Organizational Integration, Conflict, and the Choice of Business Strategies—An Incentive Perspective*

Felix Höfler†    Dirk Sliwka†

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Abstract

We analyze in a formal model how the tension within organizations between differentiation and integration affects the organization’s strategy. Organizations might choose asymmetric incentive structures that provide high powered incentives only to certain functions to ensure their operational excellence, while aligning the other units’ with the integrated, overall goals. The units with the high powered incentives will typically dominate and determine the organization’s strategy. Such asymmetric, or "pure", strategies might be optimal even in a perfectly symmetric environment. They avoid that units waste resources in internal lobbying activities to divert strategic decisions towards directions that support only the unit’s interest. However, the asymmetry comes at the cost of lower operational excellence of the non-dominant units. Only if the danger of internal lobbying is small will symmetric incentives be optimal, implying intermediate, or "hybrid", strategies in which no specific function dominates.

Key Words: Business strategy, differentiation, integration, rent seeking, generic strategies

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†Institute for Energy Economics, Vogelsanger Str. 321, D-50827 Cologne, Tel.: +49 (0) 221 - 27729 206, email: felix.hoefl@uni-koeln.de.

‡Department of Business Administration, University of Cologne, D-50931 Köln, Germany, email: dirk.sliwka@uni-koeln.de
1 Introduction

Organization theorists have a long-standing tradition in exploring the role of specialized organizational subunits in complex organizations (Simon (1962), Mintzberg (1980), Siggelkow and Levinthal (2003), Rivkin and Siggelkow (2003)). As already argued by (Lawrence and Lorsch, 1967a, b), this specialization generates at the same time a need for differentiation and integration. Differentiation means segmentation of an organization in subsystems (such as divisions or functions) which tend to develop their own goals and attributes shaped by the specific needs of the environment. But this comes along with a need for integration to achieve some “unity of effort” in order to accomplish the organization’s task. The underlying idea is that for an organization to be successful on the one hand, each unit has to achieve operational excellence in its own domain. But on the other hand, the efforts of the different units have to be coordinated to achieve the overall goals of the organization.

But as Lawrence and Lorsch already have claimed there seems to be a natural tension between those objectives, as “differentiation and integration are essentially antagonistic, and that one can be obtained only at the expense of the other” (Lawrence and Lorsch (1967a), p. 47). A key issue in this tension is a basic conflict of interest between subunits because of a difference in goals. Imagine, for instance, a car manufacturer planning a new car series. When the project is presented to the top management, the head of marketing & sales favors high quality and a fancy design, which is tailored to the firm’s target customer group. The head of procurement may intervene: This would require using non-standard and expensive components, which will make the product unprofitable; the product should rather be more standard and less costly. Discussions like this are quite common in many firms and they may naturally lead to intra-organizational conflict.

It is notable that these discussions or conflicts are essentially disputes about core parts of a corporate strategy. If the top management follows the advice of the marketing & sales department, it will go towards a high quality-high cost strategy; if it follows the procurement officer’s advice, it opts for low cost-low quality strategy. However, it might also try to compromise and go for an intermediate positioning. Why do the department heads tend to support different strategic choices? One important reason will be that such advice is in line with their incentives. A sales manager is typically rewarded when sales are large and a procurement manager when procurement costs are low. These rewards are clearly meant to provide incentives to deliver a high performance in each manager’s area of responsibility. The steeper the incentives for high performance in the differentiated functions, the more difficult it will be to make the different functions compromise on what is in the interest of the integrated,
overall goal. With steep differentiated incentives, each function will even have a motivation to spend resources on internal lobbying to tip the top management’s decision towards the own interest.

Therefore, our research interest is to understand how the solution to the organizational conflict between integration and differentiation affects the strategic positioning of firms. We apply methods from agency theory and organizational economics, to explore this issue in a formal model of optimal incentive structure and interunit conflict. In our model, two unit managers (for instance, a sales manager and a procurement manager) work for a principal (i.e. the CEO or the owner of the firm). They undertake unobservable operational efforts which affect their unit’s value contribution. This value contribution depends on the own operational effort and the chosen ‘product design’. Each manager can invest personal resources in order to influence the firm’s strategic position (for instance premium vs. low cost products) and in turn to raise the own unit’s value contribution at the expense of the other unit’s. These “lobbying” or internal haggling efforts make the units’ outputs interdependent and create interorganizational conflict on the choice of the product design.\(^1\) We will study to what extend these conflicts can be solved by appropriately designed incentive schemes and derive implications for organizational design and the choice of business strategies.

In our formal model an optimal incentive scheme now has to take care of two problems: First, the subunits must be motivated to exert high operational effort. This calls for a high weight on the subunit’s value contribution. Second, the managers should not engage too much in wasteful internal rent seeking. But rent seeking can be reduced by choosing a scheme in which a subunit’s manager also benefits from the other unit’s value contribution.

We show that if interdependencies are weak symmetric contract structures are optimal in which both agents’ incentives schemes have an identical structure, but each scheme puts a larger weight on the value contribution of the particular unit. In turn, both managers’ operational efforts are high, but both engage to some extent in wasteful conflicts by trying to influence the product design in their favor. Due to the symmetry of rent seeking efforts, lobbying efforts neutralize, and an intermediate product design results – a ‘hybrid’ strategic position.

If interdependencies are strong and thus rent seeking is effective in influencing the own value contribution, the principal must find a way to avoid wasteful haggling. One way is to choose pure profit sharing, i.e. to put equal weight on both outputs in the compensation

\(^1\) Note that already Lawrence and Lorsch (1967a) stated “differentiated subsystems often have quite different interests and objectives, so that the resolution of conflict between them may well be the most important function of integrative devices.” (p. 42).
schemes. Rent seeking can thus be avoided as managers then internalizes the full externality on the other unit. However, it also comes at a cost: Each agent is now ‘liable’ for the full firm output and in turn there is free-riding and substantially higher uncertainty in bonus payments which increases risk premia.

Our key result of the formal analysis is that such symmetric structures where both subunits are fully aligned may not be optimal as they are dominated by an asymmetric incentive structure (even though technologies in our formal model are perfectly symmetric): It suffices to align only one of the units with overall goals to eliminate rent seeking. Since this unit’s manager now has no incentives to engage in any rent seeking activity, the other unit can implement her favored design choices. In turn, the latter can receive an incentive scheme rewarding operational performance in the units own field and therefore can be substantially higher powered as the unit’s manager has a stronger influence on this performance measure. Hence, the total value created is driven to a larger extent by one ‘favored’ unit. An asymmetric strategy naturally arises in an environment which is ex-ante perfectly symmetric.

How individual behavior can be aligned with the organizational goal is widely discussed in the literature. For instance, organizations may set up profit sharing plans or grant stock options in order to align the individual units’ interests with a common goal (Wageman and Baker (1999), Kretschmer and Puranam (2008)). Alternatively, firms may in invest in creating a common culture of shared values and, hence, create forms of “normative integration” (see e.g. Van Maanen and Schein (1977), Ghoshal and Nohria (1989)). If this component of collective joint alignment has a strong weight, managers should be more inclined to compromise on the product design decision and find a common goal. We add to this view that when incentives for joint outcomes are particularly large this might weaken personal responsibilities for the particular sub-objectives of the different units.

Our paper is also related to the discussion on "generic" (or pure) strategies versus "hybrid" strategies. Porter (1985)’s concept of generic strategies - roughly speaking - states: To generate a competitive advantage, a firm has to make a choice whether it wants to be a cost leader or a differentiator, where the latter implies being a benefit leader by providing high quality. Compromises between the two ‘pure strategies’ imply that the firm will be ‘stuck in the middle’ which negatively affects performance. Porter himself argued that “becoming stuck in the middle is often a manifestation of a firm’s unwillingness to make choices about how to compete. It tries for competitive advantage through every means and achieves none, because achieving different types of competitive advantage usually requires inconsistent actions”.

\(^2\)See Porter (1985), page 17. See also Treacy and Wiersema (1993) who distinguish operational excellence,
So far, in the management literature several arguments have been put forward to explain the potential superiority of pure as opposed to hybrid business strategies. Porter (1996) himself, for instance, provides three key arguments: First, there may be inconsistencies concerning reputation as a firm may either be known to customers as low cost or high quality producer. Second, there is a more direct trade-off between different technological choices for instance as equipment or employee skills. And third, Porter argues that “companies that try to be all things to all customers, […] risk confusion in the trenches as employees attempt to make day-to-day operating decisions without a clear framework” (p. 69). Indeed, in our model, an incentive structure that supports a hybrid business strategy comes along with infighting between operational divisions, which can be avoided by choosing an incentive structure that supports an asymmetric ‘generic’ business strategy. There is now also some empirical literature on the question whether generic strategies may indeed be superior. While Campbell-Hunt (2000) found only weak evidence, Thornhill and White (2007) detect a significant positive relationship between strategic purity and performance. However, they also show that the benefits of a pure relative to a hybrid business strategy differ between industries. Indeed, our model does not predict that a pure business strategy is always superior. If interdependencies and the need for coordination between units is weak then hybrid strategies may dominate pure strategies. A key advantage of hybrid strategies is that operational excellence is achieved in both dimensions while an incentive structure implementing a generic strategy leads to a lower operational performance in one dimension. To focus on the effects of internal organization on strategy, we deliberately make the extreme assumption of perfect symmetry. However, of course additional factors and asymmetries are important, too. If firms are not symmetric ex ante, but may exhibit different productivities in the different strategic dimension, the degree of productivity differences will contribute to explaining whether (and if so: how) firms specialize into one dimension, or choose a ‘middle’ strategy (according to the resource based approach, Barney (1991); for a recent empirical survey see Crook, Ketchen Jr, Combs, and Todd (2008)). We differ from these approaches by showing that strategic purity may arise even in an ex-ante technologically symmetric environment and this can be driven by internal concerns alone.

product leadership, and customer intimacy and claim that “companies that have taken leadership positions […] typically have done so by narrowing their business focus, not broadening it”.  


4That asymmetric strategic positions in an ex-ante perfectly symmetric setup can arise is also suggested in economics literature on “natural oligopolies” in markets with vertical product differentiation, Shaked and
Our paper is related to some ideas that have appeared in the literature in organizational economics. Potential benefits of narrow business strategies have been analyzed in formal economic models by Rotemberg and Saloner (1994), Rotemberg and Saloner (1995), Corts (2000), Rotemberg and Saloner (2000), or Van den Steen (2005). The paper also builds on and adds to the literature on rent seeking contests which started with the seminal contribution by Tullock (1980). The idea that internal influence activities can affect organizational design has been introduced by Milgrom and Roberts (1988).

The remainder of the paper proceeds as follows. Section two describes the model. Section three analyzes the unit manager’s reactions to a given incentive structure. Section four compares two possible ‘generic contract types’: contracts implementing hybrid business strategies which encompass rent seeking, and contracts implementing pure strategies that avoid rent seeking, in order to determine the globally optimal contracts. Section five concludes and discusses implications for management practice. All proofs, unless otherwise stated, can be found in the appendix.

2 A Formal Model

We consider a firm with two functional departments (units). Each unit employs a manager \( i = 1, 2 \). For instance, manger 1 could be responsible for the sales and manager 2 responsible for procurement activities. Both managers can exert effort in two different dimensions. First, they can work hard to increase their operational performance by choosing operational effort \( e_i \geq 0 \), and second they can choose a ‘rent seeking effort’ \( d_i \geq 0 \), to influence the overall product design. More generally, this could reflect any lobbying activity affecting the firm’s strategy (e.g., participation in strategy projects) which is favorable for agent \( i \) but no necessarily favorable for the firm or other agents in the firm. Both kinds of effort are costly to the agents and unobservable to the owner of the firm (the principal).

Each manager produces an output \( Q_i \) and the principal’s profit is the output minus the wages, \( w_1 \) and \( w_2 \): \( \pi = Q_1 + Q_2 - w_1 - w_2 \). One could, for instance, think of \( Q_1 \) as the

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Sutton (1983). In their model, it is the strategic interaction in the product market (not internal incentive effects) that leads to the asymmetry.

5 See Konrad (2009), pp. 9 or Congleton, Konrad, and Hillman (2008) for recent surveys on the literature on rent seeking contests.

value contribution of the sales department, and \( Q_2 \) the value contribution of the production
department. Since our interest is to investigate whether an asymmetric strategic choice can
arise in a completely symmetric environment we abstract from any asymmetries between the
agents and production technologies.

While operational effort is specific to each kind of output, rent seeking efforts exhibit
externalities. The higher the effort of manager 1 in this dimension, the lower will be the
expected output of manager 2, and vice versa. Think for instance of the sales manager
lobbying internally for including high-quality features in a new product, implying higher cost,
while the production department lobbies for using only standard items which may limit the
attractiveness to buyers and therefore the sales success will be lower.

This lobbying activities affect the product design (or the business strategy) chosen by the
company. We model this as a standard Tullock (1980) contest, i.e. from agent \( \text{i} \)'s perspective
the resulting design \( D_i \) is given by

\[
D_i = \begin{cases} 
\frac{d_i}{d_i + d_j} & \text{if } d_i > 0 \land d_j > 0, \\
\frac{1}{2} & \text{if } d_i = d_j = 0.
\end{cases}
\]

Agent \( \text{i} \)'s most preferred design is \( D_i = 1 \), the most preferred design of agent \( j \) is \( D_j = 1 \)
(implying \( D_i = 0 \)). We assume that if one agent strictly prefers \( d_i = 0 \), while the other
agent \( j \) strictly prefers to tip the design to her own most preferred realization – which she
can do so by exerting an arbitrarily small effort \( d_j \) – then agent \( j \)'s preferred design choice is
implemented at zero effort cost for this agent.

Each agent’s value contribution is given by:

\[
Q_i = q \sqrt{\varepsilon_i} + z \cdot D_i + \varepsilon_i.
\]

The first term is the contribution from the operational effort, where \( q > 0 \) is a measure of the
(decreasing) marginal productivity. The last term is a random productivity shock, where \( \varepsilon_i \)
is a normally distributed i.i.d. random variable with variance \( \sigma^2 \). The middle term reflects
how an agent can increase her value contribution by exerting lobbying activities to influence
the strategic position in her favor. The larger the lobbying effort \( d_i \), the larger \( D_i \) will be.

\(^7\)See Konrad (2009) for a recent comprehensive survey on the theory of contests. Section 2.3 includes a
detailed discussion of the Tullock contest.

\(^8\)This is to avoid that agent \( j \)'s optimization problem has no solution. Alternatively, one could think of the
effort as chosen from the set: \( d_j = \{0, d_j \geq \varepsilon > 0\} \), where \( \varepsilon \) is arbitrarily small, such that we can neglect the
cost of this effort.
Note that the parameter $z$ is very important in our model as it determines to what extent the agents’ design choices affect their individual value contributions. Therefore, $z$ measures the degree of interdependence between both units’ actions. If $z$ is large the interdependency between both units is large and it becomes more attractive to invest effort to affect the design choice at the expense of the other unit. If $z$ is small interdependencies are weak and a unit’s value contribution is basically determined by its operational excellence.

For the managers’ utility, we assume that they have a CARA utility function $u(w) = -\exp(-rw)$, with an Arrow-Pratt measure of constant absolute risk aversion $r$. The disutility of effort for both, the operational and the lobbying efforts, are equal to the effort levels $e_i$ and $d_i$. Both agent’s value contributions are verifiable and the managers’ compensation schemes are linear in the value contributions:

$$w_i = \alpha_i + \beta_{ii}Q_i + \beta_{ij}Q_j.$$

Thus, agent $i$ may receive a bonus which not only depends on his own but also the other agent’s value contribution. The outside option of both agents are equal to $w^o$.

The first best operational effort is obtained by maximizing $q\sqrt{e_i} - e_i$, implying $e_i^{FB} = \frac{q^2}{4}$. Since $D_i + D_j$ is a constant, both agents should abstain from any lobbying efforts, i.e. $d_i^{FB} = d_j^{FB} = 0$.

Another implication of $D_i + D_j$ being constant is that the principal has no direct preferences for a specific product design.

### 3 Equilibrium Effort Choices

Agent $i$ maximizes her certainty equivalent given a wage scheme $(\beta_{ii}, \beta_{ij})$:

$$\max_{e_i, d_i} \alpha_i + \beta_{ii} \left( q\sqrt{e_i} + z \frac{d_i}{d_i + d_j} \right) + \beta_{ij} \left( q\sqrt{e_j} + z \frac{d_j}{d_i + d_j} \right) - e_i - d_i - \frac{1}{2} r \sigma^2 (\beta_{ii}^2 + \beta_{ij}^2).$$

The agents have a dominant strategy in their choice of operational effort:

$$e_i^* = \frac{\beta_{ii}^2 q^2}{4}.$$
The first derivative of the agent’s objective function (1) with respect to the lobbying effort \( d_i \) is:

\[
\frac{dz}{(d_i + d_j)^2} \left( \beta_{ii} - \beta_{ij} \right) - 1.
\]

which is strictly negative if \( \beta_{ii} < \beta_{ij} \). In this case, the agents would not exert any rent seeking effort, but choose the lowest possible effort level, \( d_i = 0 \).

For expositional purposes it is useful to think of \( \Delta_i = \beta_{ii} - \beta_{ij} \) as the “individualized incentive” in agent \( i \)’s compensation scheme. A larger \( \Delta_i \) implies that the agent’s incentives have a stronger focus on his own value contribution. A small value of \( \Delta_i \) implies strong “cross incentives” since a lot of weight in the agent’s payment scheme is attached to the value contribution of the other agent. A small \( \Delta_i \) makes choosing high lobbying efforts unattractive, since a damage to the other agent’s output has a larger effect on the own wage. It is important to note that an incentive scheme which has the property that \( \beta_{ii} = \beta_{ij} \) (or \( \Delta_i = 0 \)) eliminates the incentive for agent \( i \) to exert lobbying efforts as he then fully internalizes the externality caused by his rent seeking activities. However, such an incentive scheme may not be optimal to induce appropriate operational incentives.

To solve for the equilibrium outcome in lobbying efforts when \( \beta_{ii} > \beta_{ij} \) note that from setting (3) equal to zero and solving for \( d_i \) we obtain the reaction function \( d_i = \sqrt{z\Delta_i d_j} - d_j \). Since the second derivative of (1) is negative for \( \Delta_i > 0 \), there will be an interior best response if the first derivative of (3) with respect to \( d_i \) is strictly positive at \( d_i = 0 \), which holds if \( d_j \leq z\Delta_i \). Thus, the agents’ reaction functions are given by:

\[
d^*_i (d_j) = \begin{cases} 
\sqrt{z\Delta_i d_j} - d_j & \text{if } d_j \leq z\Delta_i, \\
0 & \text{if otherwise.}
\end{cases}
\]

For positive choices of \( d_i \), the best response is increasing in \( z \) and it is concave in the design choice of the other manager. We can derive the following result:

**Proposition 1** (i) If \( \Delta_i > 0 \) and \( \Delta_j > 0 \), there is a unique equilibrium in pure strategies in which the rent seeking choices of the agents are

\[
d_i = z\frac{\Delta_i^2 \Delta_j}{(\Delta_i + \Delta_j)^2} \text{ for } i = 1, 2
\]

and the chosen design is \( D_i = \frac{\Delta_i}{\Delta_i + \Delta_j} \). (ii) If \( \Delta_i, \Delta_j \leq 0 \) both will choose \( d_i = d_j = 0 \) and \( D_i = \frac{1}{2} \). (iii) If \( \Delta_i > 0 \geq \Delta_j \) agent i’s preferred design choice will be implemented, i.e. \( D_i = 1 \).
If both $\Delta_i$ are positive, i.e. if both agents’ wages depend to a stronger extent on their own that on the other unit’s signal, both agents exert rent seeking efforts. An agent’s rent seeking effort increases in the level of interdependency $z$, and in the degree of his own individualized incentive $\Delta_i$. It decreases (increases) in $\Delta_j$ whenever $\Delta_i < \Delta_j$ ($\Delta_i > \Delta_j$). The resulting design choice (or ‘strategic position’) is just a weighted average of the individualized incentives.

This result points to a key danger of providing high powered operational incentives: A large individualized incentive $\Delta_i$, i.e., if $\beta_{ii}$ is substantially larger than $\beta_{ij}$, implies that the unit managers invest high efforts in increasing their own value contribution. On the hand this is of course good, since this leads to higher operational efforts. However, this also induces a higher incentive to engage in haggling which is harmful from the organizational perspective. This effect may reflect a part of Porter’s claim that “employees, who are urged to seek every possible source of improvement, often lack a vision of the whole and the perspective to recognize trade-offs.”\(^{11}\)

If, however, the individualized incentives $\Delta_i$ in our model are zero, compensation schemes boil down to pure profit sharing schemes. Agents then have no incentive to engage in any rent seeking activities as they are fully aligned with the interests of the organization.

Finally, if the individualized incentive for agent $i$ is strictly positive, while it is zero for agent $j$, agent $j$ strictly prefers $d_j = 0$ to any positive effort – by the same argument as before. Agent $i$ however strictly prefers to tip the design into the own favor due to $\Delta_i > 0$ and she can do so by exerting an infinitesimally small level of rent seeking efforts at negligible costs. Hence, rent seeking can be avoided if the incentive scheme aligns only one unit’s objectives with company profits.

4 The Principal’s Problem

Anticipating the result of the design choice game, the principal determines the profit maximizing contract, i.e., the optimum weights $\beta_{11}, \beta_{12}, \beta_{22},$ and $\beta_{21}$. The basic trade off the principal faces is that she can not at the same time provide high powered incentives to exert productive effort and prevent the agents from exerting wasteful lobbying efforts. To achieve the former, the principal would have to remunerate the agent only according to her own value contribution; but this would lead the agent to try to inflate the own output at the expense of the other agent’s output by exerting higher rent seeking efforts.

Providing strong “cross incentives”, i.e., choosing low values of the $\Delta_i$, works against this.

\(^{11}\)See Porter (1996), p. 75.
If the own salary positively depends on the other unit’s output, rent seeking becomes less attractive. In the extreme, where \( \Delta_i = 0 \), the incentives for wasteful internal haggling vanish entirely; this would be equivalent to remunerate the agents only with respect to the firm gross profit, \( Q_1 + Q_2 \). However, strong cross incentives are also costly as they increase the agents’ risk exposure as compensation is then also affected by noise in the other unit’s value contribution. Since the agents are risk averse, this leads to higher risk premia.

From Proposition 1 we know that there are either contracts in which rent seeking occurs in equilibrium (if \( \Delta_i > 0 \) and \( \Delta_j > 0 \)) or contracts that avoid all rent seeking activities (if at least one \( \Delta_i = 0 \)). To understand the logic of the model, it is useful to compute optimal contracts for these two cases separately and then compare the profits under both regimes.

### 4.1 Contracts with Rent Seeking

The agents’ participation constraints require that their certainty equivalents (1) exceed their reservation wages. The principal also has to take the incentive constraints (2) into account, as well as the rent seeking constraints as derived in Proposition 1. When we insert the binding participation constraints into the principal’s objective function, substitute \( \beta_{12} = \beta_{11} - \Delta_1 \) and \( \beta_{21} = \beta_{22} - \Delta_2 \), and already use the optimal operational effort choices of the agents’ from (2), the principal’s optimization problem becomes:

\[
\begin{align*}
\max_{\beta_{11}, \beta_{22}, \Delta_1, \Delta_2} & \quad q \left( \frac{\beta_{11}^2 q^2}{4} + q \left( \frac{\beta_{22}^2 q^2}{4} + z - \frac{\beta_{22}^2 q^2}{4} - \frac{\beta_{22}^2 q^2}{4} - z \frac{\Delta_1 \Delta_2}{(\Delta_1 + \Delta_2)} \right) \right) \\
& - \frac{1}{2} r \sigma^2 \left( \beta_{11}^2 + (\beta_{11} - \Delta_1)^2 + \beta_{22}^2 + (\beta_{22} - \Delta_2)^2 \right) - 2w^o
\end{align*}
\]

This function is strictly concave in \( \beta_{11} \) and \( \beta_{22} \), and optimality requires

\[
\beta_{ii} = \frac{q^2 + 2r \sigma^2 \Delta_i}{q^2 + 4r \sigma^2}.
\]

Thus, we can restate the principal’s problem (5) as a problem of choosing the optimal values of \( \Delta_i \) and \( \Delta_j \). While the optimization problem is symmetric it may well be that the solution is asymmetric. However, the following lemma shows that we can restrict attention to the class of symmetric contracts as long as \( \Delta_1 \) and \( \Delta_2 \) are strictly positive.

**Lemma 1** There is no asymmetric interior profit maximum, i.e., it is never optimal to set \( \Delta_1 \neq \Delta_2 \) when \( \Delta_1, \Delta_2 > 0 \).
Hence, the only candidate for an interior solution is a symmetric contract where $\Delta_1 = \Delta_2$. It is therefore instructive to first restrict the analysis to the class of symmetric contracts and seeking the optimal contract within this class. In the next chapter we will derive conditions under which such a contract is also globally optimal. By solving the principal’s optimization problem for the case that $\Delta_1 = \Delta_2$ we obtain the following result:

**Proposition 2** There is a cut-off value $\bar{z} = \frac{4r\sigma^2 q^2}{q^2 + 4r\sigma^2}$ such that for $z \geq \bar{z}$ the optimal symmetric contract is

$$\beta_{ii} = \frac{2q^2 - z}{2(2r\sigma^2 + q^2)} \text{ and } \beta_{ij} = \frac{z}{4r\sigma^2},$$

otherwise it is a pure profit sharing contract with

$$\beta_{ii} = \beta_{ij} = \frac{q^2}{q^2 + 4r\sigma^2}.$$

Hence, if the interdependency between both units as measured by $z$ is sufficiently small, the optimal symmetric contract will entail some rent seeking. Clearly, if $z$ is close to zero, rent seeking considerations will not matter strongly for contract choice, and incentives are based on the agents’ own value contribution. But as $z$ increases, the power of operational incentives $\beta_{ii}$ decreases while profit sharing via $\beta_{ij}$ is extended and the incentive scheme becomes more team-based. The reason is that for higher values of $z$ there is a higher interdependency between the units and the agents have higher incentives to spend more efforts on wasteful rent seeking. As rent seeking is the more attractive the higher powered the operational incentives, higher values of $z$ increase the costs of implementing operational efforts. In turn these operational incentives are weaker in the optimal contract. While profit sharing can reduce rent seeking and therefore increases with $z$ this comes at a cost since agents’ have to bear more uncertainty in their compensation packages. When $z$ becomes very large the rent seeking problem becomes so severe, that the principal will choose a pure profit sharing scheme when she is restricted to a symmetric contract. Such a profit sharing scheme eliminates all rent seeking activities but leads to substantially lower powered incentives.

These considerations have important further implications. Whenever the principal is, for some reason, restricted to use symmetric contracts, she never remunerates the agents based only on the individual performance, i.e., $\beta_{ij} > 0$. This happens despite the fact that individual performance is perfectly observable and contractible. Introducing (costly) noise into the incentive scheme by using team based incentives is meant only to discourage wasteful internal lobbying. For designing remuneration schemes, this suggests an important caveat for
situations where individual value contributions are easy to measure: Even in this case, one should be reluctant to have very steep and individualized incentives; before doing so it should be checked whether there is scope for wasteful internal lobbying which would call for team based elements.

Finally, it is interesting to note that the effect of uncertainty on $\Delta = \beta_{ii} - \beta_{ij}$, the degree to which the incentive scheme is ‘individualized’, is ambiguous and depends on $z$. First note that both, $\beta_{ii}$ and $\beta_{ij}$ are decreasing in $r\sigma^2$. But for small values of $z$, the marginal reduction of $\beta_{ij}$ is smaller than that of $\beta_{ii}$ and in turn $\Delta$ decreases in $r\sigma^2$, i.e. the incentive scheme becomes more team-based.\footnote{This is the case when $z < \frac{8r^2\sigma^2q^2}{5r^2\sigma^2 + 4\sigma^2q^2 + q^4}$.} The reason is that for small values of $z$ the profit sharing incentives $\beta_{ij}$ are rather small as compared to the operational incentives $\beta_{ii}$. But as risk premia are convex in the slope parameters $\beta$ a marginal reduction of $\beta_{ii}$ leads to a stronger reduction in risk premia than a marginal reduction of $\beta_{ij}$. The marginal costs of implementing operational efforts thus increase to a stronger extent than the marginal costs of avoiding rent seeking. For large values of $z$, the opposite is true: the marginal reduction of $\beta_{ij}$ is larger than that of $\beta_{ii}$ and in turn $\Delta$ increases in $r\sigma^2$, i.e. the incentive scheme becomes more individualized. To see why this is the case, note that when $z$ is high, rent seeking is a substantial problem and a large emphasis is put on profit sharing and, in turn, additional risk premia from these collective incentives are high. An increase in uncertainty then has a substantial effect on the marginal costs of profit sharing. Hence, when $z$ is sufficiently high the marginal costs of increasing profit sharing incentives increase to a stronger extent than the marginal costs of inducing operational incentives.

4.2 Contracts without Rent Seeking

So far, we focused on contracts in which both agents are treated equally. As we have shown, any globally optimal contract, in which there is still rent-seeking in equilibrium must be such a symmetric contract. But we have also shown that for large values of $z$ optimal symmetric contracts become pure profit sharing schemes. However, as we already know from Proposition 1 the costs of rent seeking will vanish if only one of the agents receives a pure profit-sharing scheme (i.e. $\Delta_2 = \beta_{22} - \beta_{21} = 0$). Such an agent has no incentive to engage in lobbying as he entirely internalizes all externalities rent seeking would impose on the other unit. In turn, the other agent does not need to spend resources on rent-seeking as he can tip the product design in his favor at negligible costs. More intuitively, in any argument about the optimal
design (i.e., the firm’s strategy) agent 2 would be indifferent about the outcome, while agent 1 has a clear preference for $D_1 = 1$, which is then implemented.

This has an important implication:

**Lemma 2** It can never be optimal to choose an incentive scheme in which $\Delta_i = \Delta_j = 0$.

The proof is straightforward: Suppose that such a contract would be optimal and in turn $\beta_{11} = \beta_{12}$ and $\beta_{22} = \beta_{21}$. Then the principal can always increase profits, for instance, by leaving $\beta_{11}, \beta_{12},$ and $\beta_{22}$ unchanged and reducing $\beta_{21}$ to zero. Such a change does not affect operational incentives and there is still no rent-seeking. But agent 2’s compensation package entails a lower uncertainty and in turn the risk premium that has to be paid in order to satisfy his participation constraint will be reduced. In other words, the drawback of a compensation structure in which both agents’ incentives are based on the firm’s profits is that it makes each agent ‘liable’ for the total profit of the firm. This is too costly, since it suffices to make only one agent liable for profits to eliminate rent seeking incentives for both of them. Hence, the symmetric pure profit sharing contracts which are optimal within the class of all symmetric contracts when $z = \frac{4r\sigma^2q^2}{q^2 + 4r\sigma^2}$ (as we have shown in Proposition 2) cannot be globally optimal.

Since we have ruled out in Lemma 1 the optimality of any asymmetric contract in which both $\Delta_1$ and $\Delta_2 > 0$, the only remaining candidates are contracts in which in which one agent receives a pure profit sharing scheme, i.e. without loss of generality $\Delta_2 = 0$. In that case, the principal’s optimization problem reduces to:

$$\max_{\beta_{11}, \beta_{22}, \beta_{12}} q\sqrt{\frac{\beta_{11}q^2}{4}} + q\sqrt{\frac{\beta_{22}q^2}{4}} + z - \frac{\beta_{11}q^2}{4} - \frac{\beta_{22}q^2}{4} - \frac{1}{2}r\sigma^2 \left(\beta_{11} + \beta_{12} + 2\beta_{22}\right) - 2w^o.$$  

Since

$$\frac{\partial \Pi}{\partial \beta_{12}} = -r\sigma^2 \beta_{12} \left\{ \begin{array}{ll} \leq 0 & \text{if } \beta_{12} \geq 0 \\ > 0 & \text{if } \beta_{12} < 0, \end{array} \right.$$  

(7)

it is always optimal to chose $\beta_{12} = 0$: As agent 2 has no incentive to exert rent-seeking efforts, there is no necessity for agent 1 to so and therefore, his incentive scheme can be based solely on his own value contribution.
The first order conditions for the remaining parameters require:\(^\text{13}\)

\[
\frac{\partial \Pi}{\partial \beta_{11}} = \frac{q^2}{2} - \frac{\beta_{11}q^2}{2} - r\sigma^2\beta_{11} = 0, \quad (8)
\]

\[
\frac{\partial \Pi}{\partial \beta_{22}} = \frac{q^2}{2} - \frac{\beta_{22}q^2}{2} - 2r\sigma^2\beta_{22} = 0. \quad (9)
\]

This leads to the following result:.

**Proposition 3** The optimal contract in the class of contracts which eliminate rent seeking entirely is characterized by

\[
\beta_{ii} = \frac{q^2}{q^2 + 2r\sigma^2}, \quad \beta_{ij} = 0 \text{ and } \quad (10)
\]

\[
\beta_{jj} = \beta_{ji} = \frac{q^2}{q^2 + 4r\sigma^2}. \quad (11)
\]

such that one agent receives high powered operational incentives based only on her unit’s performance and the other one is remunerated according to a lower powered profit sharing scheme.

Since under such contracts rent seeking never occurs, it is obvious that the optimal wage schedule is independent of \(z\). The scheme is the higher powered the higher \(q\): the more productive operational effort, the more the contract should be focused on setting incentives to increase the own output. Finally, a higher relevance of measurement uncertainty, i.e., high values of \(r\) or \(\sigma^2\) reduce all incentive parameters.

Such an incentive scheme induces high powered operational incentives for one agent whose compensation does not depend on the other units value contribution. But for the other agent, who receives a pure profit sharing scheme, operational incentives are lower powered (i.e. \(\beta_{jj} < \beta_{ii}\)). Hence, the asymmetry in contracts creates an asymmetry in the composition of the value created. First of all, the ‘favored’ unit’s design is chosen and in addition, this unit’s management exerts a higher operational effort. In this sense, an asymmetric incentive structure is optimal under which an asymmetric ‘generic’ business strategy naturally arises.

In his 1996 article, where he strongly advocates the benefits of strategic purity, Porter himself describes an example of what we call an ‘asymmetric incentive strategy’ supporting a generic business strategy: The Vanguard Group, which is a large investment management

\(^{13}\)Note that the second derivative are always negative.
company offering investment funds and “that offer predictable performance and rockbottom expenses” taking a “consistent low-cost approach to managing distribution, customer service, and marketing” (Porter (1996), p. 66). Porter goes on to describe that Vanguard “aligns all activities with its low-cost strategy. It minimizes portfolio turnover and does not need highly compensated money managers. The company distributes its funds directly, avoiding commissions to brokers. [...] Vanguard ties its employees’ bonuses to cost savings.” (p. 71).

4.3 Optimal contracts

It remains to be analyzed under what conditions which type of contract is superior. We know already that for large values of z the optimal symmetric contract is a pure profit sharing scheme which is always dominated by an asymmetric contract. Hence, for large values of z the asymmetric solution must be optimal for the principal.

However, if z is sufficiently small, then the asymmetric boundary solution will be dominated by the interior solution even though this comes along with some rent seeking in the induced equilibrium as the following result shows:

Proposition 4 There is a cut-off value \( \hat{z} = \frac{(2-\sqrt{2})2q^2r\sigma^2}{q^2+4r\sigma^2} \) such that for \( z < \hat{z} \) the globally optimal contract induces a symmetric incentive structure which leads to an intermediate business strategy \( D_i = \frac{1}{2} \) but entails internal rent-seeking. For \( z > \hat{z} \), however, the optimal contract induces an asymmetric incentive structure in which the business strategy is determined by one of the units (i.e. \( D_i = 1 \) or \( D_i = 0 \)) and internal rent-seeking is avoided.

The cutoff \( \hat{z} \) – and therefore the parameter range for z in which the symmetric interior solution is optimal – is large, if the effectiveness of operational effort \( q \) is large and if \( r \) or \( \sigma^2 \) are rather small. The reason is that in these cases providing relatively strong operational incentives for both agents is attractive for the principal. This implies that an ‘intermediate’ business strategy is realized although this comes along with some internal haggling.

Otherwise, the asymmetric incentive structure is optimal. The asymmetric solution has the property that one agent receives a high powered incentive contract, strongly remunerating her own unit’s value contribution. The other agent receives a wage which is purely contingent on joint output. In turn no rent seeking occurs, and a ‘pure’ business strategy is chosen. Due to the symmetry of our model, the principal is indifferent which ‘generic strategy’ is implemented; however, she strictly prefers the extreme outcomes to any interior position. Figure ?? shows the profits as a function of \( \Delta_1 \) and \( \Delta_2 \) for a small and a large value of z, respectively (the other parameters are \( r = q = \sigma = 1 \)).
We already mentioned in Section 4.2 that in the asymmetric solution the agent with the high powered operational incentives exerts higher efforts than the colleague working under the profit sharing scheme. It is easy to check that the effort level chosen by both agents under the optimal symmetric contract always lies between these two effort levels. Since the efforts are directly linked to the outputs $Q_i$, it is interesting to see under which contract total effort, and therefore total output $Q_1 + Q_2$ is larger:

**Corollary 1** For $\frac{z}{2} \leq z < \frac{2q^2r^2}{q^2 + 4r^2}$, expected output $E[Q_1 + Q_2]$ in the optimal symmetric contract exceeds the expected output of the optimal asymmetric contract, although total profits are higher under the asymmetric contract.

The reason is that the symmetric contract requires higher wage expenditures due to the additional uncertainty imposed on the agents. The higher output is not sufficient to compensate for these higher wage payments. If $z$ becomes very large, the symmetric contract will also yield lower outputs, since it becomes increasingly costly to provide operational incentives while at the same curtailing internal haggling.

Finally, note that we so far assumed that there is no technological reason to prefer one type of strategy over the other. If everything was fully contractible in our model, the principal would be indifferent between all strategy choices as the strategy simply determined a redistribution of output between the two units. But it is important to note that our key result that an asymmetric solution may be optimal still holds, even when the principal has a strict technological preference for an intermediate strategy. To see that consider the following very simple extension. Suppose that the principal can still not determine the strategic choice which is the result of haggling between the units. But suppose that the total value created increases by a constant $S$ if and only if the strategy implemented is equal to $D_i = D_j = \frac{1}{2}$. Suppose for simplicity that the structure of both units’ value contributions remain unchanged and, hence, the incentive problem does not differ to our previous set-up. It is straightforward to note that the principal would always strictly prefer the symmetric strategy when the $d_i$ and $e_i$ were contractible. But if this is not the case the previous result still holds and asymmetric solution is chosen if $S$ is not too large:

**Corollary 2** Even if the principal has a direct technological preference for an intermediate business strategy, such that the value created increases by a constant $S$ if and only if $D_i = \frac{1}{2}$, she will implement a pure strategy if $S$ is not too large and $z$ is sufficiently large.

The reason is very simple: If the interdependency and thus the scope for haggling $z$ is very large, the sum of both agents’ value contributions is maximized with an asymmetric
solution as it avoids any rent seeking. The larger $z$ the larger the loss from rent-seeking under a symmetric contract. Hence, even a strict technological benefit of having a symmetric choice will be outweighed by rent seeking costs if $z$ is very large.

5 Discussion

We have analyzed how the tension within organization between integration and differentiation can affect the organization’s strategic positioning. Asymmetric incentive structures that make certain internal functions or units dominant within the organization and thereby determine its strategic focus will avoid wasteful internal haggling while still providing high powered incentives for operational performance of the dominant unit. Such asymmetries can be optimal for the organization even in a perfectly symmetric environment, i.e., if all units are equally important to the organization’s overall goal. A symmetric incentive structure with high powered incentives based on each unit’s performance will provide incentives not only to increase each unit’s operational excellence, but it also provides incentives for internal haggling since each unit tries to affect the organizational strategic choices to boost its own value contribution at the expense of other units. If interdependencies between the units are strong, this latter effect might dominate and will render such symmetric steep incentive contracts suboptimal. Alternatively, a symmetric incentive scheme could base remuneration only on overall company performance. But then incentive setting becomes less effective as units are measured not only on the basis of their own value contribution and this weakens the link between the own operational effort and the signals used to evaluate performance and in turn reduces individual responsibility for operational excellence. Again, this negative effects will be strong if interdependencies between units are important.

Hence, when interdependencies are strong and therefore there is scope for internal haggling, introducing a ‘bias’ in favor of one unit can be beneficial. This unit should receive high powered incentives to pursue its own objectives and achieve ‘operational excellence’ in its own domain. The other unit, however, receives lower-powered and overall profit based incentives such that it has no interest to divert resources to affect the product design.

Of course our model only captures internal organizational considerations and market interactions and available resources are not taken into account. But it highlights, that even in the absence of market-based reasons and even in the absence of specific capabilities favoring either side of the trade-off, the choice of a generic strategy may be preferable as it clarifies responsibilities and in turn leads to a higher performance when interdependencies are strong.
Although derived from a highly stylized formal model, our analysis has important implications for management practice. First, it stresses that organizational choices and strategic positions are interlinked in a two-way fashion. Hall (2004), for instance, argues that it is useful to think of a corporate strategy as consisting of two sub-strategies: a business strategy defining how and where to compete and an organizational strategy for the execution of this business strategy. And a key component of a firm’s organizational strategy is its incentive strategy describing the way in which performance is measured and rewarded. Our analysis stresses that there is also an effect in the opposite direction which needs to be considered: The set of available business strategies may be restricted by the way these can be supported by appropriate internal incentive strategies. Even when external market conditions and available resources and capabilities may suggest to call for a strategy that balances different strategic elements, e.g. customer benefits and low costs, internal incentive considerations can lead to superiority of a strategy in which one dimension dominates. Hence, it may be misleading to design a strategy in a two step procedure by thinking about the business strategy first, and then about the appropriate incentive strategy. Rather, these steps should be closely intertwined.

Second, and closely related, we find that asymmetric strategies might be optimal even in quite symmetric environments, which, in a way, is also a novel justification for Porter’s advice to focus on "pure strategies". However, non-surprisingly, in the perfectly symmetric environment of the model, symmetric strategies ("hybrid strategies" in Porter’s terminology) nevertheless are often superior, namely, if interdependencies between different units are sufficiently small. A key take-away here is that - if symmetric steep incentive contracts are installed - the top management must take specific care about the problem of internal haggling and the problem of wasting resources on internal lobbying.

Third, on a rather general level, our analysis suggests that it might often be optimal to treat equal unequally. Even if different functions or units are equally important for the organization’s success, this need not imply that incentive schemes should be identical if the potential of internal haggling is large. For instance, it might be optimal to set steep incentives for the sales department with a bonus conditioning on sales success, while having the procurement department remunerated with a flat contract, e.g., with a share options, even if both departments are equally important for the firm.

Forth, the ideas discussed in the paper might have implications for the hiring and selection of agents. Lazear (2000), Cadsby, Song, and Tapon (2007), or Dutta (2008), for instance, have argued that the choice of high powered incentives not only affects incentives but also selection
when the agents’ talent is unobservable. Suppose for instance that agents differ in their talent for the operational tasks. Then working for the ‘leading unit’ in a firm with an asymmetric incentive structure will become particularly attractive for those agents with a high talent for the respective operational task, as those agents know that they can earn more due to the higher powered incentives in this unit. But it should be harder to attract highly talented agents in the unit with the lower powered incentive structure. In turn, selection issues may reinforce the asymmetry in the unit’s contributions. It is an interesting question for future research to study the interplay between selection, incentive structure, and the choice of corporate strategy in more detail.

6 Appendix

Proof of Proposition 1: (i) A direct implication of the reaction functions (4) is that in any equilibrium of the design choice game, it must hold that

\[ \frac{d_i}{d_j} = \frac{\Delta_i}{\Delta_j}; \]

and therefore

\[ \frac{d_i}{d_j} = \sqrt{\frac{\Delta_i}{\Delta_j}} \frac{1}{\sqrt{d_j}} = 1 = \frac{\Delta_i}{\Delta_j}, \]

\[ \Rightarrow \quad d_i = z \Delta_j \left( \frac{\Delta_i}{\Delta_i + \Delta_j} \right)^2, \quad (12) \]

implying

\[ D_i = \frac{z \Delta_i^2 \Delta_j}{z \Delta_i^2 \Delta_j + z \Delta_i^2 \Delta_j + \Delta_i \Delta_j} = \frac{\Delta_i}{\Delta_i + \Delta_j}. \]

(ii) directly follows from (3). (iii) Directly follows as if \( d_i = 0 \) (which holds if \( \Delta_i = 0 \)), the other agent can tip the design to her desired form at infinitesimally small cost. 

Proof of Lemma 1: The partial derivative of the principal’s expected profit function \( \Pi(\Delta_1, \Delta_2, \beta_{11}, \beta_{22}) \) w.r.t. \( \beta_1 \) is equal to

\[ \frac{\partial \Pi}{\partial \Delta_1} = -z \frac{\Delta_2^2}{(\Delta_1 + \Delta_2)^2} + r \sigma^2 (\beta_{11} - \Delta_1). \]
Let $\Pi^*(\Delta_1, \Delta_2) = \max_{\beta_1, \beta_2} \Pi(\Delta_1, \Delta_2, \beta_{11}, \beta_{22})$. Applying the envelope theorem we can insert (6) and obtain that:

$$\frac{\partial \Pi^*(\Delta_1, \Delta_2)}{\partial \Delta_1} = -z \frac{\Delta_2^2}{(\Delta_1 + \Delta_2)^2} + r \sigma^2 \frac{q^2 - (2r \sigma^2 + q^2) \Delta_1}{q^2 + 4r \sigma^2},$$

(13)

$$\frac{\partial \Pi^*(\Delta_1, \Delta_2)}{\partial \Delta_2} = -z \frac{\Delta_1^2}{(\Delta_1 + \Delta_2)^2} + r \sigma^2 \frac{q^2 - (2r \sigma^2 + q^2) \Delta_2}{q^2 + 4r \sigma^2}.$$  (14)

Note that at any internal optimum $(\Delta_1, \Delta_2)$ we must have

$$\frac{\partial \Pi^*(\Delta_1, \Delta_2)}{\partial \Delta_1} - \frac{\partial \Pi^*(\Delta_1, \Delta_2)}{\partial \Delta_2} = z \frac{\Delta_1 - \Delta_2}{(\Delta_1 + \Delta_2)} - r \sigma^2 \frac{2r \sigma^2 + q^2}{q^2 + 4r \sigma^2} (\Delta_1 - \Delta_2) = 0$$

or equivalently

$$(\Delta_1 - \Delta_2) \left( z \frac{1}{(\Delta_1 + \Delta_2)} - r \sigma^2 \frac{q^2 + 2r \sigma^2}{q^2 + 4r \sigma^2} \right) = 0.$$  

To satisfy this for the case that $\Delta_1 \neq \Delta_2$, we need $z \frac{1}{(\Delta_1 + \Delta_2)} - r \sigma^2 \frac{q^2 + 2r \sigma^2}{q^2 + 4r \sigma^2} = 0$ or

$$\Delta_1 + \Delta_2 = z \frac{q^2 + 4r \sigma^2}{r \sigma^2 (q^2 + 2r \sigma^2)} =: \gamma.$$  (15)

Hence, in any asymmetric maximum $\Delta_1 + \Delta_2$ must be equal to the constant $\gamma$. Now we show that such a maximum cannot exists.

The second derivatives of the objective functions are

$$\frac{\partial^2 \Pi^*(\Delta_1, \Delta_2)}{\partial \Delta_1^2} = z \frac{2 \Delta_2^2}{(\Delta_1 + \Delta_2)^3} - r \sigma^2 \frac{q^2 + 2r \sigma^2}{q^2 + 4r \sigma^2} = z \frac{2 \Delta_1^2}{\gamma^2 - 1}.$$  (16)

$$\frac{\partial^2 \Pi^*(\Delta_1, \Delta_2)}{\partial \Delta_2^2} = z \frac{2 \Delta_1^2}{(\Delta_1 + \Delta_2)^3} - r \sigma^2 \frac{q^2 + 2r \sigma^2}{q^2 + 4r \sigma^2} = z \frac{2 \Delta_2^2}{\gamma^2 - 1}.$$  (17)

and

$$\frac{\partial^2 \Pi^*}{\partial \Delta_1 \partial \Delta_2} = -\frac{2z \Delta_1 \Delta_2}{(\Delta_1 + \Delta_2)^3} < 0.$$  

Thus, if an interior extremum exists, it must be a maximum. However, for $(\Delta_1, \Delta_2)$ to be a
maximum we additionally need that

\[
\frac{\partial^2 \Pi^* (\Delta_1, \Delta_2)}{\partial \Delta_1^2} \cdot \frac{\partial^2 \Pi^* (\Delta_1, \Delta_2)}{\partial \Delta_2^2} - \left( \frac{\partial^2 \Pi^* (\Delta_1, \Delta_2)}{\partial \Delta_1 \partial \Delta_2} \right)^2 > 0 \iff \\
\left( \frac{2\Delta_2^2}{\gamma^2} - 1 \right) \cdot \left( \frac{2\Delta_1^2}{\gamma^2} - 1 \right) - \frac{4\Delta_1^2 \Delta_2^2}{\gamma^4} > 0 \iff \\
0 > (\Delta_1 - \Delta_2)^2.
\]

but this can never be the case.

**Proof of Proposition 2:** We can solve for the optimal symmetric contract by substituting \( \Delta_1 = \Delta_2 = \Delta \) and \( \beta_{ii} = \frac{q^2 + 2r \sigma^2 \Delta}{q^2 + 4r \sigma^2} \) in the principal’s optimization problem to obtain

\[
\max_{\Delta} q^2 \left( \frac{q^2 + 2r \sigma^2 \Delta}{q^2 + 4r \sigma^2} \right) + z - \frac{1}{2} \left( \frac{q^2 + 2r \sigma^2 \Delta}{q^2 + 4r \sigma^2} \right)^2 q^2 - \frac{\Delta}{2} - r \sigma^2 \left( \left( \frac{q^2 + 2r \sigma^2 \Delta}{q^2 + 4r \sigma^2} \right)^2 + \left( \frac{q^2 + 2r \sigma^2 \Delta}{q^2 + 4r \sigma^2} - \Delta \right)^2 \right). 
\]  

(18)

The first derivative of the objective function is

\[
q^2 \frac{2r \sigma^2}{q^2 + 4r \sigma^2} - \frac{q^2 + 2r \sigma^2 \Delta}{(q^2 + 4r \sigma^2)^2} 2r \sigma^2 q^2 - \frac{z}{2} - \frac{q^2 + 2r \sigma^2 \Delta}{(q^2 + 4r \sigma^2)^2} 4r^2 \sigma^4 + 2r \sigma^2 \left( q^2 + 2r \sigma^2 \right) \left( \frac{q^2 + 2r \sigma^2 \Delta - \Delta q^2}{(q^2 + 4r \sigma^2)^2} \right).
\]

Note that the second derivative is negative. Hence, if there is an internal optimum this is characterized by the first-order condition, which yields

\[
\Delta = \frac{4r \sigma^2 q^2 - z (q^2 + 4r \sigma^2)}{4r \sigma^2 (q^2 + 2r \sigma^2)}.
\]

This is is strictly positive iff \( \frac{4r \sigma^2 q^2}{q^2 + 4r \sigma^2} > z \). 

**Proof of Proposition 4:**

First note from (13) and (14) that the first derivative of the principal’s profit w.r.t. to a \( \Delta_i \) always become negative when \( \Delta_i \) is sufficiently large. Hence, only either a symmetric internal contract with rent seeking may be optimal or an asymmetric contract preventing rent seeking in which for one agent \( \beta_{ii} = \beta_{ij} = 0 \). Expected profits under the optimal contract with rent-seeking can be computed by inserting the optimal incentive parameters from Proposition 2 into the expected profit function:
\[ \Pi^{sym} = \frac{2q^2 - z}{2(2r\sigma^2 + q^2)} q^2 + z - \left( \frac{2q^2 - z}{2(2r\sigma^2 + q^2)} \right)^2 \frac{q^2}{2} - \frac{4r\sigma^2 q^2 - z}{8r\sigma^2 (2r\sigma^2 + q^2)} \]

\[ = \frac{(2q^2 - z)^2}{8 (q^2 + 2r\sigma^2)} + \frac{z^2}{16r\sigma^2} + z \]

which – as we know from Proposition 2 – can only be profit maximizing if \( z < \frac{4r\sigma^2 q^2}{q^2 + 4r\sigma^2} \). The expected profits under the optimal contract without rent-seeking are obtained by by using (10) and (11) instead, such that

\[ \Pi^{asym} = \frac{q^4}{4 (q^2 + 2r\sigma^2)} + \frac{(q^2 - z)^2}{4 (q^2 + 4r\sigma^2)} + \frac{8q^2 r^2}{8 (q^2 + 4r\sigma^2)^2} \]

Expression (19) exceeds (20) iff

\[ \frac{(2q^2 - z)^2}{8 (q^2 + 2r\sigma^2)} + \frac{z^2}{16r\sigma^2} > \frac{q^4}{4 (q^2 + 2r\sigma^2)} + \frac{q^4}{4 (q^2 + 4r\sigma^2)} \]

which is satisfied iff

\[ z - \frac{4q^2 r^2}{q^2 + 4r\sigma^2} > \sqrt{\frac{8q^4 r^2 \sigma^4}{(q^2 + 4r\sigma^2)^2}} \] or \( z - \frac{4q^2 r^2}{q^2 + 4r\sigma^2} < -\sqrt{\frac{8q^4 r^2 \sigma^4}{(q^2 + 4r\sigma^2)^2}} \)

or equivalently iff

\[ z > \frac{(2 + \sqrt{2})}{2} \frac{2q^2 r^2}{q^2 + 4r\sigma^2} \] or \( z < \frac{(2 - \sqrt{2})}{2} \frac{2q^2 r^2}{q^2 + 4r\sigma^2} . \]
But a symmetric internal optimal contract exists only if \( z < \frac{4r\sigma^2q^2}{q^2 + 4r\sigma^2} \) which is strictly smaller than \( \frac{(2+\sqrt{2})2q^2r\sigma^2}{q^2 + 4r\sigma^2} \) but strictly larger than \( \frac{(2-\sqrt{2})2q^2r\sigma^2}{q^2 + 4r\sigma^2} \). Hence, such a symmetric contract is superior iff

\[
\frac{2 - \sqrt{2}}{q^2 + 4r\sigma^2} \cdot 2q^2r\sigma^2 =: \hat{z}
\]

which completes the proof.

Proof of Corollary 1:
Straightforward calculations yield for the relevant parameter values of \( z \) that in the optimal symmetric contract, the agents produce in expectation:

\[
Q_{i}^{\text{sym}} = \frac{z}{2} + \frac{q^2}{8} \left( 2q^2 - z \right) \frac{q}{q^2 + 2r\sigma^2}.
\]

With the optimal asymmetric contract, we find (using \( \Delta_1 > 0, \Delta_2 = 0 \)):

\[
Q_1^{\text{asym}} = \frac{z}{2} + \frac{q^2}{8} \frac{q}{q^2 + 2r\sigma^2}, \quad Q_2^{\text{asym}} = \frac{q^2}{8} \frac{q}{q^2 + 2r\sigma^2},
\]

which implies that the difference in total expected output between the symmetric and the asymmetric contract equals:

\[
\frac{1}{2} \left( \frac{q^4 - q^4}{q^2 + 2r\sigma^2} - \frac{q^4}{q^2 + 4r\sigma^2} \right),
\]

which is positive iff \( z < \frac{2q^2r\sigma^2}{q^2 + 4r\sigma^2} \).

Proof of Corollary 2:
The principal will still prefer an asymmetric solution if

\[
\Pi^{\text{asym}} - \Pi^{\text{sym}} > S.
\]

But we know from the proof of Proposition 4 that \( \Pi^{\text{asym}} - \Pi^{\text{sym}} \) is strictly positive if \( z \) is sufficiently large. Hence, indeed a cut-off for \( S \) exists, such that the principal still prefers an asymmetric solution for sufficiently small values of \( S \).
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