost savings are high enough, $k > k^{nc}$, the corporate manager standardizes. The cutoff $k^{nc}$ is now the value of cost savings at which the corporate manager is indifferent between standardizing operations or not given the expected loss from adaptation, $\bar{\Delta} = (p\Delta_H + (1-p)\Delta_L)$. That is, $k^{nc}$ solves $\frac{\alpha k}{2} - 2\gamma \Delta = 0$, which implies

$$k^{nc} = \frac{\gamma}{\alpha} 2\Delta = A2\Delta.$$  

And thus the incentive design problem of an organization with corporate control without communication is

$$\pi^{nc} = \max_{A,\alpha,\beta,\zeta} \frac{1}{K} \int_{k^{nc}}^{K} (k - 2\Delta) dk + \alpha(2 - \alpha)v^2 + \beta(2 - \beta)v^2 - [(\alpha)^2 \sigma_c^2 + (\alpha A)^2 \sigma_r^2],$$  

or

$$\pi^{nc} = \max_{A,\alpha} E[K - 2\Delta] + A(2 - A) \frac{1}{2\bar{\Delta}} \bar{\Delta}^2 + \alpha(2 - \alpha)v^2 + \beta(2 - \beta)v^2 - [(\alpha)^2 \sigma_c^2 + (\alpha A)^2 \sigma_r^2] - ((\beta \sigma_r)^2 + (\zeta \sigma_c)^2).$$

The first-order condition with respect to $\alpha$ is identical to the one with full information (13), while the choice of the balance $A$ is analogous to (14):

$$\pi_A = \frac{1}{2\bar{\Delta}} 4\Delta^2 2(1 - A) - 2(\alpha)^2 A \sigma_r^2 = 0.$$  

Now consider the separating case. Clearly, the communication constraint (18) must bind, as otherwise $\zeta$ can be lowered with a decrease in risk and thus an increase in profits. Thus, the organizational problem is

$$\pi^c = \max_{A,\alpha,\beta,\zeta} \left[ E[k - \Delta_1 - \Delta_2] + A(2 - A) \frac{1}{2\bar{\Delta}} E[(\Delta_1 + \Delta_2)^2] + \alpha(2 - \alpha)v^2 + \beta(2 - \beta)v^2 - [(\alpha)^2 \sigma_c^2 + (\alpha A)^2 \sigma_r^2] - ((\beta)^2 \sigma_r^2 + (\zeta)^2 \sigma_c^2) \right]$$

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subject to (18) at equality.

The first thing that is evident from the set-up of the problem is that strategic communication sharpens the trade-off between communication and incentives. To see this, compare the solution of the above problem with the one that would obtain if the two business unit $\Delta_i$'s were observable. The optimization problem would be exactly like (25), except without the communication constraint (18). Trivially (since the constraint is absent) this problem always yields higher profits than the (constrained) (25); moreover, it is easy to check that (25) yields point by point (for all $A, \alpha, \beta$ and $\zeta$) higher profits than (21). To see this, note that the expressions are identical except for the term multiplying $A(2 - A)/2K$. But it is easy to see that this term is higher when decision-making is better: $4\Sigma < E[(\Delta_1 + \Delta_2)^2]$. Since strategic communication plays no role under non-integration, but lowers expected profits under integration, the following result holds.

**Proposition 6** Strategic communication makes integration less attractive, compared to a situation where business-unit managers cannot hide their information. If the integrated organization chooses to induce communication, then the incentive choice is constrained; if it does not, decision-making deteriorates.

Truthful communication is costly in terms of incentives, as it requires distorting the incentives of the business-unit managers to induce truth-telling, but it results in better decision-making, as the standardization decision is taken conditionally on the realized adaptation costs. Intuitively, making the business-unit manager willing to be truthful requires balancing his incentives, by giving him a stake in both business-unit revenues (in order to induce effort) and corporate cost savings from standardization (in order to align objectives). Organizations must choose between strong effort incentives with little information flow between units or weaker effort incentives with better communication.

The following proposition establishes that as the average size of the synergies $K$ increases, as the importance of effort $v$ increases, and as the variance of adaptation costs decreases, inducing communication becomes less attractive to the organization.

**Proposition 7** Consider a set of parameters $\Delta_i, k, v, \sigma_r^2, \sigma_c^2$ such that the organization is indifferent between inducing or not communication in the business-unit managers. Then:

1. An increase in the value of synergies, $K$ or in the value of incentives, $v$, leads to no communication; a decrease in either makes communication preferred.

2. A mean-preserving spread in $\Delta$ makes communication preferred.

3. The move from no communication to communication is accompanied by a discrete drop in effort incentives $\alpha, \beta$, and a decrease in decision-making distortions, $1/A$.

**Proof.** See Appendix.
Finally, it remains to consider the integration versus non-integration decision. Similar results to the ones in Proposition 2 hold. That is, as then, and for the same reasons, the non-integration threshold is lower (non-integration will be more likely to be preferred) if motivating managers is more important ($v$ is larger) and if expected synergies are smaller.

**Proposition 8** Whenever $K/2 < E(\Delta_1 + \Delta_2)$, there exist values of $v, \sigma^2_c$ and $\sigma^2_r$ such that non-integration is strictly preferred to integration. Let $K^*$ be the threshold value for $K$ such that integration is preferred if and only if $K > K^*$, then $K^*$ is smaller if:

- Motivating managers is less more important ($v$ is larger).
- Expected adaptation costs, $E(\Delta_1 + \Delta_2)$, are smaller.

**Proof.** See Appendix.

We can summarize our analysis of this extension as follows. First, the results of our analysis in section 3 become sharper, as communication brings about a new reason to soften managerial incentives, now for both corporate and business-unit managers (rather than only corporate managers). Second, we have obtained some new results concerning when an organization will choose to forego communication from business-unit managers and implement a coarser form of control, in which local managers have strong effort incentives, the information from these local managers is not credible, and corporate managers take standardization decisions without information from the business units.

### 5.2 Bargaining

We have limited the interactions among managers to cheap talk communication of private information. Outcomes might improve if the managers could negotiate over actions and were allowed to make payments contingent on the standardization choice. We do not typically observe managers making payments to other managers within an organization and observe only restricted negotiation in some organizations over transfer prices for goods and services.\(^{22}\) It is still worth exploring how our model responds to the introduction of bargaining. In this section, we extend the model of Section 3 to include a simple bargaining game. We demonstrate that the same trade-offs persist and the first-best still cannot be achieved. Furthermore, we show that transfers and incentive alignment act as substitutes; the optimal organization design is to rely on one or the other to coordinate standardization, but not both.

The new extensive-form game is: (1) each business-unit manager simultaneously makes a monetary offer to the corporate manager; (2) if the corporate manager accepts, he receives the offers and does not standardize; if he rejects the offers, he can standardize or not. In equilibrium, business-unit managers make a positive offer only if adaptation costs are positive.

\(^{22}\)We think it is an open question why we observe extensive bargaining between organizations and very limited bargaining across divisions within an organization. There does not appear to be much research on the issue.
Hence, it is optimal for the corporate manager to accept (positive offers) if he does not plan to implement and reject only if he will implement. Obviously, he never accepts negative offers.

An alternative interpretation of the above game is that managers are bargaining over who controls standardization implementation. If the corporate manager is initially allocated control over standardization implementation (as in Section 3), then the bids are the price that business unit managers are willing to pay to gain control over this implementation. Business-unit managers are then effectively buying no standardization from the corporate manager. If instead the business-unit managers are allocated the control of standardization implementation (as in Section 4), their bids are the price at which they are willing to transfer this control to the corporate manager. Business-unit managers are then selling standardization to the corporate manager.

We go back to $\Delta_i \in \{0, \Delta\}$ and $p \in (0, 1)$, but maintain the assumption that $k$ is private information of the corporate manager and $\Delta_i$ is private to business-manager $i$. We further assume that payments come out of and go into division profits, so that the cost to a business-unit manager of giving $\$1$ to the corporate manager is $\beta$ and the benefit to the corporate manager is $\alpha - \gamma$.

There are two distinct types of equilibria that the organizational designer may choose between: a bargaining equilibrium (B), in which business-unit managers with positive adaptation costs offer transfers to the corporate manager and a no-transfers equilibrium (NT), where business-unit managers never offer any transfers and the organization relies on incentive alignment for implementation decisions.

**Equilibrium** In a bargaining equilibrium, business-unit managers with $\Delta_i = \Delta > 0$ make a positive offer. Since a business-unit manager with $\Delta_i = 0$ will never make a positive offer, it is reasonable that the corporate manager believes that a business-unit manager that makes any positive offer has $\Delta_i = \Delta$. If the corporate manager receives no positive offers, he believes adaptation costs are zero and always standardizes. If he receives one positive offer, $\tau_i$, his cutoff value of $k$ is given by $\alpha k_{LH} - \gamma \Delta = (\alpha - \gamma)\tau_i$, so

$$k_{LH} = (1 - A) \tau_i + A \Delta.$$  

Similarly, if there are two positive offers, the cutoff is

$$k_{HH} = (1 - A) (\tau_i + \tau_j) + 2A \Delta.$$  

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High-adaptation cost business-unit manager $i$ will choose $\tau_i$ to maximize

$$-rac{p}{K} \left[ \int_{(1-A)\tau_i+\tau^*}^{\tau^*} \beta \Delta dk + \int_{0}^{(1-A)(\tau_i+\tau^*)+2A\Delta} \beta \tau_i dk \right]$$

$$- \frac{(1-p)}{K} \left[ \int_{(1-A)\tau_i+\Delta}^{\tau^*} \beta \Delta dk + \int_{0}^{(1-A)\tau_i+\Delta} \beta \tau_i dk \right],$$

where $\tau^*$ is the equilibrium transfer of the other business-unit manager. Taking the first-order condition and imposing symmetry, gives

$$\tau^* = \max \left\{ 0, \frac{\Delta}{2+p} \frac{[1-A(2+p)]}{(1-A)} \right\}.$$ 

This implies

$$\tau^* = 0 \Leftrightarrow A \geq 1/(2+p).$$

Substituting gives the equilibrium cutoff values of $k$

$$k_{LH} = \begin{cases} A\Delta & \text{if } \tau^* = 0 \quad \text{and similarly } k_{HH} = \begin{cases} 2A\Delta & \text{if } \tau^* = 0 \quad \text{if } \tau^* > 0 \end{cases} \end{cases} \frac{A\Delta}{2+p} \frac{[1-A(2+p)]}{(1-A)}.$$ 

Note that if $\tau^* > 0$, the cutoff values are independent of incentive alignment. It follows immediately that introducing bargaining of this form continues to result in excessive implementation relative to the first-best as the cutoffs are below their first-best levels.

In a no-transfers equilibrium, the outcome of the game is as in Section 3. In particular, the corporate manager’s cut-off values for implementation are respectively $k_{LH} = A\Delta$ and $k_{HH} = 2A\Delta$.

The organization’s optimal incentives involve either $A = 0$ or $A \geq 1/(2+p)$. The argument for this is straightforward. In the model, transfers have no costs to the organization while incentives are costly; since the cutoffs are independent of $A$ whenever transfers are positive, the same implementation decisions can be achieved at lower costs by setting $A = 0$. Aligning managers and letting them bargain act as substitute mechanisms to improve implementation.

The optimal structure is either to:

- Set $A = 0$. Effort incentives are not distorted (relative to the second-best) and managers are exposed to less risk, but there is excessive standardization. Bargaining takes place in equilibrium, with transfers $\tau^* = \frac{\Delta}{(2+p)}$.
- Set $A > 1/(2+p)$. In this case incentives costs are higher (more effort distortions or risk exposure) but standardization decisions are closer to first best ($k_{LH}$ and $k_{HH}$ are higher). No bargaining takes place, that is transfers are $\tau^* = 0$.
**Profits**  Bargaining equilibrium \((A = 0)\): Profits are

\[
\pi^B = \max_{\alpha} E[k - \Delta_1 - \Delta_2] + \frac{1}{2 + p} \left( 2 - \frac{1}{2 + p} \right) \frac{1}{2K} E[(\Delta_1 + \Delta_2)^2] + \alpha(2 - \alpha)v^2 - (\alpha \sigma_c)^2.
\]

No-transfers equilibrium \((A > 1/(2 + p))\): Profits are

\[
\pi^{NT} = \max_{\alpha,A} E[k - \Delta_1 - \Delta_2] + A(2 - A)\frac{1}{2K} E[(\Delta_1 + \Delta_2)^2] + \alpha(2 - \alpha)v^2 - ((\alpha \sigma_c)^2 + (\alpha A \sigma_c)^2).
\]

The following proposition states that aligning managers is preferred over bargaining whenever \(\sigma_r\) and/or \(v\) are small, that is whenever incentives are not so important, or balanced incentives are easy to provide:

**Proposition 9**  (i) For \(v\) or \(\sigma_r^2\) sufficiently small, it is optimal to set \(A > 1/(2 + p)\) and have no bargaining/transfers in equilibrium.

(ii) An increase in \(v\) or \(\sigma_r^2\) may result in a shift from a no-transfer equilibrium (with \(A > 0\)) to a bargaining equilibrium (where \(A = 0\)), but never the other way around.

(iii) For \(\sigma_r^2\) sufficiently large, it is optimal to set \(A = 0\) and rely on bargaining to resolve conflicts between managers.

**Proof.**  See Appendix.

We take away three insights from the consideration of bargaining:

First, bargaining, even when it does take place, does not eliminate decision-making distortions. Intuitively, we can think of the business-unit managers buying customization (no standardization) from the corporate manager. Since the benefits and cost of no standardization are private information of respectively buyers (business-unit managers) and seller (corporate manager), this setting is similar to that in Myerson and Satterthwaite (1983), where it is well known that efficient “trade” cannot be achieved (by any mechanism that does not force trade). Basically, as in the monopoly pricing problem with uncertainty about consumers’ valuations, business-unit managers trade off a reduction in the probability of no standardization against a reduction in the transfer to the corporate manager. Higher transfers reduce the probability of standardization, but also reduce the benefits of having no standardization (since transfers are conditional on standardization). Business-unit managers therefore shade their bid, resulting in excess standardization in equilibrium. In addition, since business-unit managers do not bid as a team, each business-unit manager has an incentive to free-ride on the bid of the other manager, further reducing efficiency.

Second, when bargaining takes place, no incentive alignment is used; while if incentives are aligned, transfers are optimally zero. Thus bargaining and incentive alignment are substitutes. Third, as a result, if incentive alignment is very costly (when \(v\) or \(\sigma_r\) are high) then the organization prefers not to align incentives and allow business-unit managers to ‘buy’ the corporate manager’s consent; if, conversely, providing incentives is not hard (when those parameters are low) then the organization chooses to align business-unit managers and...
corporate managers interests more closely; this leads to smaller incentives distortions at a moderate incentive cost.

The message of both extensions broadly reinforces the message of the rest of the analysis, and adds some insights. Strategic communication strengthens the incentive coordination trade-off, as business-unit managers with high-powered incentives choose to misrepresent their adaptation costs. Bargaining does not eliminate the incentive and decision-making trade-off: if incentives are relatively cheap to provide, bargaining in fact does not take place in equilibrium; if they are hard to provide, it does, but at a cost in terms of decision-making distortions.

6 Conclusion

Organizations exist to coordinate complementary activities in the presence of specialization. Specialization expands the production frontier but results in organizational challenges. In particular, since agents are in charge of a narrower set of activities, their objectives also become narrower if they are paid based on their own performance. In this paper, the purpose of organizational design is to govern this trade-off. Employing a corporate manager specialized in identifying synergies potentially increases the production possibilities. However, ensuring coordination between this manager and business-unit managers requires muting and broadening incentives. As a result, the organizational costs of coordination may exceed the corporate cost savings. Thus our paper integrates the coordination and motivation problems that result from trying to integrate multiple business units to extract synergies.

A wide range of organizational design problems revolve around trade-offs between providing local incentives and encouraging coordination among units. For example, extending the vertical scope of a firm can improve coordination by placing linked units under common control, but probably only at the cost of diluting incentives within links of the vertical chain. Similarly, grouping tasks into jobs and these into units involves trading off measurability by grouping similar jobs and tasks together, which enhances incentive provision, against achieving coordination, which requires grouping jobs and tasks that need to be coordinated with each other. Coordination and incentives should also be considered together when designing transfer prices, internal labor markets, the managerial hierarchy, or the internal allocation of capital. Most of the literature, however, considers coordination and incentive problems separately.23

Integrating both problems highlights the limits of purely ‘structural’ solutions to the coordination problem. Simply integrating two units and placing a common manager in charge is not enough. The incentives of the manager, and of those communicating to the manager

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23 Three recent exceptions are Friebel and Raith (2007), Rantakari (2008) and Van den Steen (2006). The first two study, in different contexts, the interaction between incentives for effort and the incentives to accurately communicate information needed for coordination. Van den Steen shows how, in a world with differing priors, motivation and coordination impose conflicting demands on the allocation of authority.
must be aligned as well. Otherwise, as we show, decision-making will be too biased, and communication will not be truthful, as agents try to influence decisions in their favor.  

Our model allows us to characterize the extent to which organizational costs constrain the ability of firms to capture synergies through integration. When synergies are large and well-known, the organizational designer need not worry about when and whether the implementation of standardization is value-increasing. As a result, it is possible for the organization to keep high-powered incentives without fearing the resulting conflicts, and a large share of the potential synergies may be captured though integration of previously separate units. Instead, if contingent decision-making is important, where standardization must be decided on a case-by-case basis, it is harder to capture synergies; managers’ incentives must be sufficiently aligned to ensure efficient decision-making and truthful communication. This requires muting and broadening incentives, thereby reducing the gains from integration.

We also study ‘business-unit control’, where corporate managers may propose standardization but can not implement it without the consent of the business units. This design can succeed at weakening the trade-off between coordination and motivation. We show that this structure is only efficient at implementing win-win standardization – the corporate manager cannot impose synergies when at least one of the business units is opposed to standardization. But it can implement win-win synergies at relatively low incentive costs, as there is no need to align the corporate manager by muting and broadening his incentives. As a result, the choice between business-unit control and corporate control presents organizations with a trade-off between efficiently implementing synergies and providing strong local incentives. It follows that when incentives are not too important, corporate control is always preferred; when they are important, business-unit control may be chosen. Similarly, activities whose performance cannot be easily measured are better candidates to be put under corporate control. We have further shown that an increase in the variance or correlation of adaptation cost favors business-unit control, a result which potentially can be tested empirically.

The different effects of corporate authority and business-unit control in hybrid organizations are illustrated clearly by Jacobs Suchard’s attempt to capture synergies in the late 1980s. Suchard was a European coffee and confectionery company which had a decentralized organizational structure with largely independent business units organized around products and countries run by a general manager. As in our model, the non-integrated structure facilitated measurement and strong local incentives, but made cross-country synergies hard to capture. The tariff reductions, open borders, and standardization of regulation of the up-

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24 The importance of aligning incentives in addition to reorganizing is dramatically illustrated by the reaction of the FBI to the first World Trade Center attack in 1993. The FBI was structured in a decentralized way around field offices and it determined that this structure served the counterterrorism task poorly. It thus created a separate Counterterrorism and Counterintelligence Division “intended to ensure sufficient focus on these two national security missions.” However, the FBI changed neither the career incentives nor the authority of the local offices, and by all accounts, it captured very few between-office synergies particularly in counterterrorism. (National Commission on Terrorist Attacks upon the United States, Staff Statement No. 9: “Law Enforcement, Counterterrorism, and Intelligence Collection in the United States Prior to 9/11.”)

25 What follows comes from Eccles and Holland (1989).
coming 1992 European integration created the opportunity for Jacobs Suchard to achieve cost savings by combining manufacturing plants across countries and global marketing initiatives.

The company planned to shift from nineteen plants to six primary plants that would serve all of Europe. General managers were to lose responsibility for manufacturing, but maintain control of sales and marketing. Profit measurements for business units would be based on transfer prices from the manufacturing plants. The manufacturing unit’s decisions appear to have created significant conflict with the business units.

Suchard tried a different approach to attain marketing synergies than its approach to manufacturing synergies. It appointed “global brand sponsors” for each of the five major confectionery brands. General managers of geographically-defined business who were given the additional responsibility to promote their brands globally, develop new products, and standardize brands and packaging across countries. However, control remained with the country general managers; the sponsors could only suggest standardization initiatives. Many of the sponsors’ suggested initiatives appear to have gone unheeded by the business-unit managers.26

An extension of our paper allows us to illuminate an important open question in organizational design—why do organizations limit the amount of bargaining between units, and the extent to which managers can compensate other units financially for changing the decisions they make? We show that, when incentives are costly to provide, and thus incentive alignment is expensive, bargaining may be indeed preferred. Decision-making will be distorted (as bargaining under asymmetric information involves payments that are ‘too low’) but high powered incentives will be preserved. However, if incentive alignment is relatively cheap, it is more efficient to broaden the incentives of the corporate manager. Even if allowed, no bargaining then occurs in equilibrium. This substitutability between bargaining and alignment suggests a new avenue to explore on the classic ‘firms versus markets’ question—the choice between incentive alignment plus communication versus bargaining and lump-sum transfers.

Our analysis yields several testable empirical implications. Mergers in which the merging companies have (pre-merger) high-powered incentives are more likely to fail. Since achieving synergies requires muting incentives, the motivation/coordination trade-off will be largest in these cases. As a result, we expect such mergers to be subject to a more stringent test in terms of the profit threshold required for a merger to go ahead. Additionally, contingent decision-making may be important when there are many small decisions that must be taken that may lead to synergies, rather than a small number of key, large decisions. This suggests an explanation for the fact that cost synergies are easier to realize than revenue synergies. Cost synergies often involve a few key consolidation and standardization decisions, while revenue synergies (for example through cross-selling) may require repeatedly determining the

26 Although we cannot say if the organizational changes were good decisions or not, it is clear that the benefits from the attempt to create cross-border synergies did not come without costs. These costs take the form that is the focus of this paper—poorer coordination and incentives within business units, increased conflict from centralized decision-making, and the communication costs that go with it.
benefits and costs of combined offerings. Our model also has empirical implications for the breadth of the managerial incentives used. While corporate managers need broad incentives to take into account business-units’ objectives when they have the ultimate decision-making authority over synergies, they should have higher powered but focused incentives (e.g. based on accounting measures of costs in their own unit, rather than firm-wide profits) when the business-unit managers retain authority over key decisions. Finally, our model has a broader implication for empirical work: the size of incentive pay is a bad proxy for how high-powered incentives are. The relation between effort level or motivation, risk, and coordination incentives is more subtle than a simple risk-incentive trade-off. Functional managers with broad incentives may have a larger overall risk exposure, as we have shown, than narrowly-motivated corporate managers, and yet the former have lower effort incentives and lower motivation than the latter.

We view this paper as a starting point towards a deeper exploration of the way organizational structure can be designed to facilitate coordination while maintaining incentives. Much remains to be done. We have sought to present the simplest possible model involving the four elements we consider critical: coordination, adaptation, effort incentives and (strategic) communication. In doing this, we have drastically simplified incentive and information structures. Future work should explore the robustness of the model to larger, more complex organizations with richer incentive and information structures. It may also explore how other organizational design options, like centralized conflict resolution where senior management resolves disputes between corporate and business-unit managers, can allow organizations to capture synergies.

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27 According to a McKinsey study, some 70% percent of mergers fail to achieve expected revenue synergies, versus 35% fail to achieve cost synergies (Early, Steward “New McKinsey research challenges conventional M&A wisdom”, Strategy & Leadership, 2004, 32 (2): 4 - 11). See also the detailed studies in Kaplan (2000).
REFERENCES


A Appendix

Throughout the analysis, we have ignored the impact that uncertainty over the costs and benefits of standardization has on the risk-averse managers’ utility. In this Appendix, we show that this assumption can be formally justified by assuming that there are an infinite number of small independent standardization choices rather than one big standardization decision.

Consider a variant of our model where there are $N$ standardization opportunities, each of which, if implemented, results in revenue losses $\Delta_{it}/N$ in business unit $i$ and total cost savings $k_t/N$, $t \in \{1, ..., N\}$, where for all $t$, $\Delta_{it} = \Delta$ with an independent probability $p$ and 0 otherwise, and where for all $t$, $k_t$ is independently and normally distributed on $[0, K]$. The normalization of standardization gains and losses by $N$ ensures that the expected value of always implementing standardization remains given by $K/2 - 2p\Delta$, as in our basic model.

As in our basic model, profits (gross of wages), can then be written as $\sum_i (R_i - C_i)$, but now

$$R_i = \nu r_i + \varepsilon_{ri} - \sum_{i=1}^{i=N} \frac{\Delta_{it}}{N} I_t$$
$$C_i = C - \nu r_i + \varepsilon_{ri} - \sum_{i=1}^{i=N} \frac{k_{it}}{N} I_t$$

with

$$I_t = \begin{cases} 0 & \text{if no standardization;} \\ 1 & \text{if standardization.} \end{cases}$$

Managers are further risk-averse with CARA utility and a zero reservation wage.

The following proposition states that, as $N$ goes to infinity, the above model yields the same expected profit function as our basic model, even though decision-risk is explicitly taken into account:

**Proposition:** Let $\pi^I$ denote expected profits net of wages under integration, and let $\alpha$ and $\gamma$ be the shares given in respectively $C_i$ and $R_i$ to the corporate manager and $\zeta$ and $\beta$ those to the business unit managers, then

$$\lim_{N \to \infty} \pi^I = E[(k_t - \Delta_{1t} - \Delta_{2t})|I_t = 1] \times Pr[I_t = 1]$$
$$+ v^2 \alpha (2 - \alpha) + v^2 \beta (2 - \beta) - (\sigma_{\nu} \alpha)^2 - (\sigma_{\nu} \beta)^2 - (\mu \gamma)^2 - (\zeta \mu)^2$$

(26)

**Proof:** Managers must be rewarded for their effort and compensated for their risk exposure. When making standardization choice $I_t$, the corporate manager faces no uncertainty anymore and, hence, he will standardize if and only if $\alpha k_t > \gamma (\Delta_{1t} + \Delta_{2t})$, a rule which is independent
of $N$. Applying the law of large numbers, we then have that
\[
\lim_{N \to \infty} \sum_{i=1}^{i=N} \frac{k_{it}}{N} I_t = E(k_{it}|I_t = 1) \ast \Pr[I_t = 1]
\]
and
\[
\lim_{N \to \infty} \sum_{i=1}^{i=N} \frac{\Delta_{it}}{N} I_t = E(\Delta_{it}|I_t = 1) \ast \Pr[I_t = 1]
\]
and, hence
\[
\lim_{N \to \infty} \text{var} \left( \sum_{i=1}^{i=N} \frac{\Delta_{it}}{N} I_t \right) = \lim_{N \to \infty} \text{var} \left( \sum_{i=1}^{i=N} \frac{k_{it}}{N} I_t \right) = 0.
\]
It follows that, in the limit as $N$ goes to infinity, $R_i$ and $C_i$ are Normally Distributed with variance $\sigma_r^2$ and $\sigma_c^2$ respectively. For given shares $\alpha$, $\gamma$, $\beta$ and $\zeta$, expected profits, net of wages, are therefore given by
\[
\lim_{N \to \infty} \pi^I = \sum_i \left( E[R_i - C_i] - \frac{1}{2}(e_{c1}^*)^2 - \frac{1}{2}(e_{r1}^*)^2 - \frac{1}{2}(\sigma_c\alpha)^2 - \frac{1}{2}(\sigma_r\beta)^2 - \frac{1}{2}(\sigma_r\gamma)^2 - \frac{1}{2}(\zeta\sigma_c^2)^2 \right).
\]
Substituting optimized effort levels this yields (26). QED.

**B Appendix**

**Proof of Proposition 2.** (i) We first show that if $K/2 < E[\Delta_1 + \Delta_2]$, then non-integration is optimal provided that $v$ and $\sigma_r$ are sufficiently large.

(ii) If $\sigma_r^2$ goes to infinity, then non-integration is optimal provided that $v$ is sufficiently large. Indeed, note that $\lim_{\sigma_r \to \infty} \gamma = \beta = 0$ and thus also $\lim_{\sigma_r \to \infty} A = 0$. Denoting profits under non-integration as $\pi^{NI}$ and under integration as $\pi^I$, then
\[
\lim_{\sigma_r \to \infty} \pi^I - \lim_{\sigma_r \to \infty} \pi^{NI} = \frac{K}{2} - E(\Delta_1 + \Delta_2) - \left[ v^2(2 - \alpha) - (\alpha)^2 \sigma_c^2 \right],
\]
where, from the first-order conditions, $\alpha = 2v^2/(\sigma_c^2 + 2v^2)$. Since $\frac{K}{2} < E(\Delta_1 + \Delta_2)$, the above expression is negative if $v$ is sufficiently large.

(iib) Similarly, if $v$ goes to infinity, non-integration is optimal provided that $\sigma_r^2$ is sufficiently large. Indeed, note that $\lim_{v \to \infty} \alpha = 1$ and thus
\[
\lim_{v \to \infty} \pi^I - \lim_{v \to \infty} \pi^{NI} = \frac{K}{2} - E(\Delta_1 + \Delta_2) + A(2 - A) \left( \frac{\psi}{2K} \right) - (\gamma)^2 \sigma_r^2,
\]
where $\psi = E[(\Delta_1 + \Delta_2)^2]$ and
\[
\lim_{v \to \infty} A = \lim_{v \to \infty} \gamma = \frac{1}{1 + \frac{K}{\psi} \sigma_r^2}.
\]
It follows that
\[
\lim_{v \to \infty} \pi^I - \lim_{v \to \infty} \pi^{NI} = \frac{K}{2} - E(\Delta_1 + \Delta_2) + \frac{\psi}{2K} \left( \frac{\psi}{\pi} + \sigma_r^2 \right).
\]

Since \( \frac{K}{2} < E(\Delta_1 + \Delta_2) \), the above expression is negative if \( \sigma_r^2 \) is sufficiently large.

(ii) To prove the comparative statics, it is sufficient to show that \( d(\pi^{NI} - \pi^I)/dt > 0 \) for \( t \in \{v, 1/\sigma_c^2, \sigma_c^2, -K, \Delta, p\} \). Recall that
\[
\pi^{NI} = v^2\alpha(2 - \alpha) + v^2\beta(2 - \beta) - (\sigma_c^2(\alpha)^2 + \sigma_r^2(\beta)^2).
\]

Since \( d\pi^{NI}/dK = 0, d\pi^{NI}/d\Delta = 0 \) and \( d\pi^{NI}/dp = 0 \), we only need to show that \( d\pi^I/dK > 0, d\pi^I/d\Delta < 0 \) and \( d\pi^{NI}/dp < 0 \). Using the envelope theorem, we have that
\[
\frac{d\pi^I}{dK} = \frac{\partial \pi^I}{\partial K} = \frac{1}{2} - \frac{1}{2K} E((\Delta_1 + \Delta_2)^2) A(2 - A) > \frac{1}{2} - \frac{1}{2} A(2 - A) > 0.
\]

Following the same argument, \( d\pi^I/d\Delta < 0 \) and \( d\pi^{NI}/dp < 0 \). Consider now the comparative statics with respect to \( v \). Again, using the envelope theorem, and abusing notation, both under integration and non-integration
\[
d\pi/dv = 2v\alpha(2 - \alpha) + 2v\beta(2 - \beta).
\]

Under integration, \( \alpha \) is given by (13) where \( A > 0 \). Under non-integration, \( \alpha \) is given by (13) with \( A = 0 \). It follows that \( \alpha \) is always smaller under integration than under non-integration. Since \( \beta \) is not affected by the integration decision, it thus follows that \( d\pi/dv \) is larger under non-integration than under integration. Finally, consider comparative statics with respect to \( \sigma_c^2 \) and \( \sigma_r^2 \). Using the envelope theorem, \( d\pi/d\sigma_c^2 = -\alpha/2 \) where \( \alpha \) is again higher under non-integration. Similarly \( d\pi/d\sigma_r^2 \) equals \(-A\alpha + \beta)/2 \) under integration and \(-\beta/2 \) under non-integration, where the optimized value of \( \beta \) is identical under both structures. Since \( A\alpha \) is strictly positive, it follows that \( d\pi/d\sigma_r^2 \) is larger under non-integration. QED

**Proof of Proposition 3.** We show that corporate control strictly dominates business unit control with win-lose synergies whenever \( \sigma_c^2 \geq \sigma_r^2 \). By continuity, the same it true for \( \sigma_c^2 \geq \sigma_r^2 - \varepsilon \), with \( \varepsilon > 0 \). Let \( \alpha^*, \gamma^*, \beta^*, \beta^-^* \) and \( \zeta^* \) be the shares that maximize profit function (15). For there to be win-lose synergies, it must be that \( 2\beta^*\Delta/\zeta^* < K \). We distinguish two cases.

(1) Consider first \( \beta^* \geq \zeta^* \) and thus \( 2\Delta \leq 2\beta^*\Delta/\zeta^* \). Then profits are maximized by setting \( \gamma = 0 \) and \( \beta^- = 0 \) such that \( k_{LH} = k_{HH} = 2\beta\Delta/\zeta > 2\Delta \). Optimization further yields \( \alpha = \alpha^{**} \).
and, as in the proof of proposition 3, one can show that $\beta^* \leq \beta^{**} = \alpha^{**} = \alpha^*$. Hence,

$$\pi = (1-p)^2 K/2 + \frac{2p(1-p)}{K} \int_{2\beta^* \Delta/\zeta^*}^{K} (k - \Delta) \, dk + p^2 \int_{2\beta^* \Delta/\zeta^*}^{K} (k - 2\Delta) \, dk$$  \hspace{1cm} (27)$$

$$+ v^2 \alpha^* (2 - \alpha^*) + v^2 \beta^* (2 - \beta^*) - (\alpha^{**^2} \sigma_c^2 + \beta^{**^2} \sigma_f^2 + \zeta^{**^2} \sigma_c^2)$$  \hspace{1cm} (28)$$

Consider now corporate control with incentives $\alpha = \beta^*, \beta = \alpha^*, \gamma = \zeta^*$ and $\zeta = 0$. This yields expected profits

$$\pi = (1-p)^2 K/2 + \frac{2p(1-p)}{K} \int_{\beta^* \Delta/\zeta^*}^{K} (k - \Delta) \, dk + p^2 \int_{\beta^* \Delta/\zeta^*}^{K} (k - 2\Delta) \, dk$$  \hspace{1cm} (29)$$

$$+ v^2 \alpha^* (2 - \alpha^*) + v^2 \beta^* (2 - \beta^*) - (\beta^{**^2} \sigma_c^2 + \alpha^{**^2} \sigma_f^2 + \zeta^{**^2} \sigma_c^2)$$  \hspace{1cm} (30)$$

Note first that effort provision is equivalent under both structures. Second, since $\alpha^* \geq \beta^*$ and $\sigma_c^2 \geq \sigma_f^2$, the risk-premium is weakly lower than under business-unit control (with equality if and only if $\sigma_f^2 = \sigma_c^2$). Finally, since $\Delta \leq \beta^* \Delta/\zeta^* < 2\beta^* \Delta/\zeta$, decision-making is more efficient than under business-unit control whenever only one business-unit faces high adaptation costs (win-lose synergies). Since $\beta^* > 0$ at the optimum, it follows that corporate control strictly dominates business-unit control whenever $\sigma_c^2 > \sigma_f^2$.

2) Second, consider $2\beta^* \Delta/\zeta^* < 2\Delta$ and thus $\beta^* < \zeta^*$. An upperbound for (15) is then given by

$$\bar{\pi} = (1-p)^2 K/2 + \frac{2p(1-p)}{K} \int_{k_{LL}}^{K} (k - \Delta) \, dk + p^2 \int_{k_{LL}}^{K} (k - 2\Delta) \, dk$$

$$+ v^2 \alpha^{**} (2 - \alpha^{**}) + v^2 \beta^{**} (2 - \beta^{**})$$

$$- (\alpha^{**^2} + \zeta^{**^2}) \sigma_c^2 - (\beta^{**^2} + \beta^{-2} + \gamma^{**^2}) \sigma_f^2$$  \hspace{1cm} (31)$$

where $\alpha^{**}$ is the second-best cost share and $k_{LL} = \max \{2\beta^* \Delta/\zeta^*, \gamma^* \Delta/\alpha^*\}$ and $k_{HH} = \max \{2(\beta^* + \beta^{-*}) \Delta/\zeta^*, 2\gamma^* \Delta/\alpha^*\}$.

Consider now corporate control with incentives $\alpha, \gamma, \beta, \zeta$, where we set $\alpha = \gamma = \beta^*, \beta = \alpha^*$ and $\zeta = 0$. This yields expected profits

$$\pi = (1-p)^2 K/2 + \frac{2p(1-p)}{K} \int_{\Delta}^{K} (k - \Delta) \, dk + p^2 \int_{\Delta}^{2\Delta} (k - 2\Delta) \, dk$$

$$+ v^2 \beta^* (2 - \beta^*) + v^2 \alpha^{**} (2 - \alpha^{**})$$

$$- \beta^{**^2} \sigma_c^2 - (\alpha^{**^2} + \beta^{**^2}) \sigma_f^2$$  \hspace{1cm} (32)$$
Note first that, since $\beta^* < \zeta^*$ (by assumption) and $\sigma_r^2 \geq \sigma_c^2$, hence the third line in expression (31) is strictly more negative than the third line in expression (32). Second, effort provision (second line) is equivalent. Finally, corporate control uses a first-best decision-rule for standardization decisions, hence also the first line in (32) is larger than the first line in expression (31). It follows that whenever $\sigma_r^2 \leq \sigma_c^2$, corporate control strictly dominates business-unit control with win-lose synergies. QED

Proof of Proposition 4. The proof of statement (i) and the comparative statics with respect to to $v, \sigma_r^2, \sigma_c^2, \text{and } \Delta$ are identical as for the proof of Proposition 2. Consider now the comparative statics with respect to to $K$. Using the envelope theorem, we have that

$$\frac{d\pi}{dK} = \frac{1}{2} - A(2 - A) \left( \frac{\psi}{2K^2} \right)$$

under corporate control and $d\pi/dK = (1 - p)^2/2$ under business-unit control. Hence, $d\pi/dK$ is larger under corporate than under business-unit control if and only if

$$\frac{1}{2} \left[ 1 - (1 - p)^2 \right] - \frac{1}{2} A(2 - A) \left( \frac{\psi}{K^2} \right) > 0,$$

where $A$ is the optimized bias under corporate control. Since $K \geq 2\Delta$,

$$A(2 - A) \left( \frac{\psi}{K^2} \right) < \frac{2p(1 - p)\Delta^2 + p^2 \Delta^2}{K^2} < \frac{1}{2} p(1 - p) + p^2 < (1 - (1 - p)^2),$$

so that (33) is indeed satisfied. Consider, finally, changes in $p$, leaving $p\Delta$ and thus $E(\Delta_1 + \Delta_2)$ fixed. Using the envelope theorem, under corporate control

$$\frac{d\pi}{dp} = A(2 - A) \frac{\partial E((\Delta_1 + \Delta_2)^2)}{\partial p} = A(2 - A) \frac{2(1 + 2p)\Delta^2}{K^2} > 0.$$

whereas under business-unit control $d\pi/dp = -2(1 - p)K/2 < 0$. QED.

Proof of Proposition 5. When adaptation costs are correlated, one can verify that profits under integration through corporate control are still given by (11), but now

$$E((\Delta_1 + \Delta_2)^2) = 2(1 + \rho)p\Delta^2.$$

Applying the envelope theorem, it follows that under integration through corporate control

$$\frac{d\pi}{d\rho} = A(2 - A) \frac{1}{2K} 2p\Delta^2.$$
Since $A < 1$ and $K > 2\Delta$, we have that under corporate control
\[
\frac{d\pi}{dp} < p \frac{1}{2K} 2\Delta^2 < p \frac{K}{4}.
\]
In contrast, under integration through business-unit control
\[
\frac{d\pi}{dp} = \frac{K}{2} p.
\]
QED.

**Strategic communication.** Before comparing the integration and non-integration profits when communication is strategic, we compare the incentive levels both with and without communication. The following lemma obtains the necessary result.

**Lemma 1** Effort incentives under integration are lower than under non-integration for a given $v_\gamma, \sigma_c, \sigma_r$.

**Proof.** The incentives under non-integration are the solution to:
\[
\pi = \max_{\alpha, \beta} v^2 \alpha(2 - \alpha) + v^2 \beta(2 - \beta) - (\sigma_c \alpha)^2 - (\sigma_r \beta)^2,
\]
with first-order conditions
\[
\frac{v^2}{\sigma_c^2} = \frac{\alpha}{1 - \alpha}; \quad \text{and} \quad \frac{v^2}{\sigma_r^2} = \frac{\beta}{1 - \beta}, \tag{34}
\]
\[
\frac{v^2}{\sigma_r^2} = \frac{\beta}{1 - \beta}. \tag{35}
\]
While under integration they depend on whether communication is or not possible.

(1) If communication is possible, the incentive design solves the following problem (recall the IC constraint is $\frac{\zeta \gamma}{\beta \alpha} \geq \frac{2\Delta_L}{\Delta_H + \Delta_L}$):
\[
\pi_c = \max_{A, \alpha_f, \alpha_{bu}, \beta_{bu}} E[k - \Delta_1 - \Delta_2] + A(2 - A) \frac{1}{2K} E[(\Delta_1 + \Delta_2)^2] + \alpha(2 - \alpha)v^2 + \beta(2 - \beta)v^2 - (\alpha \sigma_c)^2 - (\alpha A^2) \sigma_r^2, \tag{36}
\]
\[-(\beta \sigma_r)^2 + (\zeta \sigma_c)^2 + \lambda \left( \frac{\zeta \gamma}{\beta \alpha} - \frac{2\Delta_L}{\Delta_H + \Delta_L} \right), \tag{37}
\]
with the first-order conditions for $\alpha$ and $\beta$
\[
\frac{v^2}{\sigma_c^2} = \frac{1}{4(\sigma_c^2 + (A)^2 \sigma_r^2)} \frac{2\Delta_L}{\Delta_H + \Delta_L} \frac{1}{\alpha(1 - \alpha)} \tag{39}
\]
\[
\frac{v^2}{\sigma_r^2} = \frac{1}{4} \frac{2\Delta_L}{\Delta_H + \Delta_L} \frac{1}{\beta(1 - \beta)}. \tag{40}
\]
Note that we only present the two first-order conditions for effort incentives; there are two more, but they are not necessary for this argument. Now note that the right-hand side of (34) is the same as that of (39) and the right-hand side of (35) is the same as that of (40). Now look at the left-hand sides. In each case it is unambiguously smaller. In (39) the denominator is larger (A is positive, as it is the ratio between two positive numbers; that both $\alpha$ and $\gamma$ are positive is trivial to verify), and then a positive quantity ($\lambda$ is positive if the communication constraint is binding) is subtracted. Thus $\alpha$ must be smaller, as incentives are now more costly for two reasons: first, decisions matter, and thus incentives must be more balanced (the ‘larger denominator’ term, which is a consequence of $A$, alignment) and communication must be incentivized (the $\lambda$ term)— higher powered incentives make communication non-credible.

(2) If communication is not possible, incentives are the solutions to

\[
\pi_{nc} = \max_{A,\alpha,r,\beta} E[K - 2\Delta] + A(2 - A)\frac{4}{2K}\Delta^2 + \alpha(2 - \alpha)v^2 + \beta(2 - \beta)v^2 - [(\alpha\sigma_c)^2 + (\alpha A)^2\sigma_r^2] - (\beta\sigma_r)^2,
\]

with first-order conditions for $\alpha$:

\[
\frac{v^2}{(\sigma_c^2 + (A)^2\sigma_r^2)} = \frac{\alpha}{1 - \alpha} \quad \text{and} \quad \frac{v^2}{\sigma_r^2} = \frac{\beta}{1 - \beta}.
\]

Clearly here incentives for the corporate manager are lower under integration, for the first reason above: the denominator is larger, as there is an extra term in the marginal cost of incentives, coming from decision-making incentives. QED.

**Proof of Proposition 7.** 1. Consider first the impact of an increase in $K$. Using the envelope theorem, and since $K$ does not enter the communication constraint (18), we have:

\[
\frac{d\pi^c}{dK} - \frac{d\pi_{nc}}{dK} = -\frac{1}{2} \left( A^c(2 - A^c)E[(\Delta_1 + \Delta_2)^2] - A_{nc}(2 - A_{nc})4\Delta^2 \right) < 0,
\]

where the inequality follows from $A^c > A_{nc}$ and $E[(\Delta_1 + \Delta_2)^2] > 4\Delta^2$.

2. As for $v$, again applying the envelope theorem (again $v$ does not enter in the communication constraint).

\[
\frac{d\pi^c}{dv^2} - \frac{d\pi_{nc}}{dv^2} = \alpha^c(2 - \alpha^c) + \beta^c(2 - \beta^c) - \alpha_{nc}(2 - \alpha_{nc}) - \beta_{nc}(2 - \beta_{nc}) < 0,
\]

since, as we have shown, communication induces lower powered incentives, $\alpha^c < \alpha_{nc}$ and $\beta^c < \beta_{nc}$.

3. To see the impact of an increase in the mean-preserving spread, $\Delta_H - \Delta_L$ simply note
(applying the envelope theorem) that, while the no communication profits are unaffected, the
profits under communication are increasing in $E[(\Delta_1 + \Delta_2)^2]$. Moreover, for given $\beta, \zeta, \alpha, \gamma$
the communication constraint $\frac{\zeta \gamma}{\beta \alpha} > \frac{2 \Delta_L}{\Delta_H + \Delta_L}$ is easier to satisfy when the spread increases,
and thus $\pi^c$ unambiguously increases in $\Delta_H - \Delta_L$. QED

Proof of Proposition 8. (i) This is immediate. Proposition 2 shows this is the case when
communication is non-strategic. Proposition 6 shows that the performance of the integrated
structure becomes worse when communication is strategic.

(ii) We proceed as in Proposition 2: To prove the comparative statics, it is sufficient to
show that $d(\pi^N - \pi^I)/dt > 0$ for $t \in \{v, -K, \Delta_H + \Delta_L\}$. Recall that

$$
\pi^N = \nu^2 \alpha(2 - \alpha) + v^2 \beta(2 - \beta) - (\sigma_c \alpha)^2 + (\sigma_r \beta)^2.
$$

Consider now the comparative statics with respect to $E_k = \frac{K}{2}$. Since $d\pi^N/dK = 0$, it
suffices to show $d\pi^I/dK > 0$. $K$ does not enter the constraint, and we can apply the envelope
theorem (see the proof of Proposition 2) to show $d\pi^I/dK > 0$.

Consider now the impact an increase in the average adaptation costs, $\Delta = (\Delta_H + \Delta_L)/2$
(holding the variance constant). First, $d\pi^N/d\Delta = 0$. The term $d\pi^I/d\Delta$ with no communi-
cation is negative: local adaptation is a net cost and decreases synergies and profits (as in
the proof of Proposition 2). With communication $d\pi^I/d\Delta$ has two components: the direct
effect, which is again trivially as in Proposition 2 ($d\pi^I/d\Delta < 0$: if costs of local adaptation
are higher, the synergies are lower and so are profits. Second, the truth telling constraint
is harder to satisfy when local adaptation is more costly. To see this, write $\Delta_L = \Delta - \delta$
and $\Delta_H = \Delta + \delta$. Then the IC constraint is $\left(\frac{\zeta \gamma}{\beta \alpha} - \frac{\Delta - \delta}{\Delta + \delta}\right)$, and $d \left(\frac{\zeta \gamma}{\beta \alpha} - \frac{\Delta - \delta}{\Delta + \delta}\right) / d\Delta < 0$
(the constraint is harder to meet). Formally, since $\lambda > 0$, this term is also negative, thus
$d\pi^I/d\Delta < 0$.

Finally, consider the effect of $v$. Using the envelope theorem we have that

$$
\frac{d\pi^I}{dv} = 2v(\alpha^I(2 - \alpha^I) + \beta^I(2 - \beta^I))
$$

$$
< 2v(\alpha^{NI}(2 - \alpha^{NI}) + \beta^{NI}(2 - \beta^{NI})) = \frac{d\pi^{NI}}{dv}.
$$

Where the inequality proceeds immediately from Lemma 1 (incentives are lower in the
non-integrated structure). QED

Proof of Proposition 9. (i) Since $\pi^{NT}$ approaches first-best profits when $\sigma_r$ and $v$ go to
zero, whereas excessive standardization is implemented in a bargaining equilibrium, we have

$$
\lim_{v \to 0}(\pi^B - \pi^{NT}) < 0 \quad \text{and} \quad \lim_{\sigma_r^2 \to 0}(\pi^B - \pi^{NT}) < 0.
$$
(ii) Applying the envelope theorem, and the fact that $\alpha$ is larger in a bargaining equilibrium than in a no-transfer equilibrium, one can show that $d(\pi^B - \pi^{NT})/dv > 0$. Similarly, given that $\gamma = 0$ in a bargaining equilibrium, $d(\pi^B - \pi^{NT})/d\sigma^2_r > 0$.

(iii) Since $\lim_{\sigma^2_r \to \infty} \gamma = \lim_{\sigma^2_r \to \infty} A = 0$ in a no-transfer equilibrium, and $\lim_{\sigma^2_r \to \infty} \alpha$ is smaller in a no-transfer equilibrium than in a bargaining equilibrium, it follows that

$$\lim_{\sigma^2_r \to \infty} (\pi^B - \pi^{NT}) > 0.$$ 

QED.